FIRE SERVICE ACCREDITATION:

ARE THERE POSITIVE OUTCOMES

ON THE URBAN 10-YEAR ACCREDITED

COMMUNITY?

By

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Title of Study: FIRE SERVICE ACCREDITATION:
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Abstract: Does Fire Service Accreditation have a positive outcome on the community? No one seems to know. My research discovered no academic research on fire service accreditation outcomes on the community. As far as that is concerned, there is no academic research on community outcomes for any publicly funded organization that can pursue accreditation. It seems that scholars are concerned more with measuring and improving the organization's outputs and not how organizational outputs affect community outcomes. Case in point, law enforcement accreditation measures case clearance rates, but fails to determine if the case clearance rates correlate to a reduction in crime. Organizations spend exorbitant amount of resources to obtain and maintain accreditation. So how does the community benefit?

This research focused on four specific fire suppression variables to determine if accreditation had a positive outcome on the urban 10-year accredited community: casualties, property loss, ISO rating, and insurance premiums. These variables were selected due to the economic impact the community felt with a decrease or increase in the variable. The database maintained by The Center for Public Safety Excellence, which serves as the fire service accreditation agency, provided the accredited sample. The National Fire Incident Reporting System Census maintained by the United States Fire Administration helped to provide the non-accredited sample as well as supplying the casualty and property loss data. Individual departments or ISO Community Hazard Mitigation supplied ISO ratings. National insurance companies located within the communities in which the fire service provided services contributed the insurance premium information utilized.

The results of the data analysis indicated a statistical significance in casualties and ISO Ratings. The inference is the urban 10-year accredited departments had a statistically lower number of injuries and deaths along with a reduction in their ISO rating. There was a practical significance in all variables in that the urban 10-year accredited departments had overall lower casualties, property loss, ISO rating and insurance premiums. Based on the observations of the data, an inference supports the hypothesis that an accredited fire service agency provides positive fire suppression outcomes in the urban 10-year accredited community.

TABLE OF CONTENTS

Chapter Page

I. INTRODUCTION 1

Problem Definition and Research Questions 1
Problem Statement 3
Significance of the Study 3
Theory/Argument/Research Questions 6
Research Question 1 8
Hypothesis 1 8
Research Question 2 8
Hypothesis 2 8
Research Question 3 8
Hypothesis 3 9
Research Question 4 9
Hypothesis 4 9
Limitations 9
Delimitations 11
Key Terms 12
Summary 13

II. REVIEW OF LITERATURE 14

Fire Service Accreditation 14
Public Service Accreditation 15
Accreditation's Effect on Performance 22
What Are Measurable Variables 24
Selection of Measurable Variables 28
Current Fire Service Benchmarking Tools 31
Accreditation Process 36
Firefighting as a Core Function 39
Summary 40

III. METHODS 41

Research Design 41
Research Questions and Hypotheses 42

Chapter Page

Research Question 1 43
Hypothesis 1....43
Research Question 2 43
Hypothesis 2....43
Research Question 3 43
Hypothesis 3....44
Research Question 4 44
Hypothesis 4....44
Population and Sample 44
Unit of Analysis 49
Research Variables....50
Data Collection Procedures....52
Statistical Analysis....53
OSU Institutional Review Board 54
Bias and Error 55
Validity 56
Statistical Tests 56
Diagnostic Testing 57
Summary....57

IV. FINDINGS....59

Descriptive Statistics....62
Diagnostic Testing 65
Type I Errors 65
Outliers....65
Normality of Variables 66
Skewness/Kurtosis 67
Bi-Variate Analysis of Independent Variables 68
Casualties 68
Property Loss 70
ISO Rating 72
Insurance Premiums....75
Dependent Variable 77
Summary....77

V. CONCLUSION....78

Research Hypotheses 78
Accreditation's Effect on the Fire Service Organization....79
Statistical Hypotheses of Comparable Organizations....80

Chapter Page

Statistical Hypothesis 1 80
Statistical Hypothesis 2 80
Statistical Hypothesis 3 80
Statistical Hypothesis 4 81
Statistical Significance versus Practical Significance 82
Research Hypotheses Answer 83
Recommendations 85
Summary 87

REFERENCES 89

APPENDICES 97

LIST OF TABLES

Table Page

3.1 Accredited Organization Type 45
3.2 CPSE Population Classes by Number of Agencies and Percentages 47
4.1 Accredited and Non-accredited Agency Data Collection Results 60
4.2 Descriptive Statistics of Casualties 62
4.3 Descriptive Statistics of Property Loss 63
4.4 Descriptive Statistics of ISO Ratings 63
4.5 Descriptive Statistics of Insurance Premiums 64
4.6 Quantile Range Outliers 65
4.7 Robust Fit Outliers 65
4.8 Shapiro-Wilk W Test for Normal Data 66
4.9 Shapiro-Francis W' Test for Normal Data 66
4.10 Skewness/Kurtosis Test for Normal Data 67
4.11 T-test and Correlation of Urban 10-year Accredited and Comparable Non-Accredited Casualties per 1000 Population 68
4.12 Z.TEST of Casualties per 1000 Population 69
4.13 T-test and Correlation of Urban 10-year Accredited and Comparable Non-Accredited Adjusted Property Loss 71
4.14 Z.TEST of Property Loss 71
4.15 Paired T-test and Correlation of Urban 10-year Accredited and Comparable Non-Accredited ISO Rating 73
4.16 Z.TEST of ISO Rating 74
4.17 T-test and Correlation of Urban 10-year Accredited and Comparable Non-Accredited Adjusted Insurance Premiums 75
4.18 Z.TEST of Insurance Premium Rates 76

LIST OF FIGURES

Figure Page

2.1 Linking Public Health Accreditation and Outcomes Logic Model 17
2.2 ISO Class and Accredited Communities Country Wide.....33
4.1 Multivariate Robust Outliers.....65
4.2 Comparison of Casualties and Accredited Status 68
4.3 Comparison of Property Dollar Loss and Accredited Status.....70
4.4 Comparison of ISO Rating and Accredited Status 72
4.5 Comparison of Insurance Premiums and Accredited Status.....75

CHAPTER I

INTRODUCTION

Problem Definition and Research Questions

What is the accreditation process and can accreditation provide positive outcomes on the urban 10-year accredited community? This chapter will provide the statement of the problem and significance of this study. Posing subsequent, more specific research questions will also be necessary to answer this broad research question. The efforts of this research will investigate specific research questions and hypotheses. Additionally, this chapter will disclose limitations and delimitations as well as identifying and discussing key terms.

Emerging public standards, assessments, and accreditation models hold potential to standardize and define disciplines that provide public services (Doerner & Doerner, 2012; Joly et al., 2007). However, there is a lack of empirical research on the relationship between the public services and delivery outcomes (DeBritz & Pollak, 2006; Doerner & Doerner, 2012; Joly et al., 2007). This lack of empirical evidence is surprising considering the amount of time, effort and resources expended for an agency to become accredited. Agencies utilize accreditation to improve internal practices by

conducting self-assessments on core criteria developed by accrediting entities. Core criteria are theoretically "best practices" for the agency participating in the accreditation process. When an agency completes the self-assessment process, the accrediting entity provides a field inspection team to verify that completion of the self-assessment is thoroughly in accordance to the accrediting entity's requirements (CPSE, 2013; DeBritz & Pollak, 2006; Doerner & Doerner, 2012; Joly et al., 2007). It is commonly contended "Being accredited is a coveted status in many fields" (Doerner and Doerner 2012, p. 6).

The Center for Public Safety Excellence (CPSE) is an organization that "promotes continuous quality improvement of fire and emergency service agencies ...worldwide" (CPSE, 2013, p. 1). CPSE is the governing body for fire service accreditation and professional credentialing. CPSE provides fire service accreditation though the Commission on Fire Accreditation International (CFAI). CFAI touts the "accreditation process provides a well-defined internationally recognized benchmark system to measure the quality of fire and emergency service" (CPSE, 2013, p. 1). Further, CFAI states the accreditation provides a "strategic self-assessment model and accreditation process to provide continuous quality improvement and *enhancement of service delivery to the community* [emphasis added] and the world at large" (CPSE, 2013, p. 1). CFAI utilizes two self-published books to guide the accreditation process: Fire and Emergency Services Self-Assessment Manual (FESSAM) and Standards of Cover (SOC).

While the FESSAM guides the participant through the entire assessment process, the SOC is the document that provides the community risk assessment and resource deployment. The participating agency collects data and conducts analysis on 258 performance indicators (82 core competencies must be met), which could result in

modification of policies relating to service delivery. The CFAI's steps to improve service delivery are: "1) Determine community risk and safety needs, 2) Evaluate the performance of the department, and 3) Establish a method for achieving continuous organizational improvement" (CPSE, 2013, p. 1). This self-evaluation process is important for quality improvement.

Problem Statement

There is no empirical data that provides definitive evidence that accreditation in and of itself results in a positive outcome on the community in which the emergency service agency provides service. The first question to be addressed is whether fire service accreditation results in positive measurable community outcomes after a fire service organization completes the accreditation process. A second question concerns whether fire service accreditation results in a positive measurable community outcome within an urban 10-year accredited agency's community in comparison to an equivalent community where the fire service agency does not participate in accreditation.

Significance of the Study

Why are these questions important? The accreditation process takes significant public resources to complete. These resources represent staff-hours conducting the self-assessment, equipment purchases to meet "best practices" and fees paid to the accreditation entity (DeBritz & Pollak, 2006; Doerner & Doerner, 2012). As a result, the public deserves to know that the fire service is utilizing resources in an efficient and effective manner. A positive relationship between accreditation and service delivery

outcomes would demonstrate the effective use of the public's resources. Ongoing research and evaluation is essential to the advancement of accreditation, public service organizations, and improved community public service outcomes.

On the local level, Spartanburg Fire Department spends over $220,000 across the five-year accreditation process to include the actual expenses of the assessment team. The accreditation review occurs every fifth year. An additional $2500 annually is committed to provide the accreditation manager travel to the annual accreditation conference, which keeps him abreast with the constant changes to the accreditation process. Although annual expenditure of $46,500 is not grandiose within a $5 million budget. In reality, this expenditure could fund fifteen sets of firefighting gear, five thermal imaging cameras, or fifty-one walkie-talkies. In today's economy, it makes a difference, especially when these expenditures have to be justified to the taxpayer, to whom the governing body must be accountable.

On a broader fire service level, this research could provide fire service agencies the information needed to make an educated decision on whether to attempt or maintain accreditation. A department considering accreditation for the first time needs to commit a large amount of initial resources in personnel time, equipment, technology and funding. If the community outcomes are negligible or non-existent, a fire service agency may have difficulty justifying the financial benefit to the governing body. The data collected to answer these research questions could be a deciding factor.

The fire service in general has looked for various methods to measure effectiveness. The United States Fire Administration states measuring our effectiveness gains insight to the fire problem, improves resource allocation, and identifies training

needs (McEwen & Miller, 1999). Insurance Service Office's (ISO) Fire Suppression Rating Schedule has been utilized by numerous fire chiefs and city officials with the evaluation termed a 'third party assessment" (Barr & Eversole, 2003; Compton & Granito, 2009; Institute for Training in Municipal Administration, 1968). The focus of ISO is to provide insurance actuary information to underwriters in an effort to evaluate their risk in property losses relating to fire events. ISO designed the Fire Suppression Rating Schedule to assess a fire service organization's ability to suppress property fires. In light of the extra services provided by fire service agencies such as hazardous materials response, Emergency Medical Service, and various technical rescue disciplines, the ISO measure is inadequate to provide an all-encompassing measure of the fire service agency's abilities or effectiveness. International City/County Management Association (ICMA) Center for Performance Measurement includes the fire service as one of four areas of municipal measurement. ICMA further divided the fire service component into four critical functions: fire suppression, emergency medical service, fire prevention, and fire education. Performance measures were developed, but again the focus was on how well the department delivered these services, not the outcome on the community in which the services were provided (Compton & Granito, 2009).

On an academic level, I am not able to find a significant amount of scholarly or empirical literature on public safety performance measures of outcomes and even less on community effects of accreditation in any discipline. This is not surprising, as most fire service assumptions of theory are not grounded in science. Ray points out in his article "Much of fire-service training has been based on perception rather than reality, and the tactics focused on skill rather than knowledge. This information should cause well-

trained, well-educated and long-experienced fire officers to stop and think" (Ray, 2013, p. 53). This is evident in the recent scientific burns conducted in Spartanburg, SC. The International Society of Fire Service Instructors and National Institute of Standards and Technology conducted a series of burns in single-family residential structures. These burns tested the commonly held fire service theories that attacking a fire from outside will "push" the fire into unburned portions of the structure, attacking the fire from outside with a broken stream will "steam" a firefighter or victim, while attacking from the interior of the structure ultimately provides the best chance of survival for a victim. Utilizing the latest scientific technology to capture temperature, various gas levels and video, all of the currently held fire service theories were debunked. As a result, new data is available for fire service practitioners and textbook authors and publishers (Ray, 2013). This research on accreditation contributes to fire service accreditation's scientific base of knowledge. It also provides a basis for further academic research on measuring fire service performance in general and more specifically, to what extent accreditation affects the community.

Theory/Argument/Research Questions

Of the performance indicators identified, fire service and civilian causality rates, fire property loss, actual insurance rates, and ISO ratings lend themselves to quantitative study for indicating an outcome in the community. The National Incident Reporting System (NFIRS) captures fire service and civilian casualty rates along with fire property loss data in a standardized format. ISO calculates their rating of property fire prevention and suppression capabilities and classifies a fire service agency's response area as a 1 to

10 with 1 being the best rating. Insurance rates on a 2600 square foot home are available from a national insurance website quote tool or local insurance agency located within the fire service agency's response area.

According to the CPSE, "The Commission on Fire Accreditation International (CFAI) is committed to assisting and improving fire and emergency service agencies around the world in achieving organizational and professional excellence through its strategic self-assessment model and accreditation process to provide continuous quality improvement and *enhancement of service delivery to the community* [emphasis added] and the world at large" (CPSE, 2013, p. 1). In theory, if a fire service agency successfully completes the accreditation process, then the subsequent effects on the community should be positive. Performance indicators should trend in a positive direction. As a result, one research question is: Does fire service accreditation result in positive measurable community outcomes after a fire service organization completes the accreditation process? The second research question is: Does fire service accreditation result in a positive measurable community outcome within an urban 10-year accredited agency's community in comparison to an equivalent community where the fire service agency does not participate in accreditation? Posing subsequent, more specific research questions will be necessary to answer these broader research questions. The efforts of this research will investigate the following specific research questions and hypotheses:

Research Question 1

What are the community's annual firefighter and civilian casualty rates before and after accreditation and how do these casualty rates compare to like non-accredited community?

Hypothesis 1

A community's fire service and civilian casualty rates will decrease after accreditation and the urban 10-year accredited community's casualty rate will be lower than a like non-accredited community.

Research Question 2

Did the community's annual fire property loss change after accreditation and how do these casualty rates compare to a like non-accredited community?

Hypothesis 2

A community's fire property loss will decrease after accreditation and the urban 10-year accredited community's property loss will be lower than a like non-accredited community.

Research Question 3

What is the community's ISO FSRS rating before and after accreditation and how do these ISO FSRS rates compare to a like non-accredited community?

Hypothesis 3

A community's ISO FSRS will decrease after accreditation and the urban 10-year accredited community's ISO FSRS rating will be lower than a like non-accredited community.

Research Question 4

What is the community's annual insurance rate on a 2600 square foot home of ordinary construction after accreditation and how do these insurance rates compare to a like non-accredited community?

Hypothesis 4

A community's annual insurance premium rates will decrease after accreditation and the urban 10-year accredited community's insurance premium rates will be lower than a like non-accredited community.

Limitations

The accreditation population included in this study is extremely small in comparison to the total number of fire service agencies located within the United States. As of 01/21/2016, only 216 emergency service agencies have attained accreditation. Paring down the data set of sample agencies with additional limitations is necessary to achieve a population of like characteristic agencies to study. The methods section will detail the population sample limitations. The National Fire Incident Reporting System is a voluntary system, and it includes only those fire incidents reported to the system by fire departments that report to NFIRS. In addition, not all States participate in NFIRS, and all

fire departments that report to NFIRS within a State do not necessarily report all of their fire incidents. Additionally, some fire departments that report fire incidents do not report associated casualties. States and/or fire departments that report in one particular year may not report to NFIRS the following year. Thus, NFIRS is not representative of all fire incidents in the United States and is not a census of fire incidents or casualties. The collection of certain data such as casualties is dependent upon the fire service agency accurately reporting such data to NFIRS and the data representing all casualties that could range from a blistered finger to fire fatality. Property loss data is dependent upon the property owner requesting a fire service agency response and the ability of the fire service agency to accurately estimate the property loss amount. Owners may often not report small fires and pay for the damage incurred out of pocket rather than filing a claim and risking an increase in property insurance premium. Firefighters are typically not familiar with how to calculate property loss. Firefighters may use the local tax appraisal and correlate the percentage burned to the same percentage of property value to determine loss, or simply take a best guess estimate. While these methods result in a variety of data errors, some scholars believe the data can still be utilized under the theory of systematic and unsystematic (random) errors. The basis of the validity comes from the theory that the errors tend to cancel themselves out (Johnson, Reynolds, & Mycoff, 2012; Olsen, 1996). "Random errors arise by chance or happenstance and (it is hoped) cancel one another out" (Johnson et al., 2012, p. 308). The cross-sectional urban 10-year accredited and non-accredited fire service agencies data collection for fire and civilian casualties and property loss is limited to 2014 as this was the last full year of data collected. The quality of data utilized to compare the accredited department before and

after accreditation is dependent on the urban 10-year accredited agencies data collection processes and record retention in excess of ten years. Finally, the scope of this dissertation is narrowly limited to specific quantitative variables and does not include qualitative measures that may be a consideration in measuring different aspects of community outcomes.

Delimitations

The accreditation population sample will be delimited to tax supported United States governmental fire service agencies as the Department of Defense and commercial/private agencies do not have the same governance structure as civilian agencies. An additional delimitation will result in career departments comprising the accreditation population due to the small number of accredited combination (30) and volunteer (1) agencies. Next, population size and at least two re-accreditation cycles will further delimit the career agencies. This delimitation will provide at least ten years' application of the accreditation process to the community. ISO recently updated their Fire Suppression Rating Schedule (FSRS) to incorporate the latest industry standards and change several of the rating formulas. As such, the sample will be narrowed to the most recent old ISO schedule the agency was rated under, as this is necessary for the like comparison of pre-accreditation and post accreditation of the fire service agency. This study selects the comparison fire service agencies by using a sampling fraction from a list of agencies that share similar independent variables with the urban 10-year accredited fire service agencies. The agencies listed as participating in the NFIRS will serve to develop a comparison list.

Key Terms

Accreditation – to recognize as maintaining standards, to consider or recognize as outstanding (Webster, 2006).

The Center for Public Safety Excellence – (CPSE) is a not-for-profit 501(c)(3) corporation and is a primary resource for the fire and emergency profession to continuously improve services, resulting in a higher quality of life for communities (CPSE, 2016).

Correlation - a relation existing between phenomena or things or between mathematical or statistical variables which tend to vary, be associated, or occur together in a way not expected on the basis of chance alone (Webster, 2006).

Fire Suppression Rating Schedule – a manual containing the criteria ISO uses in reviewing the fire prevention and fire suppression capabilities of individual communities or fire protection areas. The schedule measures the major elements of a community's fire protection system and develops a numerical grading called a Public Protection Classification (PPC™) (ISO, 2016).

Insurance Service Office - Verisk – (ISO) is a leading source of information about property/casualty insurance risk (ISO, 2016).

Performance Indicators - a quantitative or qualitative measurement or any other criterion, by which the performance, efficiency, achievement, etc. of a person or organization can be assessed, often by comparison with an agreed standard or target (Webster, 2006).

Summary

This chapter questioned the accreditation process and if the process provides a positive outcome on the urban 10-year accredited community. The previous paragraphs provided the statement of the problem and significance of this study. It is clear that posing subsequent, more specific research questions will be necessary to lead to answers of the broad research questions. The efforts of this research will investigate four specific research questions and hypotheses. Additionally, this chapter discussed the limitations and delimitations of this study and identified then defined key terms.

CHAPTER II

REVIEW OF LITERATURE

The literature review will focus on fire service accreditation and associated outcomes on the community as well as the same link with accreditation of other public service entities such as Public Health, Law Enforcement, Public Works, Emergency Management and Public Safety Communications Centers. Additionally, the literature review will seek to determine the effect of accreditation on performance. This section will also provide a basis to determine and select measurable fire suppression variables that influence the outcomes of a community. Finally, the literature review will examine current industry accepted fire service benchmarking tools and the fire service accreditation process itself.

Fire Service Accreditation

Literature searches of Oklahoma State University's Edmond Low Library, Anderson University's Thrift Library, and Colorado State University's Morgan Library's electronic databases for "fire service accreditation, fire department accreditation, and emergency services accreditation" reveal no academic journal articles. In researching fire service accreditation, a total of two journal articles were discovered

(Bruegman, 2002; Walter, 1998) in which the merits of a future fire service accreditation process were extolled, but no critical evaluation of the process was forthcoming. Rivero's dissertation (2004) explores the relationship between city/county manager and fire chief's perceptions of accreditation and curriculum development, budget variation, staffing levels and preparedness of each fire fighter of the accredited agency. Shackelford's dissertation (2002) in part attempts to measure an increase in effectiveness of public paid fire departments after accreditation and uses a cross-sectional time series of data before and after accreditation. Shackelford utilizes comparison of non-accredited fire departments with the same population categories and fire risk characteristics (Shackelford, 2002). His research finds a statistically significant increase in 72 percent of the organizational effectiveness indicators he studied with four dependent fire risk characteristics of average dollar loss from fires per capita, average fire dollar loss per $1000 of assessed valuation, average response to fire locations and average number of fire incidences occurring in buildings from one year of the date of inspection. Shackelford additionally cites the need for further study at a later date as only twenty-seven of an estimated 31,114 fire departments were accredited at the time of his study (Shackelford, 2002, p. 145). Shackelford's study does not investigate the effects on the community (Shackelford, 2002).

Public Service Accreditation

A similar search conducted for accreditation in different disciplines (Public Health Service, Law Enforcement, Public Works, Emergency Management, and Public

Safety Communications) reveals ample literature focused on the accreditation self-assessment process, but very little provides research on techniques for measuring outcomes before or after the accreditation process. This is concerning as many accreditation entities insinuate that the self-assessment process drives internal improvements in performance, which relate to improved service delivery or outcomes (Joly et al. 2007; Doerner and Doerner 2012). My search was limited to governmental agencies that perform services that are taxpayer funded. The result of the literature search revealed a focus on the internal improvements that the accreditation provides (Joly et al., 2007; McCabe & Fajardo, 2001; Tzoumis & Delaney, 1999). Even upon evaluating the internal self-assessment, there was an underlying tone that measuring community outcomes would be beneficial:

> When local government officials consider pursuing accreditation, they must keep several factors in mind. Traditional performance measures used by local government managers do not capture the benefits of the accreditation process. Proponents of accreditation have to anticipate this empirical problem and plan for new methods of measuring benefits. Based on this research, public works departments should seek out nontraditional means of assessing the benefits of organizational change from accreditation (Tzoumis & Delaney, 1999, p. 342).

Public health agencies are struggling with this measure. An entire issue of a peer reviewed journal (*Health Affairs)* was focused on the question of the public health system becoming accountable for health outcomes (Joly et al., 2007). It was illustrated that "… the need to strengthen the evidence regarding performance and outcomes remains critical to guiding policy and public health practice" (Joly et al., 2007, p.351). Joly, et al (2007) provides a theoretical framework in which to conduct such measures. The proposed "Logic Model" would compare contextual factors of Inputs, Strategies, Outputs, Short-term outcomes, Intermediate outcomes, and Long-term outcomes (Joly et al., 2007).

Upon assembling independent and control variables under the Inputs, Strategies, and Outputs, dependent variables are then assigned to Short, Intermediate and Long-term outcomes. Joly et al (2007) admits this model is intended to provide a roadmap for future research and was not employed in their research. Subsequent search of the literature for use of the "Linking Public Health Accreditation and Outcomes" did not reveal any scholarly use of the Logic Model.

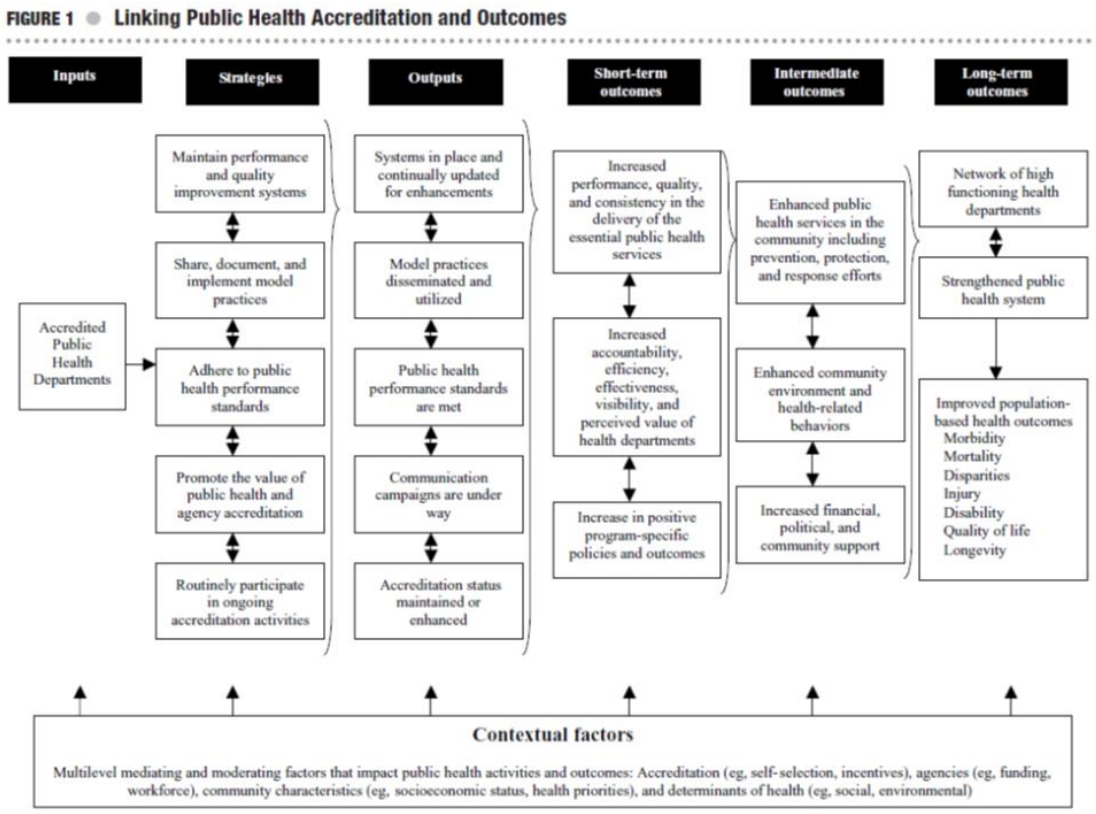


Figure 2.1 Linking Public Health Accreditation and Outcomes Logic Model (Joly et al., 2007, p. 352)

The Commission on Accreditation for Law Enforcement Agencies, Inc. provides accreditation services for law enforcement and public safety communications. "The CALEA Accreditation Process is a proven modern management model; once

implemented, it presents the Chief Executive Officer (CEO), on a continuing basis, with a blueprint that promotes the efficient use of resources and improves service delivery—regardless of the size, geographic location, or functional responsibilities of the agency" (CALEA, 2016, p. 1). CALEA assesses law enforcement agencies in the following areas: 1) Law Enforcement Role and Authority; 2) Agency Jurisdiction and Mutual Aid; 3) Contractual Agreements for Law Enforcement Services; 11) Organization and Administration; 12) Direction; 15) Planning and Research, Goals and Objectives, and Crime Analysis; 16) Allocation and Distribution of Personnel and Personnel Alternatives; 17) Fiscal Management and Agency Property; 21) Classification and Delineation of Duties and Responsibilities; 22) Compensation, Benefits and Conditions of Work; 24) Collective Bargaining; 25) Grievance Procedures; 26) Disciplinary Procedures; 31) Recruitment; 32) Selection; 33) Training and Career Development; 34) Promotion; 35) Performance Evaluation; 41) Patrol; 42) Criminal Investigation; 43) Vice, Drugs and Organized Crime; 44 Juvenile Operations; 45) Crime Prevention and Community Involvement; 46) Critical Incidents, Special Operations and Homeland Security; 52) Internal Affairs; 53) Inspection Services; 54) Public Information; 55) Victim/Witness Assistance; 61) Traffic; 70) Detainee Transportation; 71) Processing and Temporary Detention; 72) Holding Facility; 73) Court Security; 74) Legal Process; 81) Communications; 82) Central Records; 83) Collections and Preservation of Evidence; 84) Property and Evidence Control; 91) Campus Law Enforcement[1] (CALEA, 2016).

CALEA has two tiers in the accreditation process of law enforcement. Tier 1 lists one hundred and eighty-nine standards under the major titles while Tier 2 contains four

[1] Numbering nomenclature specific to CALEA and was not in sequential order. No sections omitted.

hundred and eighty-four standards. The agency is responsible for identifying how each standard is met and providing the documentation for the field assessment team. Doerner and Doerner contend that "Hardly any systematic information exists about the impact of police accreditation despite all the attendant fanfare, the multi-million dollar operation that the CALEA overseas, and the cottage industry of consultants and free-lance advisors this enterprise has spawned" (Doerner & Doerner, 2012, p. 7). Furthermore, "Since the implementation of the Commission on Accreditation for Law Enforcement Agencies (CALEA) in the early 1980s, numerous works have been dedicated to the discussion of police accreditation. Unfortunately, most of those works have been merely discussions of accreditation or empirical evaluations of officers' perceptions on the accreditation process" (McCabe & Fajardo, 2001, p. 127). McCabe & Fajardo compared specific agency characteristics to determine if there were statistically significant differences between accredited and non-accredited law enforcement agencies. The study compared seventeen agency characteristics in four aspects:

1. Agency Characteristics
    a. Population Served
    b. Budget
    c. Overtime
    d. Civilian Employees
    e. Classroom Training Hours
    f. Field Training Hours
2. Officer Characteristics
    a. Male Officers Percentage

b. White Officers Percentage

c. Salary in Dollars

d. Minimum Education Requirement

3. Policies

    a. Drug Testing Policy for Sworn

    b. Drug Testing Policy for Civilian

    c. Body Armor Usage

4. Specialized Operating Units

    a. Drug Unit

    b. Child-abuse Unit

    c. Domestic Violence Unit

    d. Gang Unit

McCabe & Fajardo found only five of these characteristics to have a statistically significant difference: field training hours, minimum educational requirements, policy for drug testing sworn employees, operation of a drug unit and operation of a child-abuse unit (McCabe & Fajardo, 2001). Doerner and Doerner likewise studied a specific characteristic of accredited and non-accredited law enforcement agencies, in particular case clearance rates. Doerner and Doerner desired to determine if accredited agencies achieved higher case clearance rates in comparison to their non-accredited counterparts. It is noted, "Much of what is currently known about the impact of accreditation stems from anecdotal and testimonial evidence. Still, the industry manages to expand and flourish. A glaring need for sound empirical research is evident" (Doerner & Doerner, 2012, p. 6). Upon applying a Random-effects Tobit analysis, the resulting analysis does

not find a statistical difference between accredited and non-accredited law enforcement agencies (Doerner & Doerner, 2012). Doerner and Doerner's research, as well as McCabe and Fajardo's, only looks at the agencies characteristics and outputs, but does not attempt to measure how these characteristics or outputs affect outcomes in the community.

The assessment of Public Safety Communications Agencies follows a similar but much reduced format: 1) Organization; 2) Direction and Supervision; 3) Human Resources; 4) Recruitment, Selection and Promotion; 5) Training; 6) Operations; 7) Critical Incidents, Special Operations and Homeland Security (CALEA, 2016). The major titles listed two hundred and eleven standards and the agency must identify and meet each standard. I am unable to locate any literature that evaluates Public Safety Communications accreditation in any manner as to how the accreditation standard is applied or any comparison between accredited and non-accredited communication centers. The only information available is from the accrediting agency's website.

The Emergency Management Accreditation Program is a collaborative work by states through the National Emergency Management Association, and the International Association of Emergency Managers, a partnership of other local state and federal stakeholders (Bentley, 2004). EMAP is organized under fourteen major programmatic areas: 1) Program Management; 2) Laws and Authorities; 3) Hazard Identification and Risk Assessment; 4) Hazard Mitigation; 5) Resource Management; 6) Planning; 7) Direction, Control and Coordination; 8) Communications and Warning; 9) Operations and Procedures; 10) Logistics and Facilities; 11) Training; 12) Exercises, Evaluations and Corrective Action; 13) Crisis Communications, Public Educations and Information; 14)

Finance and Administration (Bentley, 2004). EMAP applies fifty-four national standards to construct the program (Mortlock, 2006). Bentley goes on to talk about the continuous improvement process and the self-evaluation within EMAP, which is found in all accreditation processes. In the article *Katrina and the Governors*, Waugh (2009) describes the major issues faced by the different states during response and recovery. He evaluates the states' efforts at building emergency management capacity in the aftermath of Hurricane Katrina:

> The evidence is a bit clearer in Louisiana. The state of Louisiana and the City of East Baton Rouge emergency management programs have been accredited since the Katrina disaster. Accreditation by the Emergency Management Accreditation Program is testament to the amount of resources put into the programs since 2005 and how much the programs have improved. EMAP accredits programs, not state or local agencies, and requires the programs involve relevant stakeholders in decision-making and planning and have sufficient administrative capacity to maintain effective programs. Compliance with all standards is required for full accreditation. (Waugh, 2009, p. 348)

Waugh does not expand on this statement or provide evidence to substantiate the improvements were a result of the accreditation process.

Accreditation's Effect on Performance

There is an inference that accreditation of an organization tends to improve performance levels (Doerner & Doerner, 2012; Heras, Dick, & Casadesus, 2002). A study of two accredited and two non-accredited sleep centers indicated patients who were treated by an accredited sleep center achieved better treatment adherence, better patient education, better patient satisfaction and greater timeliness of care (Parthasarathy, Subramanian, & Quan, 2013). The sleep center study design was cross-sectional in nature, utilized a survey instrument, and focused on association (Parthasarathy et al.,

2013). Joly et al contest that "While cross-sectional research designs will provide some insight, longitudinal studies that utilize an agreed-upon core set of standards and outcomes will likely provide valuable information on the relationship between performance/accreditation and outcomes" (Joly et al., 2007, p. 354).

Researchers must pay careful attention to causality as successful organizations may have a proclivity to pursue accreditation (Heras et al., 2002). While not specifically studying publically funded entities, these researchers warn of organizational cultures that would excel regardless of pursuing accreditation status. In their study of 400 ISO accredited and 400 non-accredited firms, Heras, Dick and Casadesus (2002) conducted a longitudinal study of accredited firms' pre and post accreditation and compared these firms to non-accredited firms. While the accredited firms consistently out-performed the non-accredited firms, Heras, Dick and Casadesus concluded the accredited firms would have done so regardless of their accreditation status. "In other words for these firms as a whole, sales growth after ISO 9000 registration is much the same as that achieved prior to accreditation" (Heras et al., 2002, p. 7).

Doerner and Doerner (2012) came to the same conclusion in regards to clearance rates of violent and property crimes in regards to accredited police agencies:

> Accredited and non-accredited departments produce similar violent index and property index clearance rates, despite claims to the contrary made by accrediting bodies…In sum, it does not appear that accreditation influences clearance rates when controlling for crime rates, agency size, fiscal capacity, investigative readiness, and police-community interactions (Doerner & Doerner, 2012, p. 18).

What Are Measurable Variables?

Fire service organizations and management specifically have struggled with performance measures. However, are the routinely used performance measures really an accurate evaluation of performance? What are fire service organizations measuring and are fire service organizations calculating the right variant? Fire service organizations measure turn-out time, response time, and when certain assignments are complete. This is an assessment of the organization's outputs. Does an assessment of outputs correlate to outcomes? Does the improvement of a performance measure improve the outcome?

Performance measure concepts have been utilized as a governmental management tool since the 1940's (Streib & Poister, 1999). Swindell and Kelly reasoned "The best performance measures are valid, reliable, understandable, timely, resistant to perverse behavior, comprehensive, nonredundant [sic], cost-sensitive, program-specific and focused on the performance that are controllable" (Swindell & Kelly, 2000, p. 34). Performance measures are communication and governance (Yang & Holzer, 2006). Some governments, such as Canada, require performance measurements with reporting requirements (Pollanen, 2005).

Organizations are struggling to develop adequate and meaningful performance measures (Streib & Poister, 1999). Most organizations do not move past workload data to true measurement of program outcomes (Swindell & Kelly, 2000). Most managers prefer to measure the inputs and outputs versus the more controversial task of measuring outcomes (Kelly, 2003) (Carvalho, Fernandes, Lambert, & Lapsley, 2006b) (Yang & Holzer, 2006) (Holzer & Kloby, 2005). Unfortunately, many governments that require mandatory performance measures also mandate what measures to utilize. In most cases

these are measurements of inputs and outputs, thus the bureaucracy forces the Emergency Service Organization's (ESO) to measure efficiencies over effectiveness (Pollanen, 2005) (Holzer & Kloby, 2005). This same phenomena is noted in Canada, Australia, the United Kingdom and Portugal (although to varying degrees based on governmental sophistication) (Carvalho, Fernandes, Lambert, & Lapsley, 2006a) (Kloot, 2009) (Pollanen, 2005) and non-profit organizations (Moxham, 2009).

Most organizations utilize quantitative performance measures. These manifest themselves as statistical analysis of identified critical tasks. ESO's typically measure turn-out times, response times, first water on the fire, first defibrillation on a heart attack patient and the list goes on. These methods measure the quality and abilities of the crew delivering the services (Kloot, 2009). Additionally, financial measures may be included in the form of cost per service delivery and how well the organization holds the budgetary line (Kloot, 2009). This has been especially present in non-profit organizations that must justify the expenditure of donated funds by the quantity of the services delivered (Moxham, 2009).

Qualitative attempts include customer surveys and customer interviews (Streib & Poister, 1999). These methods generally assess the customers' or observers' perception of the quality of service delivery. Some scholars maintain that customer surveys may be skewed as citizens tend to rank their local governments high when inquired about service delivery (Swindell & Kelly, 2000). Many times the customer's perception of quality service delivery is different from that of the ESO. This disconnect casts doubt on what the survey is really measuring (Swindell & Kelly, 2000). While surveyors can rate the

quality of the survey on a numerical scale and tabulate the results, this is not the typical statistical data used by ESO's.

Scholars have used a mixed approach of quantitative and qualitative methods. This mixed method explores the linkages between individual ESO service performance indicators and customer service satisfaction questionnaires (Swindell & Kelly, 2000) (Janet M. Kelly & David Swindell, 2002). This approach tests the outputs to outcomes, although the outcomes are subjective data (Swindell & Kelly, 2000) (Kelly, 2003) (Janet M. Kelly & David Swindell, 2002). Additionally, this satisfaction rating may be a contextual assessment more so than an objective evaluation (Kelly, 2003; Janet M. Kelly & David Swindell, 2002).

Computers have increased the quality of data utilized by ESO's and have improved the statistical reliability of the data. But while improvements in measurement have impacted the immediate delivery of the service, few substantial impacts (or outcomes) were identified (Streib & Poister, 1999). Even more troubling is that the ESO's may not know that the improved measurements do not represent an improved outcome (Streib & Poister, 1999). A 2009 article published by NFPA identified nineteen "fire service performance measures". Each of these "measures" were quantitative data reflecting efficiency outputs of an ESO. The article states "performance measures relies [sic] on the evaluation of the achieved outcomes", but the "outcomes" were never identified (Flynn, 2009). The article gives the reader an inference that outputs are interchangeable with outcomes.

The measurement of effectiveness (outcomes) has been the Achilles heel for scholars and ESO's alike as "… a greater degree of ambiguity exists in measuring

outcomes than outputs" (Pollanen, 2005, p. 18). Government critics write books on how the public sector should be more like the private sector, invoking entrepreneurial methods and greater efficiencies (Osborne & Gaebler, 1992). But another study shows state owned enterprises and mixed (public and private) enterprises cannot achieve the same efficiencies as private corporations (Boardman & Vining, 1989). The study cites "conflict between public and private shareholders, leading to a high degree of managerial 'cognitive dissonance'" (Boardman & Vining, 1989). Additionally, holding public employees accountable to organizational efficiencies based on erroneous performance measures tied to customer satisfaction are due to invalid assumptions stemming from private sector measurements (Parhizgari & Ronald Gilbert, 2004). Cities can measure garbage mass delivered to the landfill, but are at a loss to measure personal casualty or property loss averted by fire prevention programs (Swindell & Kelly, 2000).

Independent professional organizations, such as the ICMA and U.S. Public Management Research Association, are working with ESO's to develop better measures (Streib & Poister, 1999) (Swindell & Kelly, 2000) (Holzer & Kloby, 2005; Kelly, 2003). The ability to measure effectiveness and efficiency to adjust services as they are consumed is the ultimate goal (J. M. Kelly & D. Swindell, 2002). Improving the effective and efficient use of citizen resources should result in a high level of citizen trust (Yang & Holzer, 2006).

The difficulty in developing methods and tools to measure effectiveness objectively should not discourage scholars and practitioners from future attempts (Swindell & Kelly, 2000). The ultimate goal of improving effectiveness measurement tools is to advance service quality (Swindell & Kelly, 2000) (Kelly, 2003) (Holzer &

Kloby, 2005). Kelly and Swindell maintain the customer satisfaction survey is currently the best tool to measure effectiveness of ESO service delivery. However, this method has many drawbacks. Race, social status, sex, age, and other independent variations influence the results of the surveys (J. M. Kelly & D. Swindell, 2002).

The quest for effective public sector measurements will continue to plague ESO's for many years to come. While there are methods to measure efficiencies, effectiveness methodology continues to elude ESO's. The best method identified in the literature review is the customer survey or questionnaire. However, there are limitations to how subjective or objective a survey can be. At best, the ESO's can draw a consensus. "Consensus is not 'proof'", (Rainey, Backoff, & Levine, 1976, p. 241). "…we are faced with the immediate decisions as to whether the comparative question is worth pursuing, and whether there are noteworthy differences in public and private management…" (Rainey et al., 1976, p. 241). The current measures utilized by ESO's do not measure outcomes, nor were any such measures identified in other disciplines or countries. The literature review identifies this lack of outcome related performance measures within ESO's.

Selection of Measurable Variables

Selection of measurable variables is of critical importance (Carvalho et al., 2006b; DeBritz & Pollak, 2006; Doerner & Doerner, 2012; Joly et al., 2007). Industry standards can provide the defined measurable variable such as Injury Severity Score, Functional Independence Measure, Violent Crime Index, Property Crime Index, Case Clearance Rates, and Return on Assets (DeBritz & Pollak, 2006; Doerner & Doerner, 2012; Heras

et al., 2002). In other professions, the comparable variable must be developed due to the context of the organizations to be studied such as the comparison between the UK's and Portugal's fire services (Carvalho et al., 2006b). Carvalho et al (2006) provides eight performance indicators from four areas that could fit well within a study of fire service organizations and the relationship to accreditation. These performance indicators of response times, sickness absence, call response time, and community fire safety should influence a community's fire loss, fire casualties, and insurance rates. Carvalho et al (2006) concludes these performance indicators focus on service delivery and are meaningful, portable and could give very important information to comparing fire service organizations. Dr. Burton Clark has proposed an alternate theory. Clark argues a residential fire can result in flashover in as little as three minutes. "That is before anyone can discover the fire, escape the building, call 911, dispatch the FD and we respond" (Clark, 2015, p. 229). As a result, Clark contends the more important performance indicators are fire prevention activities that directly result in the notification of occupants that a fire is occurring and early application of water to control or suppress a fire. Therefore, the more appropriate performance indicators are the percentage of residences in a fire service agency's jurisdiction that has the appropriate number of working smoke detectors and residences with fire sprinkler systems (Clark, 2015),

As a result, consideration of control variables is essential. Doerner and Doerner (2012) utilized a publicly available database (Florida Department of Law Enforcement's Criminal Justice Agency Profile) to gather organizational data in regards to the number of employees, salary, expenditures per capita, entry education level, community oriented policing, canine unit, and bicycle unit to determine if any of these variables influenced

the results (Doerner & Doerner, 2012). Confounding variables limit the ability to determine precisely what changes are responsible for improved program outcomes. Improvements instituted as part of the preparation for accreditation could be responsible. Examples of such improvements in trauma accreditation include addition of trauma surgeons, creating a formal trauma team, dedicated trauma program manager, trauma nurse practitioners, trauma case managers, trauma social workers, improved Emergency Medical Services, and expanded trauma education (DeBritz and Pollak 2006).

What measures commonly used are available to the fire service? The fire service has wrestled with this question for decades. In 1985, an article titled, *In Search of Fire Service Excellence,* listed six measures: 1) decrease in fire loss, 2) decrease in firefighter injury, 3) increase in financial responsibility, 4) increase in performance standards, 5) increase in amount and type of service offered, and 6) decrease in response time (Clark, 1985). Typical fire service measures are divided into several categories: Fire Incidents, Emergency Medical Response, Other Response (Haz-Mat, Fire Alarms, etc.), Fire Prevention and Fire Education (Barr & Eversole, 2003; Bruegman, 2002; Buckman & International Association of Fire, 2006; Carvalho et al., 2006b; Compton & Granito, 2009; Flynn, 2009; Kloot, 2009). Fire incidents measures include dispatch time, turnout time, response time of first due unit, response time of additional first alarm units, fire loss in dollars, fire service and civilian casualties, successful rescues and training/certification levels (Barr & Eversole, 2003; Bruegman, 2002; Cobb, 2012; Compton & Granito, 2009; CPSE, 2013; Flynn, 2009). Emergency Medical Response and Other Response look at the same response time measures along with training/certification levels (Barr & Eversole, 2003; Bruegman, 2002; Cobb, 2012; Compton & Granito, 2009; CPSE, 2013;

Flynn, 2009). Interestingly enough, foreign countries look at the same performance measures with one slight difference; several UK, Portuguese, and Australian fire service entities look at "Best Value Performance Indicators" and financial accountability (Carvalho et al., 2006b; Kloot, 2009). This is attributed to the New Public Management philosophy that was introduced on the heels of *Reinventing Government* by Osborne and Gaebler in 1992 (Carvalho et al., 2006b).

Fire prevention performance measures are: number of properties inspected, violations observed, violations corrected, pre-fire plans developed, number of fire protection plan previews, building site inspections, determination of fire cause, clearance of arson cases, number of arson arrests and prosecution, and training/certification levels of personnel (Barr & Eversole, 2003; Bruegman, 2002; Cobb, 2012; CPSE, 2013). Additional fire prevention measures include the percentage of residences with working smoke detectors and residential fire sprinkler systems (Clark, 2015). Fire education includes number of smoke house participants, program delivery at public schools, program delivery at senior citizen facilities, and civic/community talks or event participation (Barr & Eversole, 2003; Bruegman, 2002; Cobb, 2012; CPSE, 2013).

Current Fire Service Benchmarking Tools

Benchmarking is a commonly used performance measure. Benchmarking utilizes industry standards or industry best practices to set the benchmark for the organization to meet. The fire service utilizes two such benchmarking performance measures: Insurance Service Offices Fire Suppression Rating Schedule (ISO FSRS) and The Center for Public Safety Excellence – Fire Service Accreditation International.

ISO FSRS is a well-established benchmarking tool that has been in existence since 1916. The FSRS evaluates a community's ability to respond to and suppress structure fires. ISO FSRS analyzes three aspects of the fire service agency: Communications, Fire Department and Water Supply. The old ISO FSRS utilized proprietary formulas and benchmarks developed over time (1912 to last revision in 1986 and utilized until 2013) by ISO. The new FSRS utilizes industry standards: NFPA standards for the fire service, American Water Works Association for water supply and NFPA and American Public Communications Official's standards for communications. One of the advantages of the FSRS is that an outside agency conducts the assessment. FSRS has an easy to understand final rating (1 is the best and 10 is the worst), and results in favorable recognition of the organization if the rating is low (1-3 for career and 4-5 for volunteer as these are relatively low achievement). The organization can use the FSRS score as an economic development tool when comparing to other communities and there is no cost to the organization to have the rating conducted by ISO. The organization can also utilize the FSRS to justify budget expenditures or justify budget increases. The ISO applies the FSRS equally to all fire service agencies. FSRS provides a document to present accountability and transparency to the organization's taxpayers, senior management, elected officials and other stakeholders, albeit limited in scope to structural fire response. As seen in Table 2.2, 117 accredited agencies recently evaluated by ISO under the 2013 FSRS rank in the top four class categories with 90% in the two best classes.

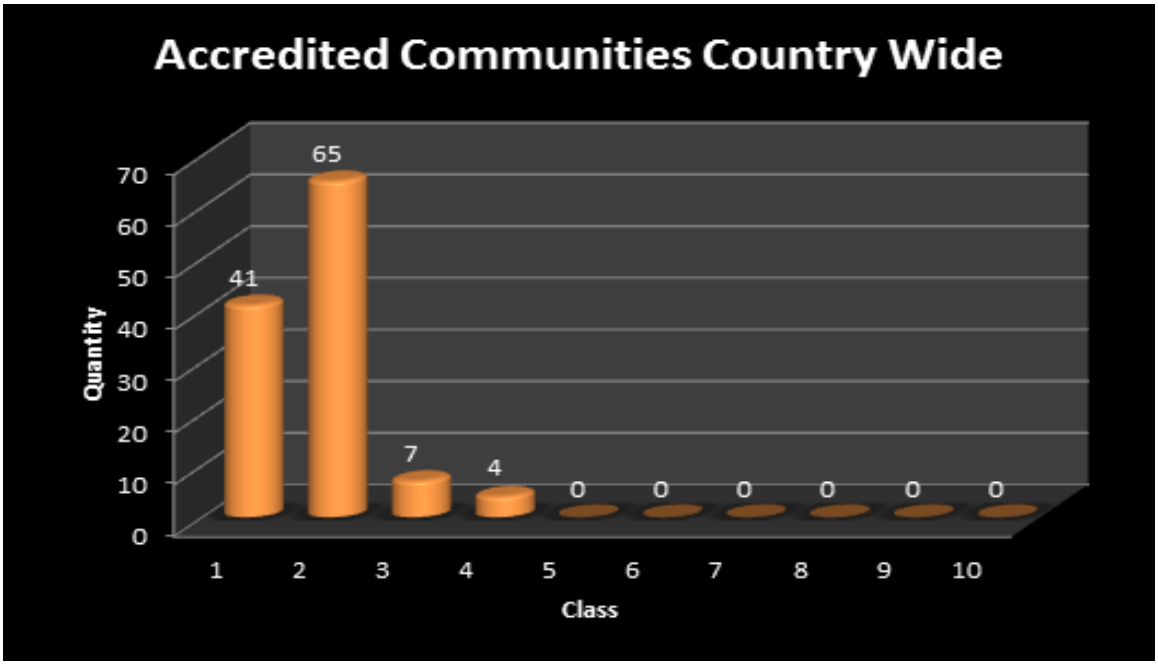


Figure 2.2 ISO Class and Accredited Communities Country Wide (Weber, 2016)

The disadvantages of the FSRS are the cost of personnel, facilities and equipment to achieve and maintain a lower rating. The FSRS individual item calculations are complex and not easily understood by the fire service practitioner. The FSRS only considers the response to structure fires (response to medical, rescues, etc. are not considered), thus distribution of fire response resources is a major point value within the survey. The FSRS is an insurance industry driven tool and ISO sells the results insuring agencies to predict risk and set actuary rates for policies. Insurance agencies can use a resultant increase in the FSRS rating to increase insurance premium. Ultimately, higher insurance premiums work as a political tool against the organization and governing body.

CPSE Accreditation is a self-evaluation process. The organization evaluates the strategic plan, policy and procedures, governance, finances, community risk and response to incidents. CPSE sets the minimal criteria in CPSE publish manuals titled the Self-

Assessment Manual (SAM) and Standard of Cover (SOC). The organization must produce a document that assesses its ability to meet the minimal criteria of each element. The SOC provides guidance to the benchmark criteria in regards to incident response. The National Fire Protection Association's (NFPA) standards identify the benchmarks. The incident response is measured in call-taking time, turn-out time, response time of first due unit, and response time for the balance of the effective response force. A community risk analysis determines the response force necessary to be most effective. CPSE sends a peer assessment team to the organization to review documentation to support the organization's ability to meet the benchmarks of the accreditation process. The peer assessment team makes a recommendation to the CPSE Board, which can grant or reject accreditation status. The accreditation process is a five-year cycle.

The advantages of accreditation are the organization conducts an annual self-assessment with an emphasis on performance improvement. Accreditation looks at all aspects of the organization. Accreditation can result in recognition of the organization as there are only 216 organizations accredited internationally on 01/22/2016. It also serves as an economic development tool when comparing service delivery to other communities. The organization can use accreditation to justify budget expenditures or budget increases. Accreditation provides a document to present accountability and transparency to the organization's taxpayers, senior management, elected officials and other stakeholders.

The disadvantages of accreditation are the resource commitment in terms of personnel time and funding. This resource commitment is taxing on the organization and can be prohibitive to many agencies. Typical time from Registered Agency Status to accreditation is one to two years. Additionally, there are aspects of the accreditation

model of which the organization does not have control (a county communication center that does not allow control over call taking times and dispatch time processing). Accreditation is a process through which to identify areas of improvement and the results could become a political tool against the organization and governing body.

Also worth noting is that there are similar and dissimilar characteristics between the ISO and accreditation benchmarking process. Both organizations provide documentation to guide the agency through the review process and associated criteria. Both organizations have identified criteria that they have determined meets the current best practices and national standards. Both organizations conduct on-site review of the organizations ability to meet the benchmarks.

However, this is where the similarities end. ISO provides a field representative to conduct the FSRS evaluation at no cost to the agency. ISO is also one-dimensional in the aspect of their benchmarking. They are only interested in the fire service agency's ability to suppress a fire in a structure. It is the risk analysis that they sell to the insurance companies so that they can base their actuary decisions upon a reliable methodology. Conversely, accreditation is a multidimensional look at over 10 performance evaluation categories that lie within the fire agency. The fire service agency bears the cost of the accreditation process. These expenses include the cost of training, printed materials, the peer review team travel, and the agency status fee with an annual one-fifth fee to maintain their accreditation status each year for five years.

Accreditation Process

The Center for Public Safety Excellence is the organization responsible for accreditation of fire service agencies and credentialing of emergency service personnel. The Commission on Fire Accreditation International operates under the umbrella of the Center for Public Safety Excellence. The commission makes the determination whether an agency is accredited, deferred, or denied accreditation.

The Commission on Fire Accreditation International divides the accreditation process into four steps. The first step an organization must take is becoming a registered agency. Upon becoming a registered agency, the emergency service agency may obtain a copy of the Fire and Emergency Service Self-Assessment manual, obtain a copy of the Standards of Cover, and send its Chief Officer and accreditation manager to the basic workshop trainings. The cost for the registered agency status is $570. The CPSE allows this fee to apply to the applicant agency's status if the agency moves to the applicant agency status within one year. It is during this time that the agency must decide whether to move forward with the accreditation process (CPSE, 2016).

Step two is becoming an applicant agency. The agency must make a commitment to the accreditation process and notify the CFAI program manager. The agency must submit the appropriate nonrefundable fee, which ranges from $4800-$13,200 based on the applicant's population. The agency can remain at an applicant agency status for 18 months. If the agency is unable to complete the self-assessment and move to Candidate status within their original application of 18 months, they may elect to pay one-half of their original fee for a 12-month extension. CPSE allows an agency to repeat this up to three times. The extension fee is nonrefundable. CPSE assigns a volunteer mentor to the

agency as an additional resource. During this 18-month period, the agency must perform all the self-assessments that are required by the fire and emergency service self-assessment manual. The self-assessment manual contains the following categories:

1) Assessment and Planning
2) Essential Resources
3) External Systems Relations
4) Financial Resources
5) Goals and Objectives
6) Governance and Administration
7) Human Resources
8) Physical Resources
9) Programs
10) Training and Competency

Within the categories, there are 258 performance indicators to measure the self-assessment of the agency. CPSE mandates that eighty-two of these criteria are core competencies that the agency must meet without exception. Once the agency determines their self-assessment is adequate, they can move to the next step as a candidate agency (CPSE, 2016).

Upon declaring eligibility for candidate agency, the agency uploads all pertinent documentation that includes their community risk analysis standards of cover and strategic planning components along with the necessary documentation to meet the criteria of the self-assessment manual. At this time, the CPSE assigns a four-person peer

review team to review the documentation and makes a determination on whether to undertake a site visit. The candidate agency is responsible for the cost of the peer review team's travel to and from the agency, the lodging, and per diem of the peer review team. The Center for Public Safety Excellence determines the peer review team's per diem, which is considerably more than the standard CONUS per diem rate. $6000 is the recommended budget for the cost of the on-site visit. Once the team is on site, the team reviews the documentation provided by the agency. The team also validates the information contained in the documentation. The peer review team may travel to the 911 center, talk to representatives within the city government, and to members of the agency itself to determine if the documents are indeed factual. Any discrepancies discovered by the peer review team are reviewed with the agency's accreditation manager and the agency is given time to correct the deficiencies prior to appearing before the commission. The team will make a determination to make a recommendation to the commission to either grant, defer, or deny the agency's accreditation. The agency will then travel to the annual Center for Public Safety Excellence conference or to the annual International Association of Fire Chiefs conference to appear before the commission and provide testimony for an accreditation determination. The agency must also provide travel, lodging and per diem for the peer-review team leader so he may appear with the agency and provide the peer-review team report and recommendation. While the peer review team carries a considerable amount of influence, the final determination is made by the Commission on Fire Accreditation International (CPSE, 2016).

Once the CPSE bestows accreditation status on an agency, the agency must submit an annual compliance report. This insures the agency is maintaining the self-

assessment through a continuous improvement process over the next five years. The accredited agency will be required to pay the equivalent of 1/5 of the current applicant agency fee annually to maintain their accredited agency status. The agency must submit for reaccreditation every five years at which time they must go through the self-assessment and peer review team process again. The agency must again pay the applicant agency fee and cover the cost of the peer review team (CPSE, 2016).

The process of accreditation is extremely difficult and CPSE provides mentors to assist in the process. The mentors attempt to provide general guidance on how to meet the various criteria, but refrain from providing specific guidance or examples, to avoid unduly influencing an agency's efforts to meet the criteria outlined for that agency's unique characteristics. As a result, several grassroots' state accreditation consortiums have formed to provide support to each agency that participates. The accreditation managers meet quarterly to review new criteria, compare responses and bounce potential solutions off each other. This informal networking provides another outlet of support for the participating agencies.

Firefighting is a Core Function

Since the beginning of civilization, fire departments or brigades developed to suppress fire to reduce loss of life and property. To this day, this is a core function of the fire service, hence, the emphasis in the name. As such, regardless of other functions or duties added to the fire service such as EMS or Haz-Mat, the fire service will always train for and respond to fires. To this point, the variables selected for this study are ISO rating, fire related casualties, fire related property loss, and insurance premiums.

Summary

The literature review focused on fire service accreditation and associated outcomes on the community as well as the same link with accreditation of other public service entities such as Public Health, Law Enforcement, Public Works, emergency Management and Public Safety Communications Centers. It is important to note that the research revealed no academic scholarly literature in regards to how accreditation of any public service discipline influences outcomes on a community. Additionally, the literature review determined accreditation's effect on improved performance through the self-assessment constant improvement process. The literature review provided the basis to determine and select fire casualty rate, ISO rating, fire related property loss and insurance premiums as measurable core fire suppression variables that influence the outcomes of a community. Finally, the literature review examined current industry accepted fire service benchmarking tools and the fire service accreditation process itself.

CHAPTER III

METHODS

This chapter highlights the methodology and procedures used in this study through the following sections: Research Design, Research Questions, Population-Sample, Unit of Analysis, Research Variables, Data Collection Procedures, Data Collection and Statistical Analysis, Bias and Error, Validity, Trustworthiness, Reliability, Diagnostic Tests and Summary.

Research Design

This study utilizes a small-n, multi-variant, intervention analysis and a small-n multi-variant, comparative analysis to determine if there is a causal relationship between accreditation and positive outcomes on the urban 10-year accredited community. The selection of a small-n study was evident due to the small sample size of urban 10-year accredited fire service agencies. Intervention analysis study is utilized within the same agency as the researcher observes variables before and after accreditation to determine if a causal relationship exists on organizational outcomes (Johnson et al., 2012).

Comparative analysis study is utilized with like urban 10-year accredited and urban non-accredited agencies as the researcher observes variables of accredited and non-accredited agencies to determine if a causal relationship exists between accreditation and community outcomes (Johnson et al., 2012). The design type was Quasi-Experimental, and Observational, as the accreditation sample is nonrandom, self-selected and the researcher does not select the treatment or the subjects of the treatment, but merely observes the causal relationships (Johnson et al., 2012).

Research Questions and Hypotheses

This study focused on two research questions to determine if a causal relationship exists between accreditation and positive community outcomes. The first research question is: Does fire service accreditation result in positive measurable community outcomes after a fire service organization completes the accreditation process? This question is necessary to determine if the urban 10-year accredited agency exhibited an improvement due to accreditation. The second research question is: Does fire service accreditation result in a positive measurable community outcome within an urban 10-year accredited agency's community in comparison to an equivalent community where the fire service agency does not participate in accreditation? This question is necessary to determine if accredited urban 10-year fire service agencies exhibited an improved community outcome as compared to non-accredited fire service agencies. Posing subsequent, more specific research questions will be necessary to answer the broader research questions. The efforts of this research will investigate the following specific research questions and hypotheses:

Research Question 1

What is the urban 10-year accredited community's annual firefighter and civilian casualty rate before and after accreditation and how do these casualty causality rates compare to like non-accredited community?

Hypothesis 1

An urban 10-year accredited community's firefighter and civilian casualty rates will decrease after accreditation and the accredited community's casualty rate will be lower than a like non-accredited community.

Research Question 2

Did the urban 10-year accredited community's annual fire property loss change after accreditation and how did these casualty rates compare to a like non-accredited community?

Hypothesis 2

An urban 10-year accredited community's fire property loss will decrease after accreditation and the accredited community's property loss will be lower than a like non-accredited community.

Research Question 3

What is the urban 10-year accredited community's ISO FSRS rating before and after accreditation and how do these ISO FSRS rates compare to a like non-accredited community?

Hypothesis 3

An urban 10-year accredited community's ISO FSRS will decrease after accreditation and the accredited community's ISO FSRS rating will be lower than a like non-accredited community.

Research Question 4

What is the urban 10-year accredited community's annual insurance rate on a 2600 square foot home of ordinary construction after accreditation and how do these insurance rates compare to like non-accredited community?

Hypothesis 4

An urban 10-year accredited community's annual insurance premium rates will decrease after accreditation and the accredited community's insurance premium rates will be lower than a like non-accredited community.

Population and Sample

The population studied are the two hundred and sixteen accredited fire service agencies as of 01/21/2016. CPSE provided the population data set which includes all accredited agencies with the effective date, expiration date, organization name, organization type, organizational population served, the CPSE population class, current ISO rating, phone number, e-mail address, mailing address, and organization's primary contact. The challenge is to derive a purposive accredited sample that can be compared to like non-accredited fire service agencies (Johnson et al., 2012). Organization type is the first control variable to be scrutinized. Organizational type is defined as Career,

DoD, Combination, Volunteer and Commercial/Private. DoD and Commercial/Private do not share the same governance structure as public safety agencies and therefore were removed from the sample. Since combination represented thirty (13.89%) accredited agencies and volunteer represented two (0.93%) accredited agencies, these two organization types were removed from the sample. Additionally, NFIRS organizational type consists of career, mostly career, mostly volunteer, and volunteer, which places only career and volunteer as similar organizational types. The selection of career provides a common variable between the CPSE and NFIRS datasets. Career organization types represented one hundred and thirty-two (61.11%) accredited agencies within the population and were selected for the study sample.

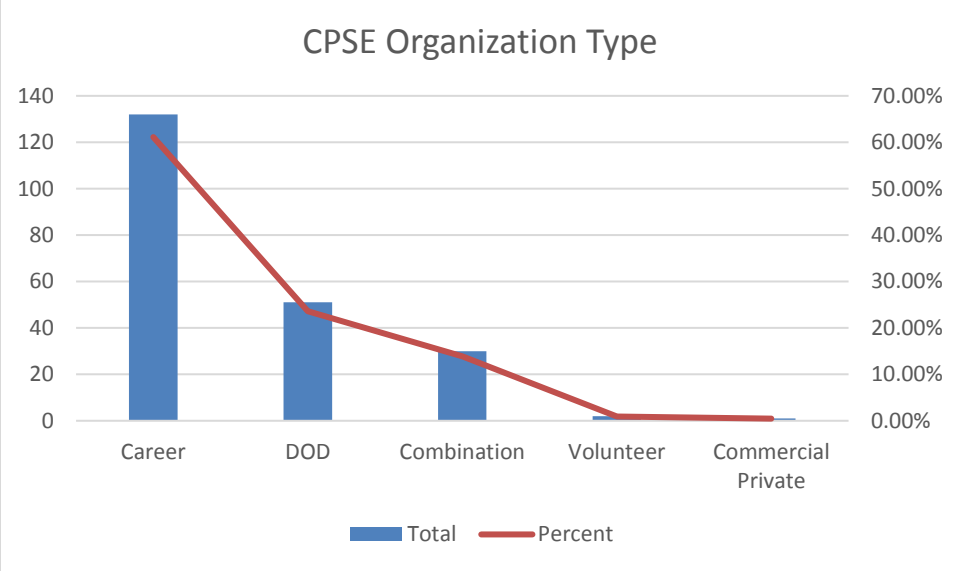


Table 3.1 Accredited Organization Type

Within the one hundred and twenty-seven career accredited departments, CPSE has divided these departments into four population classes: Metro, Urban, Suburban, and Rural:

> We use the descriptions the Federal Government uses when defining our categories. In our research, we found many different population ranges for the same or similar categories, but the most widely used and consistent are those used by the Department of Agriculture and the Department of Transportation when dealing with density issues. We selected those to be our guides in establishing our population ranges (CPSE, 2012, p. 1).

The summary for the population class is Metro, which represented thirty-three (25.98%) accredited agencies, Urban, which represented seventy-four (58.27%) accredited agencies, Suburban represented nineteen (14.96%) accredited agencies and Rural represented one (0.79%) accredited agencies. Suburban and Rural accredited agencies were removed as they only account for 15.75% of the sample. Metro represents a service population of 200,000 populations to infinity and therefore would prove difficult in finding like non-accredited fire service agencies. Ultimately, Urban class represents 58.27% of the sample and a service population of 30,000 to 199,999 and was selected for the study sample. Furthermore, this study reduced the Urban sample by removing two agencies with split ISO ratings, as it would be impossible to determine which area the actual fire loss occurred in. A split ISO rating (for example Class 3/8) provides the best rating to a structure located within 1000 feet of a hydrant in an approved water system. Structures outside the 1000 feet of an approved hydrant, but within five miles of a station receive the lower of the split rating. A jurisdiction receives a split rating when the approved water system does not provide adequate coverage within the fire service coverage area. Additionally, the sample data excludes three Canadian fire service agencies, as NFIRS data is not available for these departments. Also eliminated was one airport fire service agency since their aircraft firefighting service requirements are different from public fire service agencies' service delivery to a community.

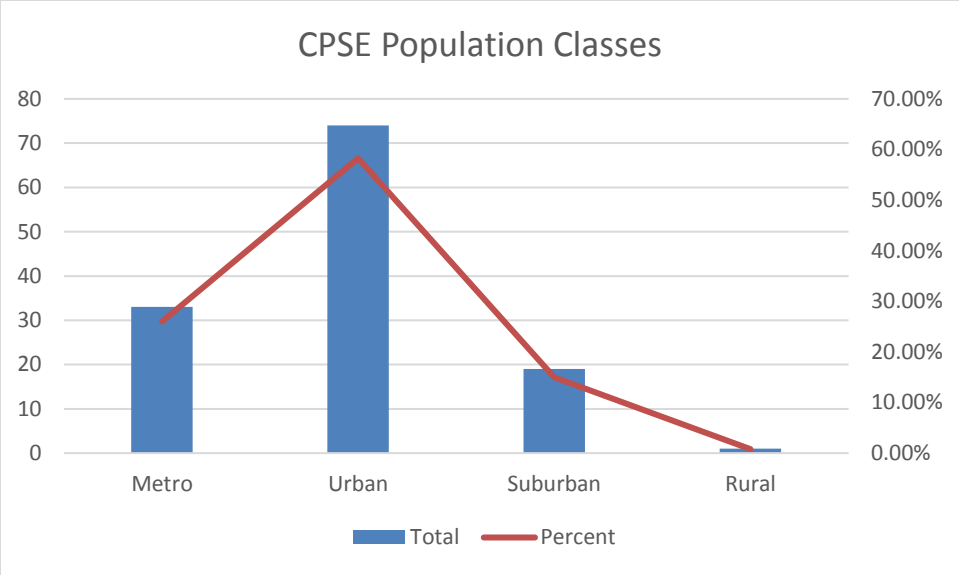


Table 3.2 CPSE Population Classes by Number of Agencies and Percentages

To further define the remaining sixty-eight career urban accredited agencies sample into a data set that can be utilized for the study, additional information was needed such as the date originally accredited, number of reaccreditations, which ISO FSRS was used (old or new FSRS) and the current ISO rating. Each of the sixty-eight agencies were sent an e-mail on 01/28/2016 requesting the additional information needed and forty-four agencies had responded with the requested information. The remaining twenty-four agencies received a second e-mail on 02/14/2016 as well as a follow-up phone call on 02/22/2016. As of 02/25/2016, sixty-seven of sixty-eight agencies had responded or 98.5% of the sample. Of the sixty-seven agencies to respond; twenty-seven have been re-accredited two or more times with nineteen rated under the old schedule, seven rated under the new schedule and one that did not respond to the ISO FSRS question. The sample selected to study is career, urban, rated under the old ISO and re-

accredited at least twice. This resulted in a sample size of nineteen departments. The population range of the selected sample was 35,000 to 143,684.

While the City of Spartanburg met all the criteria of the selected accredited departments for the accreditation sample, I have specifically excluded the department of which I am the current Fire Chief. While this dissertation is specifically oriented to determine if the citizens of Spartanburg acquired a return on their investment, I intentionally omitted Spartanburg to eliminate any appearance of bias.

The comparison fire service agencies were selected by sampling fraction from the NIFRS database (Johnson et al., 2012). As of 01/2016, there were 27,198 fire service agencies registered with the National Fire Department Census, which USFA estimates to be about 91 percent of all U.S. fire service agencies. Of this population, eight percent are career or 2,296 career fire service agencies in the database (USFA, 2016). The sampling fraction was determined by filtering the requested NIFRS sample to provide career departments with a service population of 35,000 to 144,000, which resulted in 745 agencies. The subsequent query of the 745 agencies was divided by the sampling fraction of nineteen. This calculation resulted in every 39th department with a population between 35,000 to 144,000. To verify accuracy of data, this study compared the self-reported population to the national census. With the exception of the two re-accreditation cycles, the same CPSE control variables applied to the selected comparison fire service agencies. If a sampling fraction agency did not meet the parameters of the control variables, the next agency on the list that met the control variables became its replacement. Each agency selected from the NFRIS was contacted to request the additional information needed to apply the control variables.

The nineteen urban 10-year accredited fire service agencies received an email requesting 2004 ISO rating, 2004 NFRIS Property Loss and 2004 NFIRS Casualties data. This data is necessary to assess the effect of accreditation on the organization to determine if accreditation has a measurable effect on the organization. Unfortunately, only four of nineteen organizations could provide the complete data set and two provided a limited data set. The remaining thirteen fire service organizations did not retain the data. The variety of reasons given ranged from an agency changing to a new record management system in which the older data was not transferred to the new system, a state record retention law that did not require the retention of data for the requested period and therefore purged, to even a computer "crash" which lost the data and the agency did not have a valid back-up to retrieve the data. Regardless of the reasons, the lack of sufficient data from 2004 prevented the analysis of the agency before and after accreditation. Therefore, the treatment of how accreditation affects an agency over time resulted in no inference.

Unit of Analysis

The unit of analysis for this study was the individual agency. The organizational level is the focus of the theory, argument, research questions and hypotheses. The individual agency's effort potentially affects the outcomes on the community.

Research Variables

Control variables utilized to narrow the accredited fire service agency sample were organization type, population class, version of ISO FSRS, and re-accredited at least twice. CPSE defined organization type and population class. Narrowing ISO FSRS to the old version provided an identical comparison in both the intervention and comparison analysis. At least two re-accreditation cycles were required to insure the agency has applied the CPSE accreditation process to their community for at least ten years, which increased the reliability and validity of the data.

The dependent variables are urban 10-year accredited agencies and non-accredited agencies. Independent variables are casualty rate for the community, actual property loss in United States currency, ISO rating for the community, and insurance premiums for a 2600 square foot home in United States currency within the fire service agency's boundaries. All United States currency amounts were adjusted against the national average to equalize regional differences in property and monetary values. A population of 1000 normalizes casualty rate.

The 2014 NFIRS data set provided the casualty rate, which includes all injuries regardless of severity and deaths to civilians and firefighters within the specific agency's jurisdiction. The casualty rate is a ratio value.

The ISO rating is on a scale of 1 (best rating) to 10 (worst rating) and is an ordinal value. ISO applies a standardized formula to each agency that provides a score for the fire suppression resources of the fire service agency, the water supply and communication center. The formula score derives the overall rating of the agency.

The 2014 NFIRS data set also provided property loss information. The property loss includes all property loss from fire within the agency's jurisdiction. Property loss is in American currency and is a ratio value. Property loss is normalized by adjusting for the cost of living that is derived from Sperling's Best Places (Sperling, 2016). Sperling's Best Places utilizes multiple national data sources to produce an analytical cost of living calculator (Sperling, 2016). It is noteworthy that this research explored other agencies to acquire more accurate property loss data as well. LexisNexis® Risk Solutions is a company that provides the insurance industry with data and analytics. I contacted LexisNexis® twice via web form requesting assistance in acquiring the data set with no response from the company. ISO provides actuarial information to the insurance industry. Specifically, ISO has a system called ISO Claim Search® to which I inquired as to the availability of property loss information. Per Katherine O'Kelly, Compliance Manager, "Marion – Your note below has been forwarded to my attention. Unfortunately [sic] we will not be able to compile any data for the type of use case you are looking for. Best Regards" (O'Kelly, 2016).

National insurance companies served to provide insurance premium information. . The insurance premiums obtained were for properties located within the agency's jurisdiction. Insurance premiums are in United States currency and are a ratio value. The sample home description is a four bedroom, three bath, 2600 square foot, ordinary construction, gas log fireplace, no security system, no fire suppression system and no basement. The owner description is a married 52-year-old male with 51-year-old wife with no prior insurance claims, family protection of $300,000, and guest medical of

$1000. Insurance premiums are normalized by adjusting for the cost of living derived from Sperling's Best Places (Sperling, 2016).

Data Collection Procedures

Karl Ristow, a CPSE representative, provided the list of accredited agencies used in this study on 01/21/2016. Urban career fire service agencies provided additional control variable data via e-mail and follow-up phone calls. Gayle Kelch, with the USFA, provided the NFIRS national fire department census 02/22/16 data set on 02/22/2016 via e-mail. Kelch disclosed that each agency self-reports the population-protected field using various methods. Upon comparing the population-protected field with U.S. Census data, any discrepancies defaulted to the U.S. Census records. NFIRS fire response data sets provided property loss and casualty rates for each given community. This study utilized the total dollar loss and total number of casualties reported. The NFIRS total dollar loss sample data was adjusted to the national average utilizing the same cost of living adjustment obtained from Sperling's Best Places (Sperling, 2016). The NFIRS total casualty sample data was adjusted to the casualty rate per population of 1000. Thomas G. Weber, an ISO representative who serves as the National Director of Community Hazard Mitigation, provided the past/current ISO FSRS ratings. National insurance agencies (no independent insurance companies were utilized for the data sample) within each fire service agency's jurisdiction provided insurance premiums. Insurance premiums were collected from a combination of contacting insurance agencies located within the fire service agency's jurisdiction or by obtaining an online quote for a property located

within the fire service agency's jurisdiction. The sample home description is a four bedroom, three bath, 2600 square foot, ordinary construction, gas log fireplace, no security system, no fire suppression system and no basement. The owner description is a married 52-year-old male with 51-year-old wife with no prior insurance claims, family protection of $300,000, and guest medical of $1000. The insurance estimate was adjusted to the national average utilizing the cost of living adjustment obtained from Sperling's Best Places (Sperling, 2016). The insurance agencies requested that the premium estimate data remain anonymous to protect their market share thus; a separate file collection protects the individual agencies' estimates.

Statistical Analysis

Statistical analysis of the data involved determining if a casual inference was present on outcomes on an urban 10-year accredited community between a pre-accredited and post accredited agency and an accredited and non-accredited agency. All statistical data analysis was calculated as dichotomous nominal and ratio measurement using Microsoft Excel Statistical Functions, StataCorp LP STATA® 12.1 and SAS Institute, Inc. JMP® Pro 13.0.0 as provided by Oklahoma State University. To determine if there is a correlation between a pre-accredited agency and post-accredited agency, this research analyzed data from one year prior to accreditation and 2014 data of the urban 10-year accredited agency. To determine if there is a correlation between an urban 10-year accredited agency and comparable non-accredited agency, property loss and casualty data from 2014 will be analyzed along with insurance premiums and ISO rating from 2016.

Pre and post accreditation correlation is calculated utilizing data from all the urban 10-year accredited agencies. A correlation coefficient, Z-test, and T-test test will be calculated to determine if a correlation exists and to identify statistically significant differences in the variables (Freund, Wilson, & Mohr, 2010; McCabe & Fajardo, 2001; USFA, 1995). Urban 10-year accredited and comparable non-accredited agency correlation is calculated utilizing data from all the selected agencies. A correlation coefficient, Z-test and T-test, will be calculated to determine if a correlation exists and to identify statistically significant differences in the variables (Freund et al., 2010; McCabe & Fajardo, 2001; USFA, 1995).

OSU Institutional Review Board

I submitted and received a Request for Determination of Non-Research or Non-Human Subject, which is subject to Institution Review Board's approval. The request contained the premise that no human interactions are required for the research conducted for this dissertation. The research derived data from the United States Fire Administration National Incident Reporting System, Center for Public Safety Excellence accredited agencies database, Insurance Service Organization Fire Suppression Rating Schedule database, and national insurance agencies. These data sets do not identify individuals, addresses, or individual demographic data. The IRB granted approval of the NHRS form on September 23, 2015. A copy of the original document is attached as Appendix 1.

A dissertation committee member posed the question of the appropriateness of identifying the individual departments that contributed to the collection of data. Upon emailing a request for clarification to the OSU IRB, the response took the position that the disclosure of the individual departments posed no issue as long as the data was publicly available. A copy of this correspondence is attached as Appendix 2.

Bias and Error

Use of the pre-established data set from CPSE to select all accredited fire services that were within the control variables enabled the minimization of sample bias for urban 10-year accredited fire services. . The resulting population sample came to nineteen accredited fire service agencies. Sample bias for non-accredited fire service agencies is minimized by utilizing sampling fraction selection from the pre-established USFA NFIRS fire department census data set of all career departments (Johnson et al., 2012). The requested NIFRS sample consisted of career departments with a service population of 30,000 to 144,000 which results in 745 agencies. The total number of NFIRS career agencies with a population between 30,000 to 144,000 was divided by nineteen resulting in the selection of every 39th department. When a selected agency failed to meet the parameters of the control variables, the next agency on the list that met the control variables became the rejected agency's replacement. With the exception of the two re-accreditation cycles, the same CPSE control variables applied to the selected comparison fire service agencies.

Sample error for this research is high. This is due to the limited sample set of accredited departments. Growth of the sample set, as more departments become accredited, will reduce the sample error.

Validity

External validity is high as the cross-sectional design measurements are not controlled or manipulated by the researcher. Data analysis is used to make the casual inference, not physical manipulation by the researcher, and the results can be generalized across the other fire service agency populations (Johnson et al., 2012). Internal validity is low, as not all variables that could affect a community's outcomes are controlled. Field experimental data does not have the same internal validity as classical laboratory experiments in which more control of external variables can be exercised (Johnson et al., 2012).

Statistical Tests

To determine if accreditation has an effect on outcomes of a community, this study will perform tests on the means of the data variables derived from urban 10-year accredited and comparable non-accredited communities. The first analysis is to graph the data by frequency to determine if a visual difference can be seen in the plotted variables. The resulting graph provides a visual representation of how the data distributes across the range of the data set. Next, a table of descriptive statistics provides an overall look at the data to determine trends in the means, standard error, range and sum of the data.

Next, testing of the hypothesis utilizes a classical two-sample mean-comparison test. The samples are independent and the result of one population receiving a treatment of accreditation. This is a one-tail test as the hypothesis is predicting the direction of the test. If the test cannot disprove the hypothesis, the p will be less than .05. The direction of the one-tail test should be the urban 10-year accredited value is less than the comparable non-accredited value, therefore the p value of Prob < t is utilized for the test. The t-test is to determine if there is a statistical difference in the means. These calculations were performed by SAS Institute's JMP® Pro 13.0.0.

Correlation coefficients are determined by STATA IC 12 and included in the table. Correlations calculations are a statement of value that represents the strength and direction of the association between the two data sets. The strength is represented by a scale of 0 to 1 (0 = no correlation and 1 = strong correlation) and a positive number represents that the data is moving in the same direction and a negative number represents the that data is moving in opposite directions. The STATA calculation is a Pearson's *r*. Generally, an *r* of 0.1 is a weak relationship, 0.3 is a moderate relationship, and 0.5 is a strong relationship.

A z-test represents the probability that the sample mean would be greater than the average observation in the data set. A probability higher than .5 indicates that the mean is higher than the average observation while a probability lower than a .5 indicates that the mean is lower than the average observation. In the z-test of the sample means of the urban 10-yer accredited and comparable non-accredited data, an accredited score lower than .5 would indicate a better outcome on the community. Use of the Z.TEST function of Excel conducted the z-test of the sample mean.

Diagnostic Testing

The models and variables were tested to determine if the data was in line with tests for Type I Errors, Outliers, and Normality of Variables.

Summary

This chapter defined methodology and procedures used in this study. The research design, research questions, population-sample, unit of analysis, research variables, data collection procedures, and data collection were defined. This chapter also discussed Statistical Analysis with special attention given to bias and error, validity, trustworthiness, and reliability of the data. The research further explained diagnostic testing which verifies the strength of the data.

CHAPTER IV

FINDINGS

This chapter provides a table with the findings of the data collected for casualties, property loss, ISO rating and insurance premiums for urban 10-year accredited fire service agencies and comparable non-accredited fire service agencies. Base descriptive statistics tables with subsequent diagnostic testing represent the data. Finally, utilizing a T-test, Z-test and correlation of each individual variable provides advance bi-variate statistical analysis of urban 10-year accredited and comparable non-accredited agencies.

The following table provides the data collection for the analysis of all agencies casualties, property loss, ISO rating, and insurance premium estimates.

Accredited Agency	Casualities[1]	Property Loss[2]	ISO[3]	Ins. Premiums[4]
Coral Gables, FL	0.00	$19,171.47	1	$2,094.91
Skokie, IL	0.05	$592,758.65	1	$865.05
Miami Beach, FL	0.04	$261,194.03	1	$3,673.88
Wilson, NC	0.18	$1,543,717.58	2	$2,538.46
Rocky Mount, NC	0.14	$759,863.08	2	$2,072.13
West Allis, WI	0.25	$890,457.88	2	$1,228.28
Naperville, IL	0.03	$1,760,280.75	2	$613.42
Bellevue, WA	0.02	$1,710,851.04	2	$985.03
Clovis, CA	0.12	$617,643.49	2	$704.93
Yuma, AZ	0.03	$4,124,043.20	2	$880.13
Ridge Road, NY	0.31	$4,690,370.46	3	$758.45
Hilton Head, SC	0.00	$386,445.11	3	$3,112.32
Union Township, OH	0.02	$574,340.53	3	$947.85
Jacksonville, NC	0.04	$687,966.30	3	$676.09
Gastonia, NC	0.00	$1,570,127.63	3	$1,617.10
Superstition, AZ	0.00	$1,348,513.28	3	$575.98
Asheville, NC	0.11	$3,912,872.42	3	$1,363.10
Bradenton, FL	0.02	$487,292.83	3	$1,033.23
Fishers, IN	0.00	$2,277,275.44	4	$1,088.90

Non-Accredited Agency	Causalities[1]	Property Loss[2]	ISO[3]	Ins. Premiums[4]
Clinton, MI	0.22	$3,941,067.98	4	$919.88
Rome, GA	0.08	$1,362,291.17	3	$1,828.16
Albany, NY	0.33	$4,860.772.77	3	$1,349.55
Murfreesboro, TN	0.12	$2,483,663.76	2	$2,537.62
Somerville, MA	0.30	$157,652.44	2	$682.93
Pinellas Park, FL	0.33	$4,397,703.40	3	$1,961.31
Vestavia Hills, AL	0.03	$326,824.98	3	$1,382.59
Newport Beach, CA	0.02	$753,682.22	2	$656.33
Lehigh Acres, FL	0.12	$1,538,878.17	4	$2,786.49
Galveston, TX	0.19	$3,251,914.46	4	$5,585.54
Hamilton, OH	0.34	$623,536.04	2	$524.21
Smyrna, TN	0.33	$786,818.98	3	$2,107.55
Waukegan, IL	0.09	$2,104,480.23	3	$1,411.05
Canton, MI	0.08	$1,000,408.04	5	$1,841.66
Lenexa, KS	0.00	$1,348,256.52	2	$1,067.83
Alameda, CA	0.00	$723,111.27	2	$1,278.41
Cathedral City, CA	0.00	$251,587.55	3	$1,456.68
Stow, OH	0.06	$249,628.27	3	$537.88
Fargo, ND	0.01	$2,089,964.25	2	$1,288.05

1. 2014 USFA NFIRS adjusted to Casualties per 1000 population.
2. 2014 USFA NFIRS Adjusted for Cost of Living
3. 2016 ISO FSRS (rated under old schedule prior to 2013)
4. 2016 Insurance Premiums Adjusted for Cost of Living

Table 4.1 Accredited and Non-accredited Agency Data Collection Results

Descriptive Statistics

Casualities/1000 Pop (All Departments)		*Casualities/1000 Pop (Accredited)*		*Casualities/1000 Pop (Non-accredited)*	
Mean	0.106015487	Mean	0.07233604	Mean	0.139694934
Standard Error	0.018736703	Standard Error	0.020912229	Standard Error	0.029663245
Median	0.05032421	Median	0.034673262	Median	0.089107698
Mode	0	Mode	0	Mode	0
Standard Deviation	0.115500796	Standard Deviation	0.091154293	Standard Deviation	0.129299086
Sample Variance	0.013340434	Sample Variance	0.008309105	Sample Variance	0.016718254
Kurtosis	-0.42249662	Kurtosis	1.71214078	Kurtosis	-1.338273436
Skewness	0.982805311	Skewness	1.543829591	Skewness	0.544486262
Range	0.338709677	Range	0.314285714	Range	0.338709677
Minimum	0	Minimum	0	Minimum	0
Maximum	0.338709677	Maximum	0.314285714	Maximum	0.338709677
Sum	4.02858849	Sum	1.374384753	Sum	2.654203737
Count	38	Count	19	Count	19
Confidence Level(95.0%)	0.037964167	Confidence Level(95.0%)	0.043934963	Confidence Level(95.0%)	0.062320165

Table 4.2 Descriptive Statistics of Casualties

Table 4.2 indicates the mean of casualties of urban 10-year accredited departments is significantly less than the mean of comparable non-accredited departments. This is also true of the standard deviation, sample variance, range and sum. The sample is useful for statistical analysis as demonstrated by the values of the standard deviation, skewness and range. The descriptive statistics indicate that urban 10-year accredited departments have fewer overall casualties.

$ Loss (All Departments)		*$ Loss (Accredited Departments)*		*$ Loss (Non-Accredited Departments)*	
Mean	1591248.097	Mean	1485009.747	Mean	1697486.447
Standard Error	227512.4686	Standard Error	313712.8671	Standard Error	336346.8301
Median	1174332.28	Median	890457.8755	Median	1348256.522
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	1402481.047	Standard Deviation	1367442.685	Standard Deviation	1466101.842
Sample Variance	1.96695E+12	Sample Variance	1.8699E+12	Sample Variance	2.14945E+12
Kurtosis	0.115366031	Kurtosis	0.892941183	Kurtosis	-0.099615322
Skewness	1.11456707	Skewness	1.350969739	Skewness	0.995749625
Range	4841601.298	Range	4671198.99	Range	4703120.333
Minimum	19171.47352	Minimum	19171.47352	Minimum	157652.439
Maximum	4860772.772	Maximum	4690370.463	Maximum	4860772.772
Sum	60467427.69	Sum	28215185.2	Sum	32252242.49
Count	38	Count	19	Count	19
Confidence Level(95.0%)	460984.0491	Confidence Level(95.0%)	659086.2767	Confidence Level(95.0%)	706638.4686

Table 4.3 Descriptive Statistics of Property Loss

Table 4.3 indicates the mean of dollar loss for urban 10-year accredited departments is less than the mean of comparable non-accredited departments. This is also true of the standard deviation, sample variance, range and sum. The values of the standard deviation, skewness and range indicate the sample is viable for statistical analysis. The descriptive statistics indicate that urban 10-year accredited departments have lower overall property loss.

ISO Score (All Departments)		*ISO Score (Accredited Departments)*		*ISO Score (Non-Accredited Departments)*	
Mean	2.631578947	Mean	2.368421053	Mean	2.894736842
Standard Error	0.143225655	Standard Error	0.190575096	Standard Error	0.200798652
Median	3	Median	2	Median	3
Mode	3	Mode	3	Mode	3
Standard Deviation	0.882902236	Standard Deviation	0.830697586	Standard Deviation	0.87526103
Sample Variance	0.779516358	Sample Variance	0.69005848	Sample Variance	0.766081871
Kurtosis	0.364521095	Kurtosis	-0.47534515	Kurtosis	0.209839684
Skewness	0.322427015	Skewness	-0.18183135	Skewness	0.775700339
Range	4	Range	3	Range	3
Minimum	1	Minimum	1	Minimum	2
Maximum	5	Maximum	4	Maximum	5
Sum	100	Sum	45	Sum	55
Count	38	Count	19	Count	19
Confidence Level(95.0%)	0.290202744	Confidence Level(95.0%)	0.40038342	Confidence Level(95.0%)	0.421862313

Table 4.4 Descriptive Statistics of ISO Ratings

Table 4.4 indicates the mean of ISO Ratings for urban 10-year accredited departments is less than the mean of comparable non-accredited departments. This is also true of the standard deviation, sample variance and sum. The sample is valid for use as demonstrated by the values of the standard deviation, skewness and range. The descriptive statistics indicate that urban 10-year accredited departments have a lower overall ISO Rating.

COL Adjusted Insurance (All Departments)		*COL Adjusted Insurance (Accredited Departments)*		*COL Adjusted Insurance (Non-Accredited Departments)*	
Mean	1527.170246	Mean	1412.065314	Mean	1642.275179
Standard Error	165.6019158	Standard Error	204.4061302	Standard Error	263.6078437
Median	1283.231774	Median	1033.229491	Median	1382.585752
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	1020.838769	Standard Deviation	890.9856648	Standard Deviation	1149.039952
Sample Variance	1042111.792	Sample Variance	793855.4548	Sample Variance	1320292.81
Kurtosis	5.830677042	Kurtosis	1.161958238	Kurtosis	7.534111933
Skewness	2.077283825	Skewness	1.388590646	Skewness	2.389067592
Range	5061.328003	Range	3097.8976	Range	5061.328003
Minimum	524.2117117	Minimum	575.9829968	Minimum	524.2117117
Maximum	5585.539715	Maximum	3673.880597	Maximum	5585.539715
Sum	58032.46936	Sum	26829.24096	Sum	31203.2284
Count	38	Count	19	Count	19
Confidence Level(95.0%)	335.5413537	Confidence Level(95.0%)	429.441344	Confidence Level(95.0%)	553.8195289

Table 4.5 Descriptive Statistics of Insurance Premiums

Table 4.5 indicates the mean of insurance premiums for urban 10-year accredited departments is less than the mean of comparable non-accredited departments. This is also true of the standard deviation, sample variance, range and sum. The values of the standard deviation, skewness and range indicate the sample is valid for statistical analysis. The descriptive statistics indicate that urban 10-year accredited departments have lower overall insurance premiums.

Diagnostic Testing

Type I Errors

Type I errors will be controlled by setting the significance level at 0.05. The probability of committing a Type I error correlates to the size of the critical region. Therefore, holding the significance level to 0.05, the probability of rejecting the null hypothesis incorrectly is only 5 percent of the time (Johnson et al., 2012)

Outliers:

Quantile Range Outliers

Column	10% Quantile	90% Quantile	Low Threshold	High Threshold	Number of Outliers	Outliers (Count)
2014 NFIRS Casualty	0	21.1	-63.3	84.4	0	
COL Adjusted 14 Property Loss	251392	4151409	-1.1e+7	1.59e+7	0	
2016 ISO Rating	1.9	4	-4.4	10.3	0	
Adjusted Premium	609.676	2819.07	-6018.5	9447.26	0	

Table 4.6 Quantile Range Outliers

Robust Fit Outliers

Column	Huber Center	Huber Spread	Huber N Outliers
2014 NFIRS Casualty	7.1686866	7.7677689	0
COL Adjusted 14 Property Loss	1574054	1437438	0
2016 ISO Rating	2.6156229	0.889203	0
Adjusted Premium	1443.1059	807.97588	1

Table 4.7 Robust Fit Outliers

Multivariate Robust Outliers

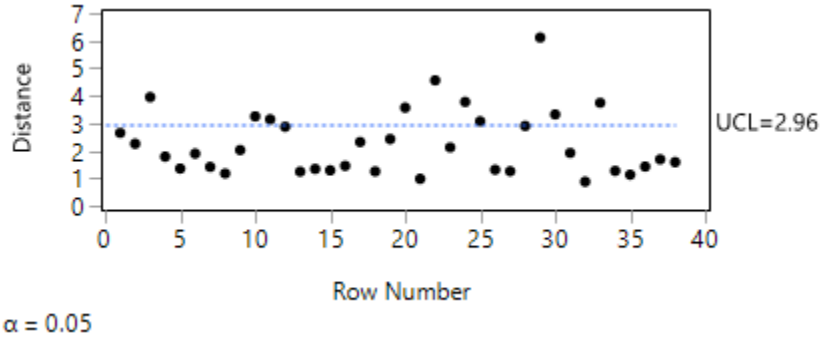


Figure 4.1 Multivariate Robust Outliers

Tests show there are no outliers within the data. An outlier is a variable or variables that are distant from the rest of the sample or population. The presence of outliers can change the values of numerical values of the coefficients. Statistical analysis of Quartile Range Outliers and Robust Fit Outliers were by JMP SAS statistical software. STATA 12 statistical software analyzed the Multivariate Robust Outliers.

Normality of Variables:

Shapiro-Wilk W test

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
NFIRSCausa~y	38	0.84773	5.786	3.683	0.00012
COLAdjuste~s	38	0.84807	5.774	3.678	0.00012
ISORating	38	0.98299	0.646	-0.915	0.82002
AdjustedPr~m	38	0.80769	7.308	4.173	0.00002

Table 4.8 Shapiro-Wilk W Test for Normal Data

Shapiro-Francis W'

Shapiro-Francia W' test for normal data

Variable	Obs	W'	V'	z	Prob>z
NFIRSCausa~y	38	0.89659	4.358	2.735	0.00312
COLAdjuste~s	38	0.85627	6.057	3.347	0.00041
ISORating	38	0.99663	0.142	-3.628	0.99986
AdjustedPr~m	38	0.79797	8.513	3.980	0.00003

Table 4.9 Shapiro-Francis W' Test for Normal Data

The normality of variables testing determines if the data is normally distributed. In the Shapiro-Wilk and Shapiro-Francis W' test, the distribution is not normally distributed if the Shapiro-Wilk K or the Shapiro-Francis W' is less than 0.05 when the alpha level is set at 0.05. All K and W' values are below 0.05 for Casualty, Adjusted Property Loss and Adjusted Insurance Premiums which indicates there is no significant departure from normality (Freund et al., 2010). ISO rating is an ordinal rank value of 1 through 5 and the test for normal distribution of the data does not apply.

Skewness/Kurtosis test

Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
NFIRSCausa~y	38	0.0023	0.0990	9.94	0.0069
COLAdjuste~s	38	0.0069	0.6978	6.75	0.0343
ISORating	38	0.3800	0.4841	1.33	0.5132
InsuranceP~m	38	0.0001	0.0096	16.37	0.0003

Table 4.10 Skewness/Kurtosis Test for Normal Data

Skewness measures the asymmetry of the sample distribution about the mean. A skewness of 0 is perfectly symmetrical. The general rule of thumb:

- -0.5 and 0.5, the distribution is approximately symmetric
- -1 and -0.5 or 0.5 and 1, the distribution is moderately skewed
- Less than -1 or greater than 1, the distribution is highly skewed

The values of all variables Pr(Skewness) are between -0.5 and 0.5, which indicates the sample distribution is approximately symmetrical (GoodData, 2015).

Kurtosis is the measure of peakedness of the sample distribution. Kurtosis indicates the height and sharpness of the central peak. STATA12 statistical software utilizes the kappa4/kappa2-square, of which zero is a normal distribution. The range of -1 to 1 is considered acceptable to indicate a normal distribution. All variable values are within the acceptable range of -1 to 1 (STATA, 2012).

Statistical tests show the data to be within normal limits.

Bi-Variate Analysis of Independent Variables

Casualties

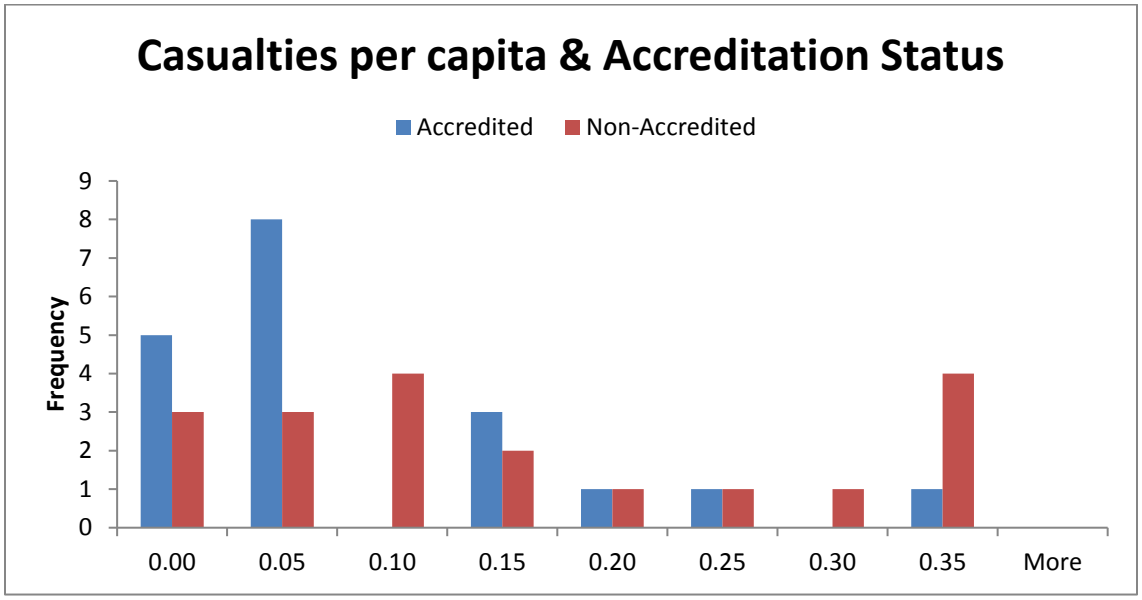


Figure 4.2 Comparison of Casualties (per 1000 population) and Accredited Status

Figure 4.2 provides a visual indication that the frequency of casualties is predominately in the lower range for urban 10-year accredited agencies than comparable non-accredited agencies with at least four non-accredited agencies tabulating in the chart's high of .35 per thousand population (one agency totaled 33 casualties).

Acc_Cas/1000	0.07234	t-Ratio	-2.560165
Non_Cas/1000	0.13969	DF	18
Mean Difference	-0.06736	Prob > |t|	0.0197*
Std Error	0.02631	Prob > t	0.9902
Upper 95%	-0.121	Prob < t	0.0098*
Lower 95%	-0.1226		
N	19		
Correlation	0.50376		

Table 4.11 T-test and Correlation of Urban 10-year Accredited and Comparable Non-Accredited Casualties per 1000 Population

Ho= The urban 10-year accredited community's casualty rate will be lower than a like comparable non-accredited community.

The paired t-test shows t= -2.560165, degrees of freedom = 18 and one-tail p = 0.0098. This indicates a statistical difference between the means of casualties in urban 10-year accredited and comparable non-accredited agencies. This result strongly indicates the treatment of accreditation may have an effect on the casualty rate of an urban 10-year accredited community.

Table 4.11 shows a strong positive correlation between urban 10-year accreditation status and 2014 NFIRS casualties. The positive indicator signifies the relationship is moving in the same direction.

Variable	Mean	Std	Z score (P)	Hypothesis
Casualties/1000				
Accredited	0.07	0.09	0.01	
Non-Accredited	0.14	0.13	0.99	Higher

Table 4.12 Z.TEST of Casualties per 1000 Population

Z-test indicates the sample mean of the urban 10-year accredited casualties is significantly lower than the sample mean of comparable non-accredited casualties. The Z-score strongly indicates the rate of casualities for an urban 10-year accredited fire service agency is lower than a comparable non-acredited fire service agency.

Bi-variate testing of Casualities indicates an urban 10-year accreditation fire service agency has statistically significant less casualities than a comparable non-

accredited urban fire service agency. This result is to be expected if the hypothesis cannot be rejected.

Property Loss

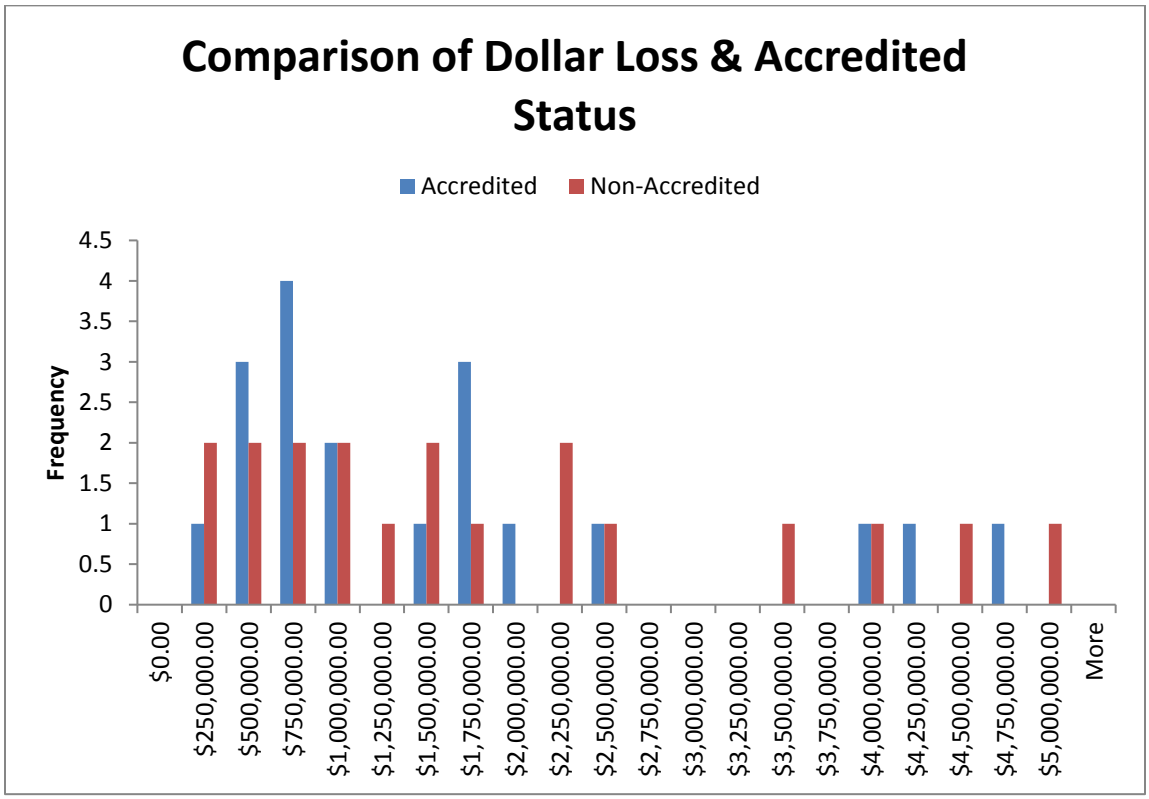


Figure 4.3 Comparison of Property Dollar Loss and Accredited Status

Figure 4.3 provides a visual representation that the frequency of dollar loss for urban 10-year accredited agencies is better overall, predominately in the lower range than comparable non-accredited agencies. Urban 10-year accredited agencies have more occurrences in the lower dollar loss categories. This indicates urban 10-year accredited agencies have lower overall property loss than comparable non-accredited agencies.

Acc_ColProp	1485010	t-Ratio	-0.4620
Non_ColProp	1697486	DF	37.8074
Mean Difference	-212477	Prob > |t|	0.6468
Std Error	459940	Prob > t	0.6766
Upper 95%	718779	Prob < t	0.3234
Lower 95%	-1.1e+6		
N	19		
Correlation	-0.2096		

Table 4.13 T-test and Correlation of Urban 10-year Accredited and Comparable Non-Accredited Adjusted Property Loss

Ho= The urban 10-year accredited community's property loss will be lower than a like comparable non-accredited community.

The paired t-test shows t= -0.4620, degrees of freedom = 37.8074 and one-tail p = 0.3234. This indicates no statistical difference between the means of property loss in urban 10-year accredited and comparable non-accredited agencies. The T-test suggests there may not be a connection between accredited fire service agencies and overall lower property loss versus a non-accredited fire service agency.

Table 4.13 shows a weak negative correlation between accreditation status and 2014 NFIRS property loss. The negative indicator indicates the relationship is inverse indicating as one value increases, the other value decreases. This may be an indication that as property loss decreases for urban 10-year accredited fire service agencies, the property loss for comparable non-accredited fire service agencies increases.

Variable	Mean	Std	Z score (P)	Hypothesis
Property Loss				
Accredited	1485009.75	1367442.68	0.26	
Non-Accredited	1697486.45	1466101.84	0.68	Higher

Table 4.14 Z.TEST of Property Loss

Z-test indicates the sample mean of the urban 10-year accredited property loss is significantly lower than the sample mean of comparable non-accredited property loss. The z-score may indicate that generally urban 10-year accredited fire service agencies have a lower property loss than comparable non-accredited fire service agencies.

Bi-variate testing of Property Loss indicates an urban 10-year accreditation fire service agency is not statistically significant, but indicates practically significant less property loss than a comparable non-accredited urban fire service agency. This overall result is to be expected if the hypothesis cannot be rejected.

ISO Rating

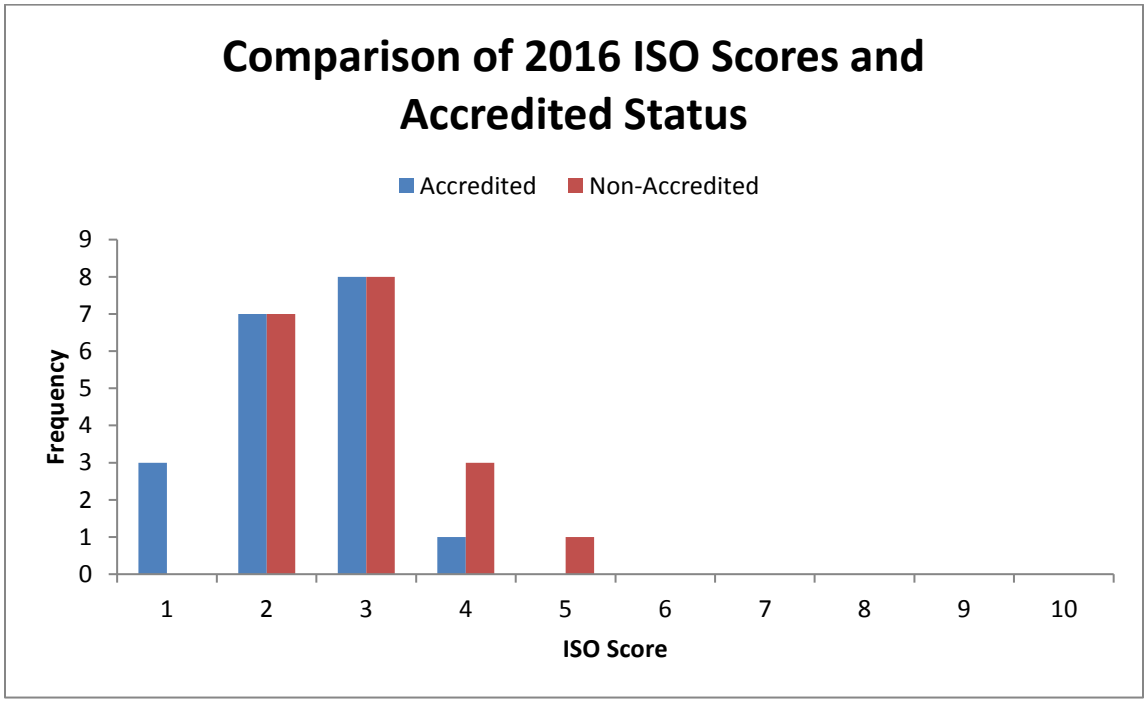


Figure 4.4 Comparison of ISO Rating and Accredited Status

As Figure 4.4 provides a visual representation that the frequency of ISO Rating for urban 10-year accredited agencies are better overall and predominately in the lower range than comparable non-accredited agencies. This indicates that urban 10-year accredited fire service agencies have an overall lower ISO rating than comparable non-accredited fire service agencies.

Acc_ISO	2.36842	t-Ratio	-1.9012
Non_ISO	2.89474	DF	37.8913
Mean Difference	-0.5263	Prob > |t|	0.0649
Std Error	0.27684	Prob > t	0.9675
Upper 95%	0.341651	Prob < t	0.0325*
Lower 95%	-1.0868		
N	19		
Correlation	-0.2493		

Table 4.15 Paired T-test and Correlation of Urban 10-year Accredited and Comparable Non-Accredited ISO Rating

Ho=The urban 10-year accredited community's ISO FSRS rating will be lower than like comparable non-accredited community.

The paired t-test shows t= -1.9012, degrees of freedom = 37.8913 and one-tailed p = 0.0325. This indicates a statistical difference between the means of ISO Ratings in urban 10-year accredited and comparable non-accredited agencies. This result indicates that urban 10-year accredited fire service agencies have a better overall ISO rating than comparable non-accredited fire service agencies.

Table 4.15 shows a weak to moderate negative correlation between accreditation status and 2014 NFIRS property loss. The negative indicator indicates the relationship is inverse indicating as one value increases, the other value decreases.

Variable	Mean	Std	Z score (P)	Hypothesis
ISO Rating				
Accredited	2.37	0.83	0.03	
Non-Accredited	2.89	0.88	0.97	Higher

Table 4.16 Z.TEST of ISO Rating

Z-test indicates the sample mean of the urban 10-year accredited ISO Rating is significantly lower than the sample mean of comparable non-accredited ISO Rating. The Z-score indicates urban 10-year acccredited fire service agencies have a significantly lower ISO rating than comparable non-accredited fire service agencies.

Bi-variate testing of ISO Rating indicates an urban 10-year accreditation fire service agency has statistically significant lower rating than a comparable non-accredited urban fire service agency. This result is to be expected if the hypothesis cannot be rejected.

Insurance Premiums

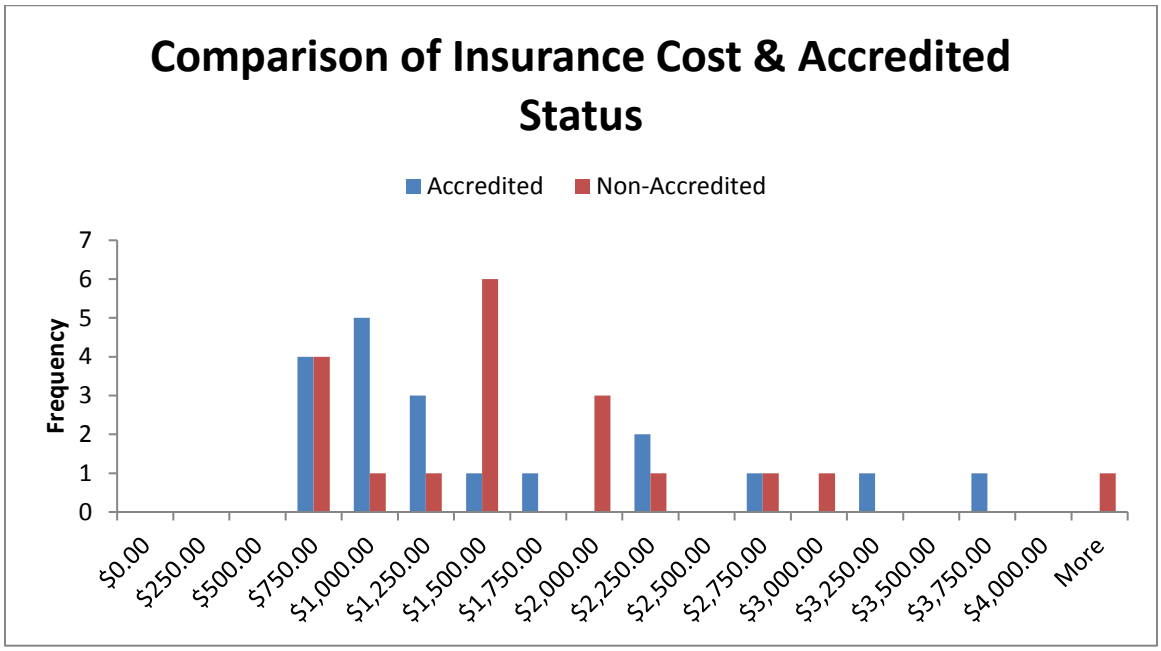


Figure 4.5 Comparison of Insurance Premiums and Accredited Status

Figure 4.5 provides a visual representation that the frequency of premiums for urban 10-year accredited agencies is better overall and predominately in the lower range than comparable non-accredited agencies. Urban 10-year accredited agencies have more premiums in the lower premium cost categories.

Acc_ColPrem	1412.07	t-Ratio	-0.6901
Non_ColPrem	1642.28	DF	35.6646
Mean Difference	-230.21	Prob > |t|	0.4946
Std Error	333.573	Prob > t	0.7527
Upper 95%	446.5285	Prob < t	0.2473
Lower 95%	-906.948		
N	19		
Correlation	-0.0547		

Table 4.17 T-test and Correlation of Urban 10-year Accredited and Comparable Non-Accredited Adjusted Insurance Premiums

Ho= The urban 10-year accredited community's insurance premium rates will be lower than a like comparable non-accredited community.

The paired t-test shows t= -0.6901, degrees of freedom = 35.6646 and one-tailed p = 0.2473. This indicates no statistical difference between the means of insurance premiums in urban 10-year accredited and comparable non-accredited agencies. The T-test suggests there may not be a connection between urban 10-year accredited fire service agencies and overall lower insurance premiums versus a comparable non-accredited fire service agency.

Table 4.17 shows an extremely weak negative correlation between accreditation status and insurance premiums. The negative indicator indicates the relationship is inverse indicating as one value increases, the other value decreases.

Variable	Mean	Std	Z score (P)	Hypothesis
Insurance Premium				
Accredited	1412.07	890.99	0.24	
Non-Accredited	1642.28	1149.04	0.76	Higher

Table 4.18 Z.TEST of Insurance Premium Rates

Z-test indicates the sample mean of the urban 10-year accredited insurance premium rates is significantly lower than the sample mean of comparable non-accredited insurance premium rates. The z-score may indicate that generally urban 10-year accredited fire service agencies have a lower insurance premiums that comparable non-accredited fire service agencies.

Bi-variate testing of Insurance Premiums indicates an urban 10-year accreditation fire service agency is not statistically significant, but indicates practically significant lower premiums than a comparable non-accredited urban fire service agency. This overall result is to be expected if the hypothesis cannot be rejected.

Dependent Variable

The dependent variable of accreditation status or treatment of a fire service agency within the community is the key to the anaysis of the results of the independent variables. Urban communities where the accreditation treatment was implemented for at least 10 years show statistically significant lower ISO Ratings and Casualty loss. Additionally, urban communities where the accreditation treatment was implemented for at least 10 years show practically significant lower Property Loss and Insurance Premiums.

Summary

This chapter provided a table of the results of the data collected for casualties, property loss, ISO rating and insurance premiums. Base statistics tables with subsequent diagnostic testing represented the data. Finally, T-test, Z-test and correlation of each individual variable provided advance bi-variate statistical analysis of urban 10-year accredited and comparable non-accredited agencies.

CHAPTER V

CONCLUSION

This chapter presents the conclusions based on the data collected. After reviewing the research hypothesis, this chapter explains the inability to provide an answer for the question of "Accreditation's Effect on the Fire Service Organization." The statistical hypothesis is stated followed by an explanation of whether the hypothesis is inferred to be true by applying T-Tests. An introduction to the theory of Statistical Significance versus Practical Significance provides insight into the statistical hypothesis utilizing Z scores. Examining the resulting statistical analysis answers the Research Question. In hopes that the data collection process improves in the future, this chapter provides recommendations to improve the data collection and validity as well as identifies gaps in available data.

Research Hypotheses

The research is inconclusive in regards to the theory that fire service accreditation results in positive measurable community outcomes after a fire service organization completes the re- accreditation process twice. The research supports fire service

accreditation results in a positive measurable community outcome within an urban 10-year accredited agency's community in comparison to an equivalent community where the fire service agency does not participate in accreditation. The research hypothesis is accreditation has a positive effect on the community. Ultimately, posing subsequent, more specific research questions and hypotheses provides answers to the broad research hypotheses.

Accreditation's Effect on the Fire Service Organization

The statistical hypothesis of accreditation's effect on a fire service organization cannot be determined. The data necessary to assess the effect of accreditation on the organization to determine if accreditation has a measurable effect on the organization is not available. Unfortunately, only four of nineteen organizations could provide the complete data set and two provided a limited data set. The remaining thirteen fire service organizations did not retain the data. The variety of reasons given ranged from an agency changing to a new record management system and the older data was not transferred to the new record management system, a state record retention law that did not require the retention of data for the requested period, therefore it was purged, to even a computer "crash" which lost the data and the agency did not have a valid back-up to retrieve the data. Regardless of the reasons, the lack of sufficient data from 2004 prevented the analysis of the agency before and after accreditation. As a result, the information available provided no inference on how the treatment of accreditation affected the agency over time.

Statistical Hypotheses of Comparable Organizations

A research hypothesis is the hunch or suspicion hypothesis that motivates the research where statistical hypothesis are tested to arrive at a conclusion of a population based on evidence contained in the sample selected from that population (Daniel, 1977; Johnson et al., 2012). A statistical inference can be obtained from the evidence of the sample and inferred upon the population (Daniel, 1977; Johnson et al., 2012). The statistical inference of the statistical hypothesis can then be applied to answer the research hypothesis (Daniel, 1977; Johnson et al., 2012). The following four statistical hypotheses tested the community difference between urban 10-year accredited and comparable non-accredited fire service agencies:

Statistical Hypothesis 1:

Ho= The urban 10 year accredited community's casualty rate will be lower than a comparable non-accredited community.

Statistical Hypothesis 2:

Ho= The urban 1-year accredited community's property loss will be lower than a comparable non-accredited community.

Statistical Hypothesis 3:

Ho=The urban 10-year accredited community's ISO FSRS rating will be lower than a comparable non-accredited community.

Statistical Hypothesis 4:

Ho= The urban 10-year accredited community's insurance premium rates will be lower than a comparable non-accredited community.

A review of the descriptive statistics from each urban 10-year accredited and comparable non-accredited variable set reveals the mean of the urban 10-year accredited fire service agency lower than the mean of the comparable non-accredited fire service agencies. This is also true of the standard deviation, sample variance, range and sum with the exception of ISO Rating range, which were equal. The descriptive statistics show the overall reduction of critical variables for urban 10-year accredited fire service agencies. The descriptive statistics broadly indicate that accreditation has an effect on the fire suppression efforts of an urban 10-year accredited community. The results of descriptive statistics indicate that the samples are valid for statistical analysis.

T-Tests applied to the sample of the means determined statistical significance in community casualty rate and ISO ratings with a statistically significant one-tail p score of .0098 and .0325 respectively. The tests strongly indicate the treatment of accreditation results in overall lower injury and death rate and a lower ISO rating in the current data set. The reduction in injury and deaths signify a reduction in work loss time, reduction in medical costs, and the ability of insurers to apply a lower premium in relation to the lower ISO rate. These results build on Shackelford's statistically significant variables measuring organizational effectiveness (Shackelford, 2002).

T-Tests applied to the sample of the means determined no statistical difference in community property loss and insurance premiums. While the samples of the means were

not statistically different, both samples exhibited lower means for urban 10-year accredited fire service agencies than comparable non-accredited fire service agencies.

Statistical Significance versus Practical Significance

The theory of Practical Significance holds that statistical significance cannot be the sole determination of decision making in proving or disproving a hypothesis. In fact, a statistically significant result can hold no practical implications as well as not having a statistically significant result with useful information obtained from the data (Freund, 2010). Freund provided the following example: Ten subjects are weighed and placed on a diet. After two weeks, the subjects weigh in again. Of the ten subjects, nine lost between 1 to 2 pounds and one gained 10 pounds. The resulting calculations would hold no statistical significance, but nine of the ten lost weight. The loss of weight was not arbitrary but due to the treatment of the diet. Therefore, there is a significance to the nine subjects that lost weight. Freund explained this as Practical Significance. Roger Kirk (1996) further expands on the theory inferring that statistical significance is concerned with a research result or sampling variable where practical significance is concerned with whether the result is useful in the real world. He further identified that the APA Board of Scientific Affairs appointed a task force to study the possibility of phasing out the use of the null hypothesis significance testing in journal articles and textbooks (Kirk, 1996). Daniel likewise points out that practical significance may be more effective in describing the difference in small sample as "small sample size requires a large absolute difference between groups to demonstrate statistical significance" (Daniel, 1977, p. 404).

Z-Tests, applied to the sample data, tested for practical significance. Z-Tests represent the probability that the sample mean would be greater than the average of the observations in the data set. The same principal applies to T-Tests (which are used to compare urban 10-year accredited sample against the comparable non-accredited sample), but on a larger sample (greater than 30) as the Z-Test is compared to the entire sample. A Z-score of 0.5 is the exact middle of the sample. For the theory of Practical Significance to be relevant, urban 10-year accredited Z-scores must be less than 0.5. The actual Z-scores of all urban 10-year accredited agencies are significantly lower than 0.5 (Casualty 0.01, Property Loss 0.26, ISO Rating 0.03, and Insurance Premiums 0.24). As a matter of Practical Significance, urban 10-year accredited fire service agencies have a significant effect on a community's casualties, property loss, ISO rating and insurance premiums outcomes. This result mirrors Daniel, Kirk, and Freund's Practical Significance theory due to small sample size and Freund's weight loss example (Daniel, 1977; Freund, 2010; Kirk, 1996).

Research Hypotheses Answer

The research of the data reveals accreditation does have a positive effect on the community outcomes. Casualties and ISO Rating are statistically significant and all variables are practically significant. If an organization determines to expend resources on accreditation, the inference is a return on that investment with lower casualties, lower property loss, lower ISO rating and lower insurance rates for their respective community.

For fire chiefs, these results are noteworthy. Budgets are tight and all expenditures must be justified. Now the fire chief can produce statistical evidence that accreditation provides results. Fire Service and civilian casualties have direct and indirect monetary effects on the community. Lost work productivity, lost wages, and medical expenses are just a few examples. The accreditation process provides a means to mitigate these losses. Lower ISO Ratings result in lower insurance premiums for residential and business structures. In Spartanburg, we have found the lower premiums almost offset the additional property tax levied by the city, which becomes an economic development incentive to potential developers, investors, and homeowners. Reduced property losses may help businesses and residents get back into their structures faster and lower insurance payouts. Additionally, this assists in keeping property on the tax rolls at the optimal value. Lower insurance premiums provide additional spendable income to residents and business owners.

Accreditation also works as an economic development tool. In Spartanburg, we intentionally identified the fact that both the police and fire departments are accredited and this is an elite status. Only 8 other fire departments are accredited in South Carolina and only two that are accredited as well as ISO Class 1. We can show that potential development may save money on their insurance premiums and the accredited status infers a higher level of service.

Recommendations

Recommendation 1: Improved selection of comparison organizations – In selecting the comparison variables, I utilized the entire NFIRS data set with a resident population of 35,000 to 144,000 (to match the CPSE population size) which revealed 745 agencies, which, divided by 19, resulted in every 39th agency for the random sample. This provided samples from several locations in the United States that were not present in the CPSE sample. While this is truly a random sample, further dividing the NFIRS sample by the same states could make a better comparison of like departments represented in the CPSE sample.

Recommendation 2: CPSE to benchmark selected variables of Registered Agencies – Registered Agency status is the first step of the accreditation process. This step occurs before the agency begins applying the accreditation treatment on their organization. This is the perfect time to acquire selected variables to benchmark and compare against the agency after re-accreditation in five and ten years. The resulting data could be viable for use in statistical models to determine if the accreditation treatment provided a statistically significant improvement on the organization and community outcomes.

Recommendation 3: Conduct research on the same variables again in the future – ISO Rating was a difficult variable to measure as ISO updated the rating schedule in 2012. While some agencies in the CPSE population received their rating under the old schedule, others received their rating under the new. To avoid inconsistency, the research utilized the old schedule as it provided the most samples. Additionally, all the urban 10-year accredited agencies were evaluated in 2004 under the old schedule, so to attempt

comparison of pre and post treatment, the ISO variable had to be created under the same schedule. ISO is dedicated to rating all departments under the new schedule as quickly as possible. Once all rated under the new schedule, the CPSE sample of agencies becomes much larger and will provide greater accuracy and validity.

Recommendation 4: Expand the scope of the research – The research in this dissertation focused on the fire suppression aspect of the fire service agency. Additional aspects of a fire service agency are Emergency Medical Services, Special Operations, Fire Prevention, and Fire Education. Studies of each of these aspects opens an entire new set of variables to determine if accreditation provides better EMS, Fire Prevention or Fire Education outcomes on the community. This area of study would tend to support Dr. Clark's (2015) theory of studying different variables to assess the effectiveness of a fire service agency.

Recommendation 5: Examine the Qualitative measures of accreditation – The qualitative aspects of accreditation hold an entirely different view of community outcomes. How does the community perceive the fire department? How often is the department engaging with the community? Do children hold a different view of firefighters than adolescents, adults and elderly populations? How do these views differ between accredited and non-accredited agencies?

Recommendation 6: Examine the accuracy of the NFIRS property loss data sets – firefighters who have very little experience in estimating property loss are usually responsible for entering the data. Property loss estimates could vary widely from the actual insurance industry payouts. A study that takes a representative sample of NFIRS

property loss data compared to the actual insurance industry payouts would assist in validating future use of NFIRS property loss data.

Recommendation 7: Examine the actual ISO scores of accredited departments over time – The ISO classification designation spans a scale of 10 points. A study of pre-accredited agencies' ISO scores compared to post 10-year accredited scores would provide a more accurate picture of the effect of accreditation on a fire service agency. The data would provide the exact areas of improvement realized by the accreditation process. This study could support Tom Weber's assessment (see Figure 2.2) that accredited fire service agencies tend to score in the upper four ranges of the ISO FSRS evaluations with 90% in the best two classes.

Summary

This chapter presented the conclusions based on the data collected. Upon reviewing the research hypotheses, this chapter provided an explanation of the inability to provide answers for the question of "Accreditation's Effect on the Fire Service Organization" due to the lack of data prior to the organization's accreditation. The statistical hypothesis was stated with subsequent explanation of whether the hypothesis was proven false by applying T-Tests. An introduction to the theory of Statistical Significance versus Practical Significance provided insight into the statistical hypothesis utilizing Z scores. Examination of the resulting statistical analysis provided answers to the Research Question. Additionally, in hopes that the data collection process improves in

the future, this chapter provided recommendations to improve the data collection methods and validity as well as identified the gaps in available data.

REFERENCES

Barr, R. C., & Eversole, J. M. (Eds.). (2003). *The Fire Chief's Handbook* (6th ed.). Tulsa, Okla.: PennWell Corp.

Bentley, E. (2004). Interstate Cooperation in Homeland Security: Emergency Management Standards and Accreditation. *Spectrum: Journal of State Government, 77*(4), 18-25.

Boardman, A. E., & Vining, A. R. (1989). Ownership and Performance in Competitive Environments: A Comparison of the Performance of Private, Mixed, and State-Owned Enterprises. *Journal of Law and Economics, 32*(1), 1-33.

Bruegman, R. (2002). Fire service accreditation, 1710, and standards of response. *PM. Public Management, 84*(1), 4.

Buckman, J. M., & International Association of Fire, C. (Eds.). (2006). *Chief Fire Officer's Desk Reference*. Sudbury, Mass.: Jones and Bartlett Publishers.

CALEA. (2016). About Us - The Commission. Retrieved from http://www.calea.org/content/commission

Carvalho, J., Fernandes, M., Lambert, V., & Lapsley, I. (2006a). Measuring fire service performance: a comparative study. *Internation Journal of Public Sector Management, 19*(2), 165-179.

Carvalho, J., Fernandes, M., Lambert, V., & Lapsley, I. (2006b). Measuring fire service performance: a comparative study. *International Journal of Public Sector Management, 19*(2), 165-179.

Clark, B. A. (1985, October, 1985). In Search of Fire Service Excellence. *Firehouse,* 6.

Clark, B. A. (2015). *I Can't Save You But I'll Die Trying: The American Fire Culture*. Nashville, TN: Premium Press American.

Cobb, R. (2012, 08/04/2012). *ISO: What You Need To Know about, "The New Fire Suppression Rating Schedule 2012"*. Paper presented at the Fire Rescue International, Denver, Colorado.

Compton, D., & Granito, J. A. (2009). *Managing Fire and Rescue Services*. Washington, D.C.: Published for the ICMA University by the International City/County Management Association.

CPSE. (2012). CPSE Newsletter, Volume 6, Number 5.

CPSE. (2013). About Accreditation & CFAI. Retrieved from http://www.publicsafetyexcellence.org/agency-accreditation/about-accreditation-cfai.aspx

CPSE. (2016). About Accreditation & CFAI. Retrieved from http://www.publicsafetyexcellence.org/agency-accreditation/about-accreditation-cfai.aspx

Daniel, W. W. (1977). Statistical significance versus practical significance. *Science Education*, *61*(3), 423-427.

DeBritz, J. N., & Pollak, A. N. (2006). The impact of trauma centre accreditation on patient outcome. *Injury*, *37*(12), 1166-1171.

Doerner, W. M., & Doerner, W. G. (2012). Police Accreditation and Clearance Rates. *Policing: An International Journal of Police Strategies & Management*, *35*(1), 6-24.

Flynn, J. D. (2009). *Fire Service Performance Measures*

Retrieved from Quincy, MA:

Freund, R. J., Wilson, W. J., & Mohr, D. L. (2010). *Statistical methods* (3rd ed.. ed.). Boston: Elsevier.

GoodData. (2015). Normality Testing - Skewness and Kurtosis. Retrieved from https://help.gooddata.com/display/doc/Normality+Testing+-+Skewness+and+Kurtosis

Heras, I., Dick, G. P. M., & Casadesus, M. (2002). ISO 9000 Registration's Impact on Sales and Profitability: A Longitudinal Analysis of Performance Before and After Accreditation. *The International Journal of Quality & Reliability Management, 19*(6/7), 774-791.

Holzer, M., & Kloby, K. (2005). Public Performance Measurement: An Assessment of the State-of-the-Art and Models for Citizen Participation. *International Journal of Productivity and Performance Management, 54*(7), 517-532. Retrieved from ABI/INFORM Global. (Document ID: 952030171)

Institute for Training in Municipal Administration, T. (1968). *Municipal Fire Administration* (7th ed. with corrections.. ed.). Washington, D.C.: Washington, D.C. : Published for the Institute for Training in Municipal Administration by the International City Managers' Association.

ISO. (2016). ISO Title Page. Retrieved from http://www.verisk.com/

Johnson, J. B., Reynolds, H. T., & Mycoff, J. D. (2012). *Political science research methods* (7th ed.): Cq Press.

Joly, B. M., Polyak, G., Davis, M. V., Brewster, J., Tremain, B., Raevsky, C., & Beitsch, L. M. (2007). Linking Accreditation and Public Health Outcomes: a Logic Model Approach. *Journal of Public Health Management and Practice, 13*(4), 349-356.

Kelly, J. M. (2003). Citizen Satisfaction and Administrative Performance Measures. *Urban Affairs Review, 38*(6), 855-866. doi:10.1177/1078087403038006005

Kelly, J. M., & Swindell, D. (2002). A multiple-indicator approach to municipal service evaluation: Coorelating performance measurement and citizen satisfaction across jurisdictions. *Public Administration Review, 62*(5), 610-621.

Kelly, J. M., & Swindell, D. (2002). Service Quality Variation Across Urban Space: First Steps Toward a Model of Citizen Satisfaction. *Journal of Urban Affairs, 24*(3), 271-288.

Kirk, R. E. (1996). Practical significance: A concept whose time has come. *Educational and psychological measurement, 56*(5), 746-759.

Kloot, L. (2009). Performance measurement and accountability in an Australian fire service. *Internation Journal of Public Sector Management, 22*(2), 128-145.

McCabe, K. A., & Fajardo, R. G. (2001). Law enforcement accreditation: A national comparison of accredited vs. nonaccredited agencies. *Journal of Criminal Justice, 29*(2), 127-131.

McEwen, T., & Miller, C. (1999). *Fire Data Analysis Handbook* (pp. 199). Retrieved from http://www.usfa.fema.gov/downloads/pdf/publications/fdah.pdf

Mortlock, M. (2006). A Disaster Report Card. *Public Manager, 35*(1), 26-29.

Moxham, C. (2009). Performance Measurement: Examining the applicability of the existing body of knowledge to nonprofit organisations. *International Journal of Operations & Production Management, 29*(7), 740-763.

O'Kelly, K. (2016, 11/06). [Personal E-mail to MarionF. Balckwell, Jr.].

Olsen, E. (1996). Effect of sampling on measurement errors. *Analyst, 121*(9), 1155-1161. doi:10.1039/AN9962101155

Osborne, D., & Gaebler, T. (1992). Reinventing government : how the entrepreneurial spirit is transforming the public sector (pp. xxii, 405 p.). Reading, Mass.: Addison-Wesley Pub. Co.

Parhizgari, A. M., & Ronald Gilbert, G. (2004). Measures of organizational effectiveness: private and public sector performance. *Omega, 32*(3), 221-229. doi:DOI: 10.1016/j.omega.2003.11.002

Parthasarathy, S., Subramanian, S., & Quan, S. (2013). A Multicenter Prospective Comparative Effectiveness Study of the Effect of Physician Certification and Center Accreditation on Patient-centered Outcomes in Obstructive Sleep Apnea. *Journal of Clinical Sleep Medicine: JCSM: Official Publication of the American Academy of Sleep Medicine, 10*(3), 243-249.

Pollanen, R. M. (2005). Performance measurement in municipalities: Empirical evidence in Canadian context. *International Journal of Public Sector Management, 18*(1), 4-24.

Rainey, H. G., Backoff, R. W., & Levine, C. H. (1976). Comparing Public and Private Organizations. *Public Administration Review, 36*(2), 233-244.

Ray, S. (2013, April 2013). Game Changer. *Fire Chief, 57*, 80.

Rivero, M. A. (2004). *A comparative Analysis Of The Likely Impact Of An Accrediation Process Between Professional Fire Fighters And City/County Managers.* ProQuest Dissertations Publishing.

Shackelford, R. O. (2002). *A Critical Analysis Of The Fire Accreditation Process To Discover If It Impacts The Effectiveness Of Paid, Public Fire Departments.* ProQuest Dissertations Publishing.

Sperling, B. (2016). Sperling's Best Places. Retrieved from http://www.bestplaces.net/

STATA. (2012). STATA 12 User Manual and Documentation. College Station, TX: StataCorp LP.

Streib, G. D., & Poister, T. H. (1999). Assessing the Validity, Legitimacy, and Functionality of Performance Measurement Systems in Municipal Governments. *The American Review of Public Administration, 29*(2), 107-123. doi:10.1177/02750749922064300

Swindell, D., & Kelly, J. M. (2000). Linking Citizen Satisfaction Data to Performance Measures: A Preliminary Evaluation. *Public Performance & Management Review, 24*(1), 30-52.

Tzoumis, K. A., & Delaney, K. I. (1999). Evaluating the Effectiveness of Public Works Accreditation on Quality of Service. *Public Works Management & Policy, 3*(4), 331-343.

USFA. (1995). *Fire Data Analysis Handbook*. Emmitsburg, MD: USFA.

USFA. (2016). National Fire Department Census Quick Facts. Retrieved from https://apps.usfa.fema.gov/census/summary

Walter, A. (1998). Accreditation: building fire departments through self-assessment. *Public Management, 80,* 14-19.

Waugh, W. L. (2009). Katrina and the Governors. *Public Organization Review, 9*(4), 343-351. doi:http://dx.doi.org/10.1007/s11115-009-0092-9

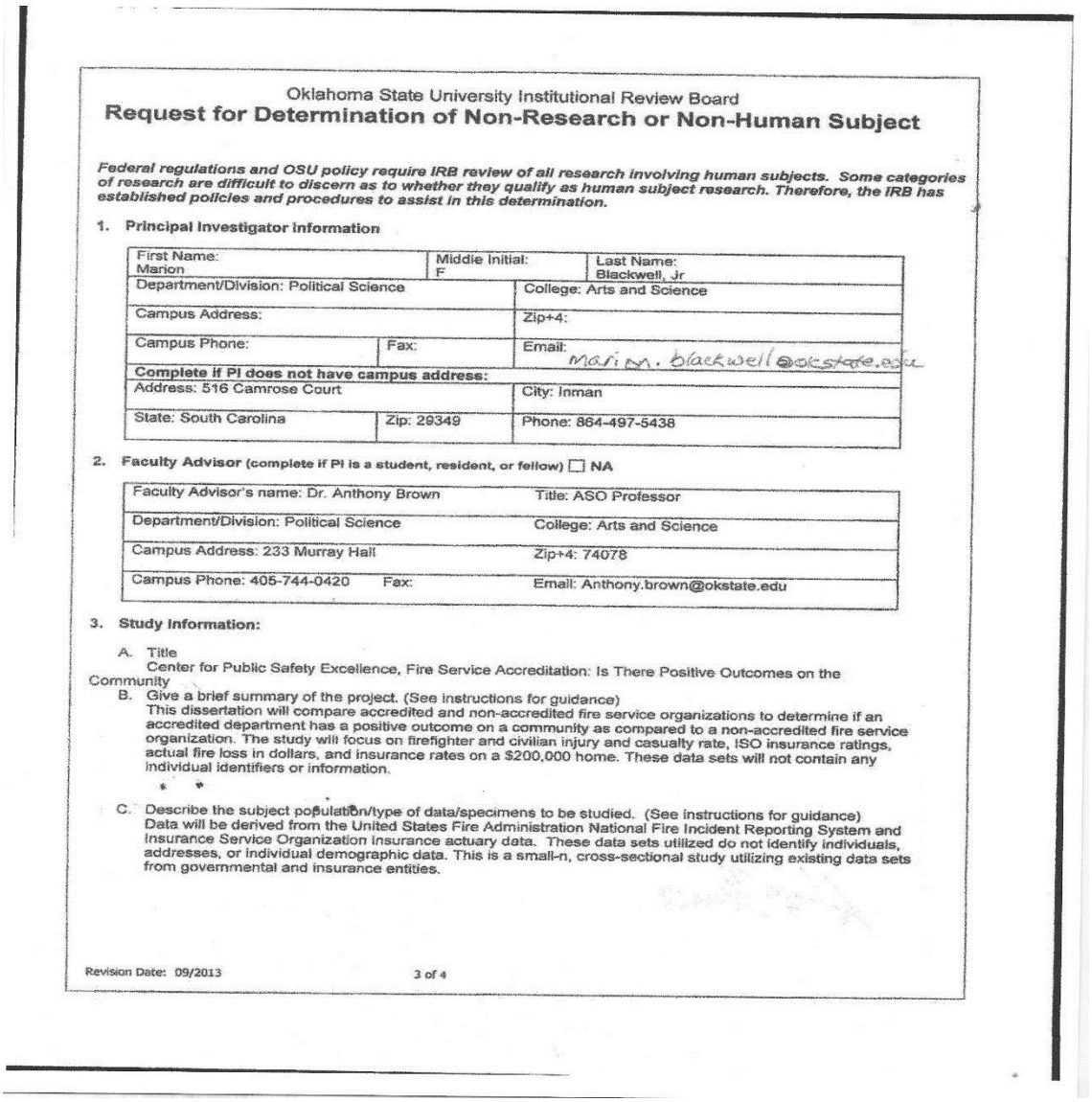
Weber, T. (2016, 04/21/2016). [Accredited Departments' ISO Classification].

Webster, M. (2006). Merriam-Webster online dictionary.

Yang, K., & Holzer, M. (2006). The Performance-Trust Link: Implications for Performance Measurement. *Public Administration Review, 66*(1). Retrieved from ABI/INFORM Global. (Document ID: 974079031)

APPENDICES

Appendix 1 – OSU IRB Request for Determination of Non-Research or Non-Human Subject



Oklahoma State University Institutional Review Board

Request for Determination of Non-Research or Non-Human Subject

Federal regulations and OSU policy require IRB review of all research involving human subjects. Some categories of research are difficult to discern as to whether they qualify as human subject research. Therefore, the IRB has established policies and procedures to assist in this determination.

1. Principal Investigator Information

First Name: Marion	Middle Initial: F	Last Name: Blackwell, Jr
Department/Division: Political Science		College: Arts and Science
Campus Address:		Zip+4:
Campus Phone:	Fax:	Email: Mari.M.blackwell@okstate.edu
Complete if PI does not have campus address:		
Address: 516 Camrose Court		City: Inman
State: South Carolina	Zip: 29349	Phone: 864-497-5438

2. Faculty Advisor (complete if PI is a student, resident, or fellow) ☐ **NA**

Faculty Advisor's name: Dr. Anthony Brown	Title: ASO Professor
Department/Division: Political Science	College: Arts and Science
Campus Address: 233 Murray Hall	Zip+4: 74078
Campus Phone: 405-744-0420 Fax:	Email: Anthony.brown@okstate.edu

3. Study Information:

A. Title
Center for Public Safety Excellence, Fire Service Accreditation: Is There Positive Outcomes on the Community

B. Give a brief summary of the project. (See instructions for guidance)
This dissertation will compare accredited and non-accredited fire service organizations to determine if an accredited department has a positive outcome on a community as compared to a non-accredited fire service organization. The study will focus on firefighter and civilian injury and casualty rate, ISO insurance ratings, actual fire loss in dollars, and insurance rates on a $200,000 home. These data sets will not contain any individual identifiers or information.

C. Describe the subject population/type of data/specimens to be studied. (See instructions for guidance)
Data will be derived from the United States Fire Administration National Fire Incident Reporting System and Insurance Service Organization insurance actuary data. These data sets utilized do not identify individuals, addresses, or individual demographic data. This is a small-n, cross-sectional study utilizing existing data sets from governmental and insurance entities.

Revision Date: 09/2013 3 of 4

Oklahoma State University Institutional Review Board

Request for Determination of Non-Research or Non-Human Subject

4. **Determination of "Research".**
   One of the following must be "no" to qualify as "non-research":

   A. Will the data/specimen(s) be obtained in a systematic manner?
   ☐ No ☒ Yes

   B. Will the intent of the data/specimen collection be for the purpose of contributing to generalizable knowledge (the results (or conclusions) of the activity are intended to be extended beyond a single individual or an internal program, i.e. widely or universally applicable)?
   ☐ No ☒ Yes

5. **Determination of "Human Subject".**
   A. Does the research involve obtaining information about living individuals?
   ☒ No ☐ Yes
   If no, then research does not involve human subjects, no other information is required.
   If yes, proceed to the following questions.

   All of the following must be "no" to qualify as "non-human subject":

   B. Does the study involve intervention or interaction with a "human subject"?
   ☐ No ☐ Yes

   C. Does the study involve access to identifiable private information?
   ☐ No ☐ Yes

   D. Are data/specimens received by the Investigator with identifiable private information?
   ☐ No ☐ Yes

   E. Are the data/specimen(s) coded such that a link exists that could allow the data/specimen(s) to be re-identified?
   ☐ No ☐ Yes
   If "Yes," is there a written agreement that prohibits the PI and his/her staff access to the link?
   ☐ No ☐ Yes

6. **Signatures**

Signature of PI _____ **Date** 09-18-15

Signature of Faculty Advisor (If PI is a student) _____ **Date** 09/23/2015

☒ Based on the information provided, the OSU-Stillwater IRB has determined that this project **does not** qualify as human subject research as defined in 45 CFR 46.102(d) and (f) and **is not subject to oversight by the OSU IRB.**

☐ Based on the information provided, the OSU-Stillwater IRB has determined that this research **does** qualify as human subject research and **submission of an application for review by the IRB is required.**

_____
Dr. High Crethar, IRB Chair

9/23/15
Date

Appendix 2 – OSU IRB Clarification E-mail

Blackwell, Marion

From: IRB
Sent: Friday, January 20, 2017 9:27 AM
To: Blackwell, Marion
Subject: RE: Clarification

Dear Marion,

As long as the information you are providing is public information that anyone has access to, then we would not consider it human subjects research and it falls outside the domain of the IRB. It is up to you and your advisor how to report the agencies data in your dissertation.

Sincerely,

Whitney Mc.

From: Blackwell, Marion
Sent: Thursday, January 19, 2017 3:41 PM
To: IRB <irb@okstate.edu>
Subject: Clarification

My advisor asked that I contact you for a quick confirmation. I have a signed IRB Non-Human Subject form for my research. I utilized a publicly available database from the United States Fire Academy in which I took fire related casualty rates and property loss values for selected fire service agencies. I placed these in a table with the fire agency identified. The question is should I make the fire service agency anonymous or can they be identified in my dissertation since they are identified in the publicly available database?

Marion Blackwell
Sent from my iPhone

1

Appendix 3 – ISO Public Protection Class Summary

The Public Protection Classification (PPC™) program provides important, up-to-date information about municipal fire protection services in each community we survey. ISO's expert staff collects information about the quality of public fire protection in more than 47,500 fire protection areas across the United States. In each of those protection areas, ISO analyzes the relevant data and assigns a Public Protection Classification — a grading from 1 to 10. Class 1 generally represents superior property fire protection, and Class 10 indicates that the area's fire suppression program does not meet ISO's minimum criteria.

Most U.S. insurers of home and business properties use ISO's PPC in calculating premiums. In general, the price of insurance in a community with a good PPC is lower than in a community with a poor PPC, assuming all other factors are equal.

A community's PPC depends on:

- emergency communications systems, including facilities for the public to report fires, staffing, training, certification of telecommunicators, and facilities for dispatching fire departments
- the fire department, including equipment, staffing, training, and geographic deployment of fire companies
- the water supply system, including the inspection and flow testing of hydrants and a careful evaluation of the amount of available water compared with the amount needed to suppress fires
- community efforts to reduce the risk of fire, including fire prevention codes and enforcement, public fire safety education, and fire investigation programs

Appendix 4 – Center for Public Safety Excellence Fire Service Accreditation Summary

What is "Accreditation"?

Accreditation is a comprehensive self-assessment and evaluation model that enables organizations to examine past, current, and future service levels and internal performance and compare them to industry best practices. This process leads to improved service delivery.

CPSE's Accreditation Program, administered by the Commission on Fire Accreditation International (CFAI) allows fire and emergency service agencies to compare their performance to industry best practices in order to:

- Determine community risk and safety needs and develop community-specific Standards of Cover.
- Evaluate the performance of the department.
- Establish a method for achieving continuous organizational improvement.

Local government executives face increasing pressure to "do more with less" and justify their expenditures by demonstrating a direct link to improved or expanded services. Particularly for emergency services, local officials need criteria to assess professional performance and efficiency. The CFAI accreditation process provides a well-defined, internationally-recognized benchmark system to measure the quality of fire and emergency services.

VITA

Marion F. Blackwell, Jr.

Candidate for the Degree of

Doctor of Philosophy

Thesis: FIRE SERVICE ACCREDITATION:
IS THERE POSITIVE OUTCOMES ON THE URBAN 10-YEAR ACCREDITED COMMUNITY

Major Field: Fire and Emergency Management Administration

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Fire and Emergency Management Administration at Oklahoma State University, Stillwater, Oklahoma in May 2017.

Completed the requirements for the Master of Science in your Executive Fire Service Leadership at Grand Canyon University, Phoenix, Arizona in 2004.

Completed the requirements for the Bachelor of Professional Studies in Fire Administration and Fire Prevention at University of Memphis, Memphis, Tennessee in 1998.

Experience:

Fire Chief, City of Spartanburg, Spartanburg, SC, 2010 – Present
Fire Chief, City of Stillwater, Stillwater, Oklahoma, 2007-2010
Fire Chief, Northern Lakes Fire Protection District, Hayden, Idaho, 2004-2007
Asst. Fire Chief, BWXT-Pantex DOE facility, Amarillo, Texas, 2001-2004
Fire Chief, Timberlake Fire Protection District, Athol, Idaho, 1996-2001
Police Chief, City of Chesnee, Chesnee, SC 1991-1996 (Vol. Fire Chief)

Professional Memberships:

Institute of Fire Engineers – Fellow
International Association of Fire Chiefs
Executive Fire Officers Section of the IAFC
Chief Fire Officer Designation - CPSE