# FIRE PREVENTION SERVICE PROVISION

# WITHIN A NEW AGE OF

# LOCAL GOVERNMENT RETRENCHMENT

By

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Abstract: This dissertation examines the effects of the Great Recession on the provision of fire prevention services by local government fire departments in the United States. Fire prevention is integral to community fire protection and equally important as emergency response. Anecdotal evidence at the time indicated that fire prevention program cuts were among the first made by fire departments. This exploratory study utilizes data from a nonrepresentative convenience sample of fire prevention providers who responded to the Vision 20/20 Fire Prevention Cuts Survey in 2012 regarding the effects of the Great Recession. Recurrent economic downturns keep this topic relevant given the pervasive financial stress faced by local government. The study first developed a common method of comparing fire prevention programs across communities. This method is informed by the literature on public cutback budgeting and uses an ordinal index based on the locus of budgetary control. It was applied to score different community-based provision schemes for plan review, new construction inspection, existing building inspection, public education and fire-arson investigation services. Higher index scores are associated with these services being consolidated under the fire department. Lower scores are associated with fewer services provided by multiple entities. Analysis showed that larger communities protected by career-oriented fire departments tend to concentrate provision of all five services under the local fire department, while smaller communities protected by volunteer-oriented departments tend to spread out provision among different entities or not provide some services. Analysis in the second part of the research found that departments in these larger communities were also the most likely to make budget cuts to fire prevention. This implies that larger populations proportions will face increased fire risk during retrenchment. The last part of this study examined cutback strategies. Results indicated that across the board cuts predominate at the department level, but that there are clear preferences within fire prevention to cut existing building inspections before other services. Short-term budget balancing approaches in the form of personnel cuts are universal regardless of cut depth. However, many departments also apply longer-term strategies to lessen the impact on those two services.

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# CHAPTER I

## INTRODUCTION

The challenge of justifying and maintaining expenditures toward fire prevention occurs within the larger context of external budget pressures on federal, state, and local governments. Given the vertical structure of funding streams, department management choices are grounded within the reverberating effects of global events. Anecdotal evidence suggests that fire prevention programs are among the first items to be cut when fire departments face financial hardship. My dissertation examines the topic of cutback management that took place during the Great Recession of 2008 and its protracted recovery. My primary focus is upon the 3Es of fire prevention - *Education, Engineering, and Enforcement*. Utilizing original survey research responses of fire officials, I investigate the different structures through which 3E services are provided, which structures appear more vulnerable to budget constraints, and the strategies used when implementing constraint driven budget cuts.

While my examination of cutback management's effects on fire prevention services is rooted in the Great Recession, its applicability extends to future economic downturns, which recur with some frequency (Chien and Morris 2016). There have been 11 such events since the end of World War II occurring, on average, every 58.4 months.

Furthermore, market downturns are not the only events that create economic hardship for local government. Public pressure, policy decisions, and international geopolitical events can have similar contraction effects on the government business cycle (Amadeo 2017).

For example, California's Proposition 13, which was enacted in 1978, provides a prime example of a non-market event leading to local government financial distress. Proposition 13 resulted in a 60% drop in property taxes collected, a 22% decrease in budgeted expenditures for local government, and an increased reliance on state support (Castellano 2013, Chu and Uhler 2016, Greenblatt 2018). Proposition 13 led a wave of similar taxpayer initiatives that swept across the United States during the late 1970's and 1980's. Many local government-provided services were reduced or shuttered as a result. More recently, the Tea Party movement has advanced anti-tax and small government efforts that have resulted in deep cuts to government spending at all levels (Goldfarb 2013, Westermeyer 2017). Clearly, fiscal tightening is a repeated theme for local government leaders.

**The Global Financial Crisis and Great Recession Environment**

In December 2007, the greatest financial crisis since the Great Depression of the 1930s officially hit the United States (Love and Mattern 2011). At the global level, one-third to one-half of all assets on the global stock exchange disappeared and anywhere between eight and eleven trillion dollars of wealth evaporated (Sakbani 2010, Love and Mattern 2011, The Financial Crisis Inquiry Commission 2011). Within the United States, 465 financial institutions failed during the crisis (Sakbani 2010, Love and Mattern 2011, Tatom 2013), including several major ones, such as Bear Stearns, Merrill Lynch, Lehman Brothers, and Countrywide Financial.

U.S. Gross Domestic Product (GDP) declined by roughly 6.0%, median family incomes declined by about 8.0%, and aggregate household worth dropped by 15% when measured in constant dollars (Danziger 2013, Jagannathan, Kapoor, and Schaumburg 2013). One-quarter of all households lost 75%, or more, of their net worth and more than half lost at least 25% (Pfeffer, Danziger, and Schoeni 2013). The number of jobs in the United States dropped by 6.0% and the unemployment rate topped 10% by October 2009. The Great Recession officially ended in 2009 with a return to market growth, albeit at a sluggish rate that was stubbornly consistent. For instance, in 2013, housing prices were still 30 percent below their peak of 2006. Since then, unemployment numbers have dramatically improved and income returned to pre-recession levels. However, family wealth, mostly found in home ownership, continues to be weakened and stratified (DePillis 2017).

In this protracted recovery environment, state and local government austerity policies continued to act as a drag on long-term recovery. Indeed, four years after the Great Recession officially ended, those conditions, coupled with European economic uncertainty pointed to a lengthy period of stagnated recovery (Danziger 2013, Jagannathan, Kapoor, and Schaumburg 2013, Dominguez and Shapiro 2013, Magdoff and Foster 2014). The Great Recession's effects and subsequent economic stagnation lasted longer than any previous economic downturn since World War II (Dominguez and Shapiro 2013, Magdoff and Foster 2014). And today, debate continues as to whether complete recovery has occurred (Cynamon and Fazzari 2016, Brophy and Goldstein 2017, DePillis 2017, Bennett, Yuen, and Blanco-Silva 2018, Duque, Pilkauskas, and Garfinkel 2018, Maciag 2018).

The subprime mortgage market collapse clearly is the initiating event of the Great Recession (Sakbani 2010, The Financial Crisis Inquiry Commission 2011, Love and Mattern

2011, Katkov 2012, Tatom 2013). Yet, its root cause is hotly debated and typically focuses upon a number of interrelated factors, including: 1) the 1980s macroeconomic policy change to the supply-side economics, 2) liberal trade agreements, and 3) the shifting of social safety net spending to the states during President Reagan's New Federalism (Nathan and Doolittle 1984, Cahill 2011, Palley 2011, Katkov 2012). Along this line of reasoning, a suddenly globalized workforce (Jagannathan, Kapoor, and Schaumburg 2013), and inadequate government regulation of financial instruments (Sakbani 2010, Tatom 2013) contributed to a huge speculative bubble in fixed income markets.

Regardless of existing disagreements as to cause, the meltdown process followed an easily identified path. It is axiomatic that business improves profitability by improving productivity. Along this line, wage control improves productivity by keeping production costs down. Globalized markets offered firms the opportunity to move production offshore to cheaper labor pools thereby improving productivity (Palley 2011, Katkov 2012, Jagannathan, Kapoor, and Schaumburg 2013). Reduced production costs acted to decrease domestic aggregate purchasing power and growth. The national government's policy response was to ease credit and lower taxes to maintain growth, creating an illusion of wealth.

In short, excessive liquidity led to debt-fueled wealth, the exportation to foreign labor resulted in domestic wage contraction, which artificially depressed interest rates and enabled subprime home buying among lower income groups. The unregulated marketing of subprime loans to unwary investors set the stage for a global credit default.

When the speculative loans came due, over-extended buyers defaulted, investment values plummeted, property values tanked, and the economy crashed (Smith et al. 2011).

Surviving financial institutions reacted by tightening lending to both consumers and businesses, which constrained goods consumption and investment. With consumption and investments down, production decreased and layoffs followed. A self-reinforcing downward cycle pushed the economy into recession (Love and Mattern 2011, Smith et al. 2011).

**Resulting Effects on Federal, State and Local Governments**

Federal government attempts to revive the struggling economy included massive financial bailouts and an expensive economic stimulus plan that included over $900 billion in public spending programs, tax cuts, and business write-offs (Pollin 2012). Unlike previous stimulus efforts, however, these federal efforts were not fully successful in restoring the economy. Consumer spending habits, implementation delays, insufficient stimulus, and state resistance presented substantial obstacles to renewed growth and restabilization (Pollin 2012, Blinder 2013, Parker et al. 2013). The stimulus package acted to prevent a slide into a depression, but it also increased public debt and created an additional long term drag on the economy (Hall 2010, Leeper, Walker, and Yang 2010). Moreover, federal and state level political obsession with public debt reduction and an enmity for bailouts and intervention stymied a full robust recovery (Love and Mattern 2011, Bartels 2013, Chowdhury, Islam, and Lee 2013).

States obviously play a crucial role in economic stimulus. At best, they operate in concert with the federal government through increased spending, public safety net expenditures, and the pass-through of federal stimulus efforts. In the particular case of the Great Recession, states did not tend to follow through on federal stimulus efforts due to a range of policies adopted during the 1970s and 1980s (Hall 2010). Under President Reagan's *New Federalism*, federal spending in social programs was severely curtailed and delegated to

the states. Grant-in-aid spending to the states fell off sharply leaving states to pick up the costs of numerous social programs. Coupled with the taxpayer revolt exemplified by California' Proposition 13, states lost their ability to react to economic downturns, while simultaneously gaining a larger share of responsibility for managing any economic recovery (Nathan and Doolittle 1984). Federal stimulus spending from the Great Recession further curtailed available funds for local recovery.

Every state but one has codified balanced budget requirements that restricted these types of policy actions. States generally rely on a mixed strategy of property, income, and sales taxes to generate income. Drops in personal income, housing values, and consumer spending thus severely hampered state revenue sources (Campbell and Sances 2013). In 2010 and 2011 combined, states faced budget shortfalls of $380 billion (Johnson, Oliff, and Williams 2011).

To make up this shortfall, states mostly turned to budget cuts. Widespread state-level cuts that focused on health, education, and social services further ate into household wealth and spending capacity, which tended to prolong the recovery from the financial crisis (Pollin 2012).

State aid to local governments essentially dried up. Hall (2010) observed that state and local government expenditures decreased by almost 35%, most of which came through the pruning of over 400,000 positions. These jobs cuts acted to further diminish market demand, leading to more severe downturns and longer recovery times (Scorsone and Plerhoples 2010). Deep cuts to state budgets thus quickly flowed downstream to local governments.

Of course, economic stress on local government did not begin with the Great Recession. As Cooper (1996) notes, the research places the advent of local government fiscal stress in the early 1970's. Federal tax cuts, increased deficit spending, and the growth of unfunded mandates already substantially affected the prevailing levels of state revenue streams. The Great Recession exacerbated already difficult local government financial conditions and has been viewed as a "break point" defining a new normal (Martin, Levey, and Cawley 2012, 17S, Perlman and Benton 2012). The National League of Cities (2013) reports that weak financial health is the biggest concern of local governments. Martin, Levey, and Cawley (2012), as well as Ammons, Smith, and Stenberg (2012) posit that the "new normal" local government environment consists of *perpetually restricted resources*.

**The New Normal**

Local government cannot expect to return to the conditions that existed prior to the crisis. Constrained resources are now the norm. The National League of Cities reports that the 2015 revenue base for cities was only 91.6% of the 2006 revenue base. With annual growth in the 0.31% to 1.3% range, full revenue recovery is still many years away (McFarland and Pagano 2015). Indeed, the GAO (2015) reported that local government had experienced the loss of $225 billion out of their budgets and that the fiscal gap for local governments will continue through 2047. Further, in an example of federal policy affecting local government revenues, the 2017 federal tax code changes are expected to depress home prices between 4% and 10%. With roughly half of local government revenue coming from property taxes, local budgets will face additional shortfalls (Charles 2018). Likewise, the increased debt associated with the Tax Cuts and Jobs Act of 2017 is expected to create a drag

on the economy similar to President Reagan's supply side tax cuts (Nathan and Doolittle 1984, Shkliarevsky 2018).

Another facet of tight local government finances is centered around structural imbalances (Patton 2015). Revenue generation simply is not keeping pace with ongoing budgetary demands. Legacy sales-tax systems tend to lag within a growing service economy and the loopholes associated with on-line retail cut into available revenue streams. Cities with less than 100,000 population have not fared well when compared to larger municipalities. Many are routinely dipping into reserves to make ends meet. Two looming issues further exacerbate the financial picture for local government: failing infrastructure and pension liabilities. Addressing these issues will consume large percentages of local government budgets and force service decisions.

This *new-normal* environment limits local government service delivery strategies. Size, duration, and severity of the cut-back environment dictate available options to manage budgetary gaps (Baker 2011). If the new normal environment is already constrained then local governments have even fewer options available to manage the next economic slide. Perlman and Benton (2012) indicate that local governments typically start their response by choosing to reduce labor costs rather than examining long-term solutions that reduce demand for services. As the fiscal crisis deepens, the local government then turns to cutting particular services (Baker 2011) and a process of targeted program elimination. Neither strategy affects demand. Beyond this incremental approach, local governments seldom employ a cutback strategy that considers service demand impacts. A survey of 74 California and Georgia counties (Afonso 2013) supports this concept, finding that 80 percent of the

counties made cuts in personnel and capital projects with some respondents making specific note of cuts to public safety departments.

**Fire Department Service Provision in the Context of Budget Crisis**

The International City/County Management Association (ICMA) observes that fire services have faced decreased budgets since the onset of the taxpayer revolution of 1978 (Page 2002, Freeman 2002). Many fire departments routinely contend with incremental budget reductions. However, the Great Recession was an altogether different level of magnitude. The city of Vallejo, California provides an exemplar of the level of fiscal stress faced by local governments within the economic meltdown. The city faced a 30 and 20 percent decline in property and sales tax revenues with the onset of the Great Recession (Peck 2014). The city subsequently filed for bankruptcy and in the downsizing that followed its police and fire departments were halved in size and continue to operate at roughly one-third original capacity. While Vallejo represents an extreme level of fiscal stress upon fire departments, Walters (2011) observes that other departments across the country contended with dramatic budget cuts. Lowell, Massachusetts lost 25 percent of its staffing. Muskegon, Michigan opted to use part-time personnel. Baltimore City imposed furloughs rather than lose 100 positions. Newark, New Jersey lost two dozen firefighter positions and San Diego implemented rolling brown-outs. These fire departments are just a few examples of the constraints that fire departments faced during the Great Recession and they may portend behaviors of the next downturn. A recent study of the Great Recession's effect on career fire departments (England and Brown 2014) found that almost one-third of career fire departments represented by the International Association of Fire Fighters (IAFF) reported losing positions.

The services provided by a fire department frequently are established by state statute or local code, as well as political and citizen expectations (Callahan and Bahme 1987, Page 2002). Coulter (1979) observes that fire department effectiveness is the extent to which a fire department avoids or minimizes fire loss in a community. This metric incorporates both emergency response (e.g., fire suppression)[1] activity as well as fire prevention actions (e.g., code enforcement and education). While provided under the umbrella of fire safety, these two services approach the fire problem from distinctly different directions. Response is reactive. Prevention is proactive. The mix of these two services determines the total cost of fire to a community with fire response capacity constituting the great majority of those costs (Schaenman and Swartz 1974, Donahue 2004a, 2004b, Jaldell 2005, Hall 2012). In larger departments, the emergency response and prevention functions, as well as other supporting functions, may be separate budget categories. In smaller departments, they may simply be found within a line item or within program budgets that are grouped under larger budget elements (Stephens, Gannon, and Clark 2002). In some jurisdictions, prevention services may be provided by a different government agency.

For most of the history of the fire service, fire departments have largely focused upon fire suppression or a reactive approach to their core mission. *America Burning* (1973), however, ushered in a historical trend of declining losses that can mostly be tied to engineering improvements and increased emphasis upon public education. Alongside the reductions in fire incidents and losses, fire departments' missions expanded to address new types of community risks. Internal and external pressures escalated the level of community health and safety expectations being placed upon fire departments (Donahue 2004b).

[1] Non-emergent services, such as water removal are captured under emergency response since these incidents still require the mobilization of resources.

Regardless of the benefits a proactive, preventative approach provides, public trust in the fire department places a premium on its response capacity. Consistent, prompt, capable response leads communities to view the fire department as the responder of first and last resort regardless of the perceived emergency (Freeman 2002, Page 2002). These responses now include emergency medical services, hazardous materials response, technical rescue (high-angle, collapse, water), and general service calls such as flooded basements and downed trees on houses. Contemporary fire departments are all-hazards response agencies that provide a panoply of emergency response services keeping them in the public eye (Page 2002, Smoke 2004, National Fire Data Center 2009). With the emphasis on expanded capability, community response demand tripled fire department service calls from 1980 through 2013, from around 11 million to 32 million incidents per year (National Fire Protection Association 2014). With this heightened level of demand, the process of cutting the emergency response budget has become a daunting challenge for local governments.

Fire departments typically consume 15 to 20 percent of local government budgets (Moeller 2012). From the public and local government perspectives, the emergency response function is also more easily quantified and evaluated than prevention efforts. Results (outputs) of a fire department response are predictable, easily observed, and fit within the short-time frame of budget cycles. Fires are extinguished; victims are removed from collapsed buildings and vehicle collisions; and patients are packaged and transported to hospitals.

Moreover, effective suppression response is rewarded through the prevailing level of insurance premiums. The Insurance Services Office (ISO) rates community fire departments across three response-oriented dimensions that help establish insurance premiums. These

ratings are calculated within a 100 point range and the published local score roughly drives insurance rates (Insurance Services Office 2016). Thus, a strong external financial incentive exists to maintain emergency response capabilities and capacity at the cost of all other roles.

Prevention, on the other hand, addresses fire risks proactively, with a larger scope, and more efficient use of resources (Jongejan, Jonkman, and Vrijling 2012). Prevention programs influence multiple incidents by targeting classes of at risk persons or prevailing incident types. Emergency response must wait until an adverse event has begun before mobilizing and limits resources to mitigating one event at a time. Prevention activities by definition seek to keep the adverse event from happening in the first place or, failing that, mitigating the harm from these events.

**The 3E's of Fire Prevention**

Fire prevention makes use of three primary approaches to accomplish its objectives: education, engineering, and enforcement. These approaches reflect public health concepts of primary, secondary, and tertiary prevention, as well as viewing incidents in pre-event, event, and post-event phases (Haddon 1970, Runyan 1998). *Education*, *Engineering*, and *Enforcement* are commonly referred to as the 3E's. Public fire safety education (hereafter 'public education') focuses on changing people's behavior. Engineering concerns fire protection features in the built environment. Enforcement addresses fire and building code enforcement and fire/arson investigation. In some communities, engineering and enforcement may be assigned to other government agencies. Public education almost always is the responsibility of the local fire department. That said, there is no requirement for instituting each of the 3E's in a department (Crawford 2012). It is strictly a policy decision by the local government.

The 3E's originated with President Truman's 1947 Conference on Fire Prevention. Participants outlined a comprehensive approach to fire prevention that stressed voluntary action through public education and systems of passive and active protection through engineering and code requirements. Enforcement focuses on ensuring compliance with the engineering requirements. Typical fire risk scenarios are conceptualized as causal chains (Weller et al. 2017), but also linked to multiple contributing causes (Corcoran, Higgs, and Higginson 2011, Jennings 2013). Viewing fire risk from this perspective permits broad-based preventive interventions that utilize each of the 3E's.

Education

Public education is considered the *cornerstone* of effective fire prevention. The objective is to change individual behavior to avoid activities that may lead to a fire event, as well as teaching effective reactions when those events do occur. Public education is considered a primary prevention approach that fire departments generally conduct through short one-time contacts. Organized curricula, when used, are generally done in cooperation with local school systems. Public education's main push is the pre-incident phase and it attempts to avoid fire ignition altogether. However, when concerned with reactions post-ignition, it blurs into secondary prevention and focuses on mitigating damage.

Public education takes on additional importance in our contemporary environment, since fire risk generally has transferred from commercial/industrial settings to private dwellings. The home environment now presents the bulk of the fire problem within the United States (National Fire Data Center 2009). Once a dwelling is occupied, the fire department lacks authority to inspect and ensure safe conditions (Callahan and Bahme 1987), making residences a growing risk of fire over time. The National Fire Data Center (2016)

finds most fires in the United States are behaviorally linked to unintentional acts. Experience and research show that people have difficulty conceptualizing fire risk (Subramaniam 2004, Rohrmann 1995). Unfortunately, there is a dearth of valid research supporting the cost-effectiveness of public education programs (Schaenman et al. 1987). Critically, the lack of such evidence makes public education programs especially vulnerable to cuts during hard times.

Engineering

Engineering primarily is concerned with the built environment at the state and local level. There tends to be at least some spillover into product design, such as coffee makers, but those policies mostly emerge at the national level. Within the built environment, engineering applies fire and life safety science to features of design and construction. These features include exiting configuration, automatic suppression systems, and fire alarm notification systems. It also covers items such as interior finishes and building methods and materials. These systems provide secondary aspects of prevention by passively protecting building occupants from an unintended fire. Such systems remain static until a fire event ignites. Upon ignition, systems will activate to suppress the fire, control the byproducts of fire, ensure timely and safe evacuation of occupants, or improve the safety and effectiveness of emergency response forces. The objective is to moderate damage. Accordingly, engineered systems fall under secondary prevention and operate within the event phase of an incident.

Engineering has its origins in the insurance industry of the late 19$^{th}$ century. Today's building and fire safety codes and standards grew out of a concern for controlling the financial risk faced by insurance underwriters and communities. This concern also ushered

in a new perspective on managing fire risk (Tebeau 2003, Varone 2012). Engineered fire protection systems have demonstrated effectiveness in reducing fire loss provided they are installed correctly and maintained (Ford 1997, Ahrens 2009, Hall 2013). Rather than communities focusing solely on the effectiveness and efficiency of response forces, fire became a controllable risk that could be countered with technological planning and code restrictions. Today, industry codes and standards are published to guide design professionals and create uniform approaches to existing threats. These codes and standards are crafted so that local governments can easily make them obligatory through adoption into law (Varone 2012).

Enforcement

Enforcement has a number of principle tasks: 1) that structures and occupant protection systems are designed according to the code; 2) that they are then built according to the code; and 3) that structures are maintained according code. It can also refer to processes that supplement compliance (e.g., malicious burning laws). Within local government, then, enforcement typically takes on the form of new plan review, new and existing structure code enforcement, and fire/arson investigation (Crawford 2012).

Local government typically assumes a quality assurance role in plan review and inspection for compliance during construction and after occupancy. In many jurisdictions, plan review and compliance inspections are used to generate an industry-tolerated revenue stream for local government. Although these fees seldom cover the actual costs of providing these services (U.S. Fire Administration 2012).

Code enforcement is often received with suspicion, since compliance in new and existing structures is coercive and often requires expenditures for compliance on the part of

owner/occupants. Within existing structures, coercive enforcement is considered a prevention effort of last resort. Voluntary or incentivized compliance are preferred. Furthermore, the effectiveness of code enforcement activities is very difficult to observe and assess for local voters and governmental decision-makers. It yields benefits that extend past the current budget cycle, making current line item justification very difficult (Hall, Flynn, and Grant 2008).

**The Resulting Research Questions**

As with the rest of local government, local fire departments tend to emphasize immediate outputs within the annual budget cycle. Fire departments provide two distinct intervention services within a constrained resource environment. Most of the allocated resources are devoted to direct provision of services in the communities they protect. Eighty-five percent or more of their budgets go into personnel costs (Moeller 2012). Budget cuts of any consequence mean personnel are lost, which immediately affects the scope and quality of service delivery (Lipsky 2008). When these personnel come out of the emergency response forces, their loss has an immediate demonstrable negative affect on the service provided (Averill et al. 2010).

Conversely, resource cuts to fire prevention have limited near-term demonstrable effects. Prevention efforts suffer from both weak relationships and significant delays between action and benefit (Wasem 2007). First, benefits are measured in discounted future dollars making budget cut comparisons difficult. Second, realized benefits frequently accrue outside of the fire department's emergency services realm. Thus, without a standard means of operationalizing measures of effectiveness, enforcement efforts often do not survive strategic cutback decisions.

The balancing act faced by fire department decision-makers is finding the point of equilibrium between emergency response and prevention. Too few resources allocated to emergency response leads to immediate reductions in service scope and quality. Too few resources allocated to prevention risks increasing future service demands and fire losses. It is often assumed that financial resources will be restored by those future years even if overall budgets remain stagnant. Unfortunately, in the new normal this may no longer be the case and the effects of short-term reactions can be magnified over time.

Strategic cutback decisions regarding the emergency service-prevention mix must now consider a multitude of factors, including community characteristics, citizen service expectations, political responsiveness, and potential trade-offs between efficiency, equity, and effectiveness (Honadle 1984, West and Davis 1988). In general, cutback strategies can be grouped into three broad categories consisting of fiscal approaches, structural approaches, and community engagement approaches (Angelica and Hyman 1997). This dissertation primarily is concerned with the structural approaches to cutback management found in the fire prevention function of fire departments.

At the organizational level, structural approaches modify department mission, organization structure, and organization culture. At the program level, different structural approaches connote the unique levels and types of services provided to organizational clients, variance in system productivity, and efforts to shift or transfer service responsibilities (McMurtry, Netting, and Kettner 1991). Those programs not seen as mission critical, or those associated with weaker constituencies, tend to be sacrificed first (Jick and Murray 1982, Plant and White 1982, Berne and Stiefel 1993).

Thus, the organizational arrangement of fire prevention services within local government logically foretells the effect of budget cuts. From a strategic level, when services are concentrated, they become more visible. When they are dispersed, they disappear into the background of overall service provision. The same can be said for which services are emphasized by the providing organization. Therefore, the obvious starting point for my analysis is determining how the 3E services are delivered across the range of fire departments and other fire prevention service providers. This study first examines the question:

*1) How are 3E fire prevention services provided across different communities?*

The results of this query will elicit rudimentary approaches to 3E service delivery, which does not exist elsewhere. Carper and Snizek (1980) state that such a schematic provides the necessary foundation for further inquiry. In this case, the resulting schematic illustrates different organizational strategies for fire prevention service delivery. Those strategies are heavily influenced by internal organizational factors such as culture and structure, and external factors such as political climate and social beliefs.

Culture and structure are subject to defined mission, resource needs, and historical precedent. Defined mission is predicated on political and community expectations, as well as willingness to provide resources. In short, there is continual process of adjustment between the organization, political decision-makers, and the community. The result is that public organizations face a paradox not faced by the private sector. While their service goals and objectives receive general public support, mission goals and objectives are subject to political conflict and compromise between constituencies and are likely ill-defined (Pandey 2010). Since 3E services can be arranged on a continuum from voluntary to coercive, their delivery

generates different reactions from those receiving the service. Further, each service also has distinct primary audiences or constituencies of different strengths, although the lines between audiences are somewhat blurred. The resultant conflicts and compromises are ultimately embedded into the strategies used by the organization to deliver the service. They can be glossed over when resources are plentiful, but during lean times, these conflicts and compromises rise to the surface.

This ultimately leads to differences in 3E services priorities both in opinion and practice. Clientele on the coercive end of the service spectrum will generate political pushback and force a renegotiation of the status quo. In a cutback environment, different strategic approaches to service delivery are expected to have different levels of vulnerability (Plant and White 1982, May and Wood 2003). Identifying the strategic vulnerabilities in this readjustment leads to the second question:

2) *Which departmental provision schemes were affected by the Great Recession cutback?*

The fire prevention services of plan review, new construction inspections, and existing building inspections create the most conflict and compromise. Opposition generally comes from persons and entities that have considerable political influence. Klingner and Nalbandian (1983) wrote that cutback management covers organizational reaction to the tensions between fundamental values of political responsiveness, administrative efficiency, social equity, and individual rights. West and Davis (1988) expanded on their concept to posit that each of these values portends different reactions. Political responsiveness invites activities that are conducted in a manner not to anger those clients with political influence. Short-term political priorities will take precedence over long-term gains. Administrative

efficiency will drive long-term productivity improvements and organizational redesign efforts. Social equity leads to uniform service delivery for all clients regardless of position in society. While the authors originally focused internally on individual worker rights, such rights easily extend externally to customers.

The equilibrium between these values is fluid. During economic downturns, political responsiveness takes on even greater importance and fire prevention services that are viewed as interfering with personal rights and tax revenues become vulnerable. For the department delivering services, strategic cutback decisions often involve trade-offs in services and service levels (McTighe 1979). The short-term politically driven budget concessions are made against the backdrop of legislative mandates, community service demands, and drive for organizational continuity. This leads to the third question, which investigates:

3) *How did departments with different provision schemes strategically approach cuts to 3E services?*

The first question about service provision provides a common reference for comparing different 3E fire prevention programs. This enables the next two questions. Question 2 looks at which schemes suffered from the effects of the Great Recession and the last question examines how departments went about making the requisite cuts to budget. History tells us that economic downturns are a given. While this study has roots in the Great Recession, the observations reasonably apply to future economic slumps.

This study also adds to the literature of cutback management in public organizations by looking at the narrow field of fire prevention. It represents the first attempt to analyze the effects of budget stress upon the provision of fire prevention programs.

# CHAPTER II

# THEORY

## No Technical Solution Problems

From mankind's early societies to modern urban settings, losses associated with fire have been a central community concern. Thus, community fire response capacity has been developing from early dates as far back as the Roman Empire. Due to combustible construction, close building proximity, and unsafe practices, even small fires easily and quickly became community-wide destructive events. For example, the first documented catastrophic fire on the North American continent dates to the Jamestown settlement in 1608. Between 1861 and 1918, major American cities experienced conflagration events roughly every three and one-quarter years (Smoke 2004). While the outbreak of destructive fires is not as severe as it once was, such events can and do take place. As recently as 2016, fires in Gatlinburg, Tennessee damaged or destroyed close to 1700 structures, injured over 130 persons and caused the death of 14 others (Gabbert 2016). Finally, large life-loss fires still occur with annual regularity. Twenty-one such events were recorded in 2016 alone (Badger 2017).

Fire remains a significant community threat with over 3000 fatal and 15,000 non-fatal injuries, over 1.3 million fires, and direct losses exceeding $14 billion each year (National Fire Data Center 2016). The magnitude of this threat has been associated with

independent variables such as poverty level, education, language diversity, the quality of housing stock, and other characteristics (Shai 2006, Corcoran et al. 2011, Jennings 2013). Reducing the community fire threat requires more than simply responding to events when they occur. Maintaining response capacity is an expensive community proposition that is increasingly difficult in the face of decreased resources.

Olson (1965, 1971) theorized that organizations form to address collective action problems and provide public goods. Fire departments are firmly located within this sphere. They were established to address the community-wide fire threat both in terms of frequency and potential to affect the entire community. Beginning as community bucket brigades, citizens mustered together whenever a fire event occurred and attempted extinguishment. Fire suppression in a packed, highly combustible environment required the participation of hundreds of persons working in concert (Smoke 2004). The fire problem clearly represents a type of collective action problem and it was one where significant numbers of the population voluntarily came together to ensure the safety of homes, livelihood, and communities (Olson 1965, 1971). As fire events became more frequent and serious, communities began organizing with an emphasis on task specialization that resulted in establishing fire departments for community protection.

Early organized fire departments were all volunteer and response-oriented. Population volume and density have a clear link to fire department service demand (Brunet, DeBoer, and McNamara 2001, Smoke 2004). This demand grew in pace with community growth. Population driven demand, compounded by technological advances, led to career fire departments making their debut in the middle 1800's. However, like the preceding volunteer departments, they were still focused on response. It was not until fire losses were

recognized as unsustainable that fire insurance companies began exploring prevention and engaging fire departments for risk reduction / prevention purposes (Tebeau 2003, Smoke 2004).

Today, most fire departments are all-hazard agencies and response to emergencies remains their core mission. Almost every town, borough, city or county in the United States is protected by a local fire department, be it volunteer, career, or combination. Regardless of who calls, a request for help generally receives a response (Page 2002). The 32 million annual responses made by fire departments in the United States indicate that these organizations provide a valuable service within their communities. Given the public good aspects of this service (i.e., it is both nonrival and nonexcludable), it stands to reason that overuse is a real possibility.

Fire Department Goods

Samuelson (1954) identifies two general types of goods or services provided in societies. Private goods are those are allocated among competing consumers (rivalrous). Goods consumption is regulated or constrained according to the desires of the owner of that good. In other words, it is excludable. Public goods, on the other hand, are those allocated among all consumers without competition (non-rivalrous) in that consumption of the public good does not diminish the availability of that good for others (Samuelson 1954). Following on Samuelson, Hardin (1968) theorized in *the tragedy of the commons* that overconsumption of finite public resources follows from each person acting in their own self-interest at the expense of the community welfare. In the absence of a coercive mechanism that prevents individuals from maximizing their economic self-interest, individuals conduct themselves in series of strategic movements that consume the entire asset. The point is that individuals

pursuing their self-interest in an unconstrained environment will lead to the peril of all. Levine (1986) extended "the commons" reference to any shared community resource, such as public libraries, health, police, and emergency services. In this sense, the fire department constitutes a public good.

However, not all private goods are eminently excludable and not all public goods are of such unlimited supply that all consumers enjoy unlimited access. These observations gave rise a theory of club goods which are distinguishable by excludability and limited rivalry (Buchanan 1965), as well as theories of common-pool goods or resources (Ostrom 1990, Ostrom, Gardner, and Walker 1994). A prime example of club goods is subscription cable television. Consumers must pay to receive service, yet the number of potential simultaneous consumers is practically unrestricted. Common pool goods, however, are distinguishable by non-excludability, yet rivalrous consumption in that they are finite. At some limit, consumption by one entity restricts availability to other consumers of that good or resource (Randall 1983).

Fire departments straddle to line between public goods and common pool goods. Those where service demand is low and slack remains in capacity fall into the category of public goods. However, for those fire departments where service demand is high, they fall into the category of common pool goods (or resources). They have a finite service capacity based on available resources. Drawing on Ostrom, Gardner, and Walker (1994), the openness of fire department service potentially creates a supply-side service provision dilemma when there simply is not enough of the service to meet demand.

Public perception of the fire department as the responder of first and last resort (Page 2002), which the fire department encourages with its expansion of services, leads to overuse

and the inherent free-rider problem. Citizens are encouraged to call the fire department for almost any perceived emergency. The quintessential example being a cat stuck in a tree. It is exceptionally difficult to exclude requests for service from the protected community, even in the face of abuse. Furthermore, organizations which treat free-riding as inevitable or desirable may reinforce such behavior (Kelman 1981).

This perverse incentive exists within the fire service. For example, *Firehouse.com* has published a listing of the busiest fire departments in the country for over 30 years. Making this list is a source of pride, regardless of whether the responses are based in actual emergencies or faulty policy. This incentive also extends to budget preparation, when busy can be conflated with efficiency and effectiveness. Thus, there is an innate incentive for fire departments to unwittingly pursue transition from public goods to common pool resources.

Solving the free-riding dilemma is difficult in a system where abuse is difficult to track and, to some extent, either tolerated or forgiven. Hardin (1968) described *no technical solution problems* in the sense that market exchange and maximization of self-interest could not readily solve them. The choice is between public policies with varying degrees of sub-optimal outcomes. Resolution of *no technical solution problems* depends upon systems of mutual coercion that force individuals not to pursue their complete economic self-interest. It then becomes a social and political issue requiring compromise that is inherently value-laden.

Hardin (1968) exposed the divergence between self- and community interests. Benefit accrues to the individual, while risk is spread amongst the population. The crux of the commons (or common pool resource) problem is that the prevailing rewards scheme favors short-term individual gain and punishes persons who act for the community good (Hardin 1968, Feeny et al. 1990, Stroup 1991, Shultz and Holbrook 1999). For the fire

department, unnecessary calls for service seldom result in the sanctioning of the caller. In addition, the primary beneficiaries of fire services frequently are individuals who do not shoulder the full costs of the service. Individuals who shirk fire safe behaviors gain a net benefit. Costs are absorbed by the entire community.

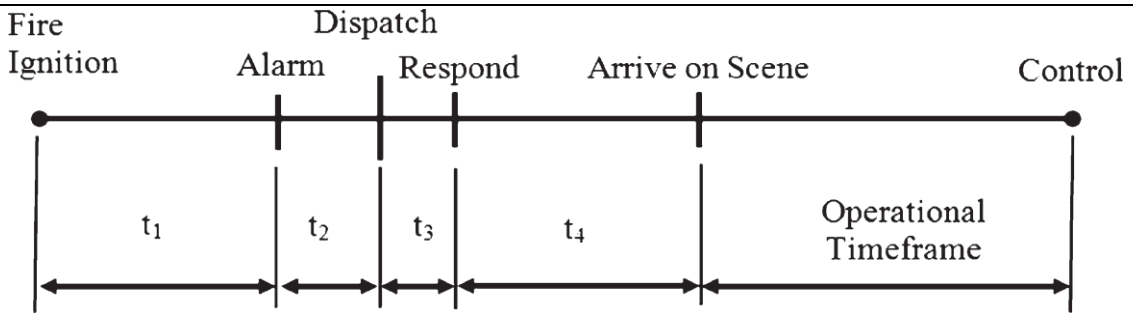
For example, building fire alarm and notification systems have an associated cost to install and maintain. When false alarms occur due to lack of system maintenance, the building owner avoids the cost of maintenance, whereas the community absorbs the cost of the unnecessary response. The magnitude of unnecessary calls is exemplified by the fact that fire departments within the United States responded to 2.2 million false alarms in 2012 (Karter 2013). Costs associated with each false alarm response minimally includes personnel, vehicle wear and tear, and fuel, as well as the opportunity costs associated with being unavailable for other calls. False alarms are just one type of unnecessary call for service.

When the service capacity of a fire department is approached or exceeded, the service becomes congested and some form of regulation must be applied to maintain distribution efficiency (Oakland 1972, Brueckner 1981). Fire prevention fills this role by tamping down unnecessary calls for service or intervening early in an event to lessen the resources required to control an event. Fire prevention establishes rules of expected behavior in the form of the 3E's which help reduce calls for service and help maintain the local fire department as a public good. Without these rules, fire departments are subject to the same degradation of public benefits as are other renewable resources (Ostrom, Gardner, and Walker 1994).

Fire response is a collective action problem that must be supported by the entire community, whether in the form of taxes, non-tax contributions, or direct participation. It is

labor intense and expensive (Schaenman and Swartz 1974, Moeller 2012). Critically, fire response cannot provide the optimal solution to the collective action problem. Response is always reactionary and loss control is inherently time dependent (Challands 2010, Kerber 2012). Kerber (2012) notes that fire department incident intervention is a function of fire initiation through time of discovery, notification, dispatch, turnout, travel time, set up time, and time to control as seen in Figure 2.1. The time function from discovery to incident control can be extended to any event requiring fire department emergency response. Kerber (2012) places the average response time in the United States at roughly 6.5 minutes, which includes only time from fire department notification to arrival on scene. Damage continues unabated until the fire department gains control of the event.

**Figure 2.1: Fire Service Timeline**




Note: Source: Kerber (2012, 885).

Fire prevention on the other hand, attempts to shift responsibility for a fire event from the collective community to individual persons. Public fire safety education tries to instill behaviors that avoid the fire event in the first place and, failing that, how to react properly to minimize fire loss. Engineering shifts costs from the community to the owners or occupants of buildings in the form of safety systems that react quickly to fire events. Enforcement is focused most directly on addressing the free rider issue by ensuring that owners and

occupants do not shirk fire safety responsibilities and sanctioning persons who engage in unsafe behaviors that risk others.

**Cutback Management**

In his influential work *The Science of Muddling Through*, Lindblom (1959) observed that the complex nature of social problems results in incremental decision making in public institutions. Such institutions are found at the levels of "the macro or constitutional level; the collective choice or policy decision level; and the operational level" (Kay 2005, 555). Change takes place only at the margins of policy to maximize the value of past knowledge and minimize the potential cost of future mistakes. Incrementalism provides for policy stability over time, but it also reinforces existing behaviors and stymies the emergence of newer, more efficient behaviors (Bednar and Page 2018). For social problems requiring collective action to resolve, this practice reinforces suboptimal performance since options that stray far from established paths are not considered (Robinson and Meier 2006). Both actors and the social network must be moved. These observations describe current fire service practices embedded in the expectations of local communities.

A more in-depth examination of incrementalism leads to *path dependency theory*. In essence, path dependency is a three-phase process in which present and future behaviors are increasingly locked into past behaviors (Robinson and Meier 2006, Sydow, Schreyogg, and Koch 2009, Wilson 2013). Path dependency develops due to issues associated with learning new behaviors over engrained ones, challenging established complex social institutions, unplanned social and financial expenditures, and institutionalization of self-amplified small changes over time (Kay 2005, Robinson and Meier 2006, Wilson 2013). Furthermore, path dependence affects the interactions between the environment (community) and organization,

which then influences organizational decisions. For example, within the fire service, public expectations of emergency response service may lead the organization to favor emergency response over vigorous prevention services. Much like the *Tragedy of the Commons*, the reward system favors established suboptimal behavior over more efficient strategic alternatives.

Path dependency arises from and reinforces a stable policy and operating environment. However, natural and man-made events frequently disrupt human systems. Among these man-made disruptions lie economic depression and recession (Wilson 2013). The loss of resources destabilizes government institutions, causes permanent change, and calls for new approaches to social problems. How social institutions weather the disruption depends on the store of economic capital, social capital, and cultural capital available within the community (Bourdieu 1987).

During severe financial downturns, economic capital dries up. Institutional resilience therefore depends on social and cultural capital. Social capital includes non-monetized aspects of social networks, particularly characteristics of the cultural and institutional belief and behavioral systems that hold communities together and provide for collective action (Bodin and Crona 2008). Culture affects institutional performance but also serves as a cushion that helps preserve organizational identity during disruptions. It maintains the familiar set of behaviors within the context of the social network. Further, culture influences the potential range of reactions to the emergence of newer social institutions in response to the disruption (Ravasi and Schultz 2006).

Unfortunately, those same social networks and cultural beliefs restrict strategic decisions to only favor those options that lie close to the already established path. Fire

departments have strong cultural identities that highly value emergency response capabilities (Tebeau 2003). At the same time, the community's social network also favors emergency response (Schaenman et al. 1987, Page 2002). And, fire departments tend to have strong ties to the community creating a community-fire department feedback loop as described above. Thus, fire departments may find that alternative methods of providing community protection will not be likely to gain traction.

Robinson and Meier (2006) note that organizations facing resource scarcity and unmeetable service demands *must* engage in suboptimal sorting of tasks. The authors suggest that hard decisions must be made in a swift manner – "one process for allocating resources is *triage* whereby the organization decides which problems can fix themselves, which problems the organization can solve, and which problems are beyond hope" (2006, 250). This triage process encapsulates cutback management, which refers to public organization adaptations when faced with declining resources and decreased activity.

Cutback management theory can be traced to Levine (1978) when he proposed that cutback management is not merely a process of reversing organizational growth. When organizations grow, their essential qualities change. Culture, beliefs, and processes adapt to increased resource availability. In some cases, entirely new missions emerge and in times-of-plenty error tolerance. Because the emergent culture, beliefs, and behaviors become increasingly engrained over time and limit future options, they are quite difficult to change (Kay 2005, Robinson and Meier 2006).

Levine (1978) proposed a four-cell typology to explain the causes of public organization decline. The first axis concerns internal or external organizational influences.

The second axis concerns whether political or economic/technical conditions drive the decline. The four basic causes are identified in Table 2.1.

**Table 2.1: Typology of Public Organization Decline Cause**

| **Factors** | **Internal** | **External** |
|---|---|---|
| Political | Political Vulnerability | Problem Depletion |
| Economic/Technical | Organizational Atrophy | Environmental Entropy |

Note: Drawn from Levine's (1978) proposed four-cell typology explaining the causes of public organization decline. Factors refer to the causes of decline, while internal and external refer to the locus of the cause.

Looking at internal causes first, according to Levine (1978), *political vulnerability* refers to systemic organizational instability rising from intrinsic characteristics that limit adaptability and compromise resistance to budget shocks. *Organizational atrophy* concerns falling performance brought about by mismanagement and internal feedback systems failures, leading to a weakened institution that has difficulty responding to cutbacks.

As for external causes of decline, *problem depletion* refers to a circumstance when the social problem addressed by the organization no longer a popular or political concern. Levine (1978, 318) makes particular note of "demographic shifts, problem redefinition, and policy termination" that lie outside of the organization's control yet effect its viability. Finally, *environmental atrophy* refers to the ability of the environment to support the organization at its current service level, if at all. This is the case during economic downturns. In short, public organizations, such as fire departments, are subject to a host of internal and external challenges that determine their form, functions, and life cycle.

Fire departments tend to have very strong paramilitary cultures that emphasize taking pride in one's work (Daniels 2012). It is also a profession with high community standing (Miller and Miller 1991) relative to other public services and it tends to have prolonged community history with deep bonds to the public (Tebeau 2003). Furthermore, outside

standards of performance, such as accreditation and the National Fire Protection Association, focus management activities on core competencies. These characteristics tend to provide cover from internally-oriented threats of decline.

Nevertheless, fire departments are not immune to environmental entropy or problem depletion. During economic crisis, funds are not available to finance the fire department's full suite of tasks that emerge during growth spells. Management must then determine which services will be provided and which will be cutback. Given the documented trend of increases in service demand (National Fire Protection Association 2014), problem depletion is generally not much of an issue for fire departments. While the fire problem in this country is improving, the expansion of the fire department mission into other community risks maintains their relevancy. However, this type of mission creep creates additional challenges for institutions under growing budget constraints.

At some point of resource decline, public organizations must make a choice to cut or have the choice made for them (Levine 1978, Williamson 2014). Management's reactions to cutback conditions are grouped into two categories of *resisting* or *smoothing*. The choice of cutback strategies and tactics depends on whether the cause of the decline is internal or external (Levine 1978), as well as the length and depth of the crisis. Under the resisting strategy, organizations apply tactics that cut high demand programs, improve resource streams, or improve productivity. The fire service, as a whole, has successfully applied the tactic of diversifying programs in the face of the declining fire problem. Smoothing strategies use tactics that attempt to reduce the impact of cuts. For the fire department, this would include actions such as reduced unit staffing, or combining services (e.g., fire code inspections with fire investigations).

Revenue is the essential resource that facilitates all government services. For public services, the source, control, and level of revenue lies with the polity. Political compromise, law, and public choice frequently define the public organization's mission, organizational goals, and objectives within funding parameters (Pandey 2010). Missions, goals, and objectives, however, are characterized by ambiguity. Public organizations do not follow product life cycles and as a result do not act by cutting unprofitable business lines. Instead, the fire programs with weaker constituencies are sacrificed first. Further, annual budget cycles drive cuts to those programs relying on long time frames to demonstrate success versus those with short-term measurables (Pandey 2010).

Public management cutback strategies can be found in strategies such as shifting burdens and responsibilities, prioritization of tasks, alliance building, output innovation and overall capacity building. McTighe (1979) identifies seven variables, which affect the strategic and tactical choices for managing cutbacks. These include political attitudes, organizational mission, the cause of resource decline, personnel systems, centralization, clientele, and past levels of stability. The choice of final management response is either internalized or externalized. Actions such as layoffs, and reduced employee benefits, fall under internalized responses. Actions such as reduced community service fall under externalized responses (McGowan and Stevens 1983).

Cutback Management in Local Government

Public budgets reflect policy choices over the services governments should provide, the relative priority of those services, who will benefit / pay, and who will prove to be the focus of public attention (Rubin 2010). There is intense competition for limited resources among local government agencies. Political actors and systems of rules define the allocative

decision-making process. Overall community health and the quality of life is reflected in the eventual choice of priorities (Rubin 2010). The selection of a particular policy choice involves tradeoffs. Tradeoffs come with costs (Natchez and Bupp 1973). These costs include cost-effectiveness, cost-efficiency, and equity, as well as overarching political transaction costs (Rubin 2010).

In the cutback environment, political costs will tend to increase. North (1990) observes that in democratic governments, the exchange between competing interest groups is fundamental to policy formulation. Cutback budget decisions will create winners and losers among program constituents. Political actors make the choice of which programs to fund in an effort maximize the likelihood of reelection. However, in a reflection of Hardin (1968) *Tragedy* there is a high degree of uncertainty since constituents base their votes on personal cost-benefit calculations rather than the costs and consequences to the entire community. Political actors consequently delegate the hard work to administrators, who in-turn must weigh the costs of implementation of cuts while maximizing their own career choices (Kwon, Lee, and Feiock 2010).

Local governments, arrive at two important decisions in the face of budget shortages. First, what are the essential services that have to be provided? Second, which short-term adjustments fit within the annual budget cycle? Short-term policy choices generally include revenue increases, reserve fund usage, intergovernmental aid, and, most importantly, cutback management. More often than not, local governments employ the easy path of decreasing personnel expenditures through the elimination of employee positions, which comprise the largest portion of local government expenditures (Pandey 2010, Perlman and Benton 2012, Williamson 2014).

Local Government Cutback Strategies

Political cutback policy often falls into two basic camps: 1) across-the-board cuts, or 2) rational cuts (Levine 1978, Raudla, Savi, and Randma-Liiv 2015). Across-the-board strategies cut equal amounts or proportions from all governmental entities so that sacrifice is shared. Targeted cuts, on the other hand, impose selective budget cuts and concentrate the level of sacrifice. Unlike the private sector, however, the public sector faces long-term consequences on those citizen services scaled back during cutback management. The resulting consequences that appear small may end up being quite consequential should a highly salient event take place (i.e., the deadly fire).

Either strategy can be applied at the macro level or the organizational level. Macro level cuts involve political prioritization or a lack thereof between the various units of government. Cuts at the organizational level imply distributional decisions among programs. At the organizational level, cuts are made strategically, reflecting mission-oriented priorities, or managerially, reflecting mandates. The reality is that neither strategy is solely relevant (Raudla, Savi, and Randma-Liiv 2015). Research indicates that executive budgeting is heavily influenced by political desires. This effectively limits the choice of department level executives. Such lack of choice precludes department level executives from making the most effective or efficient choice in the allocation of resources (Thurmaier 1995).

Stipak and O'Toole (1993) examined fiscal stress at the local level and proposed four basic strategic reactions: reduce services, raise revenues, improve productivity, or shift services. Available strategies are influenced by political factors, organizational mission, cause of the resource decline, clientele, city versus county government, government size, frequency and degree of fiscal stress, employee participation, and the use of more

sophisticated budget tools (McTighe 1979, Levine, Rubin, and Wolohojian 1981, McGowan and Stevens 1983, O'Toole and Stipak 1988). In a survey of California and Georgia counties, Afonso (2013) found that the most likely course of action in the face of fiscal stress is to cut both capital budgets and personnel.

**The Dilemma of Response-Prevention Trade-Offs**

Public safety is a clear responsibility of government that garners a lot of public attention (Callahan and Bahme 1987, Page 2002). This makes the fire department a political concern regardless of whether the organization is fully career, fully volunteer, or somewhere in between. The manner in which local governments choose to fulfill this responsibility is a matter of public choice (i.e., collective action). Mission, service mix, and staffing preferences consequently fall under political influence. As the agency head, the fire chief is a political actor in every sense of the word. He or she influences political leaders' decisions and then exercises discretion within politically acceptable ranges when implementing those decisions (Goodnow 1900/2008, Svara 2001, Demir 2009).

Political officials do not have the same time horizons or interests as private owners, the public, or government itself (Feeny et al. 1990). Kwon, Lee, and Feiock (2010) observe that political actors are motivated to make local service decisions based on political expediency, while administrators are motivated by career advantages. It follows that political needs rather than effectiveness and efficiency will drive mission, as well as service configurations (Wood and Bohte 2004). However, inherent path dependency at the political and organizational level constrains decisions to emphasize current service structure. Significant policy shifts will not be considered in the face of resource scarcity. Programs that serve powerful constituencies are less vulnerable than those with weak constituencies (Rubin

2010). Likewise, programs that antagonize power constituencies become more vulnerable. Levine (1985, 692) observes that policy-makers prefer "familiar, short-run, incremental, and piecemeal problem-solving methods over viewing retrenchment as a strategic, long-term problem."

Assuming that a fire chief is reasonably well versed in the fire literature, we can take for granted that he or she will know the benefits of fire prevention. The release of *America Burning* in 1973 put considerable attention on fire prevention and national fire loss statistics reflect its effectiveness (National Fire Data Center 2016). Fire prevention provides an unseen benefit to communities through reduced losses and improved quality of life, though gauging the effect at the local level is difficult. Retrenchment poses a policy dilemma. Citizens and politicians are generally unaware or do not care about prevention benefits (Schaenman et al. 1987). Their expectations focus on emergency response, which is much more visible and politically salient.

Emergency response and fire prevention approach the community fire problem from two distinct directions. Response is reactive. Prevention is proactive. Response assumes a certain level of loss based on a time-dependent five-step process from fire initiation to control as seen in Figure 2.1. Response cannot influence the loss associated with the time frame of ignition to discovery ($t_1$), and has minimal opportunity to influence loss associated from receipt of alarm to arrival on scene through increased process efficiencies ($t_2$, $t_3$, $t_4$). Maximum loss control occurs during the operational timeframe. Fire prevention assumes no loss from avoided events and limited damage due to the compression of times from initiation to control. Response requires collective action and considerable investment in resources in personnel, equipment, and supplies. Prevention requires a fraction of those resources and

focuses responsibility on individual building owners and behaviors. In emergency response, free riding is tolerated, if not accepted. Prevention attempts to shift responsibility and costs back to individual actors, rather being borne by the community. Prevention takes measures to minimize free riding by demanding the installation of fire protective measures and the practice of fire safe behaviors.

The choice of overall cutback strategy employed by the fire department, then, is a function legal mandates, maintenance of mission and organizational integrity, and political preferences. It is a collective action problem with no clear technical solution that emerges at the transition of a fire department from a public good to a common pool good. Cutback decisions must preserve the efficiency and effectiveness of fire prevention against the political practicality of preserving emergency response capabilities. The essence of this dilemma comes down to two questions. What *can be* cut? What *should be* cut? Several factors influence the answers to these questions. These include the internal and external resources available to the community and local government/department, which services are already provided, and the extent of budget cutbacks.

**Formal Hypotheses**

The FPC survey asked respondents to provide information on three department demographic variables that the survey work group believed would exert considerable influence on the provision of 3E services and cuts made to those services. These variables were size of the community protected, department size, and type of fire department. These variables also provide the basis for my first two hypotheses.

Explaining Cutbacks in 3E Services – Department Scale

The first two variables are inextricably related, though the particular circumstances driving the relationship change from community to community. The size of the community protected in terms of population is a primary driver of department size. Fire department service demand is a function of population and service demand greatly influences the size, structure, and management of the local fire department. Service demand is raised or lowered by certain characteristics of the protected population. From another viewpoint, community size and characteristics influence the level of services provided by a public good, but also increase the likelihood of resource overutilization.

Population characteristics of density, poverty rate, existing building stock condition, and presence of industrial properties have been shown to increase firefighting demand (Brudney and Duncombe 1992, Duncombe 1992, Southwick Jr and Butler 1985). Further, economic growth, as seen prior to the Great Recession, fuels demand for fire protection services. New residents look for more services, as well as faster response, but are not tied to existing community collective action paradigms (e.g. volunteer fire departments). Instead, they will look to spread the cost of additional service demands across the remainder of the community in the form of additional firefighting forces.

New industries following into growing population centers introduce unique hazards that require specialized emergency response capabilities, such as hazardous materials. Increasing population density also comes with the hazards associated with vertical, tightly packed living and working environments. These taller, sprawling structures are also accompanied by their own special emergency response needs (Brunet, DeBoer, and

McNamara 2001). Again, addressing these needs follows the well-worn path of adding additional firefighting forces.

Firefighting is a labor-intensive service. Higher levels of desired protection generally equate to more personnel. Fire stations and the units they house have a finite capacity for response limited by physical, political, and organizational constraints. Such constraints must be considered and negotiated between stakeholders with an eye toward avoiding service unit overload and degrading the service provided. Pirkul and Schilling (1988) point to two important considerations. One is abrupt peak capacity when a call for service arrives. Units assigned to that call are no longer available to service other calls. Second, is that calls for emergency service cannot be queued. Thus, the allocation of resources must include sufficient redundancy to ensure that other nearby units are available to handle overlapping service demand. When service demand overtakes the availability of resources, the fire department transitions to a common pool good. At that point, service access for some users will suffer.

In their study of fire department service demand, Southwick Jr and Butler (1985) found that increased loss leads to demand for additional firefighting forces. Unfortunately, as seen in Figure 2.1, emergency firefighting forces are limited to affecting loss only after they arrive at an incident. Prevention services can intercede at the point of ignition. In other words, investing in prevention as an alternative means of decreasing fire department service demand and improving productivity has positive budgetary benefits. Fire prevention, delivered by the 3E services can change the cost of a desired level of protection by changing service demand. This fact is not lost on municipal administrators. Thus, one would expect that as communities and fire departments increase in size, they will pursue service delivery

and cutback strategies favoring fire prevention as a means of controlling escalating costs and shifting the burden of providing fire protection services to those entities increasing service demand. This leads to my first hypothesis:

> $H_{1a}$ – Fire service provision and cutback strategies for Education, Engineering, and Enforcement (3E) activities are associated with the relative size of the community and its fire department.

Explaining Cutbacks in 3E Services – Department Type

The National Fire Protection Association (NFPA) identifies four basic types of fire departments: all-volunteer, mostly-volunteer, mostly-career, and all-career. Within these categories, the public configuration may change (Young 2012) (e.g., public versus private / non-profit versus local government). Regardless, however, the basic services of emergency response and prevention will remain intact and reflect a desired level of fire protection. Once a community has settled on a desired level of fire protection, they will then seek to provide it at the lowest cost. For instance, (Brunet, DeBoer, and McNamara 2001) demonstrate that where the level of desired fire protection is low, volunteer forces are less expensive and popular. However, where the level desired is higher, career forces are relatively less costly and more desirable. The actual level of service will then be defined by a combined measure of relative quality and needed quantity.

Two macro-level trends currently are influencing community desired levels of fire protection. Census data shows that baby boomers (those born between 1946 and 1964) are moving to rural and small-town settings in record numbers driven by quality of life concerns that center on amenities and housing costs (Cromartie, Nelson, and Barkey 2010). Furthermore, the ongoing change in economic markets from local industries to centralized multi-national corporations and greater worker mobility (i.e., commuting) has strongly influenced suburban growth patterns (Simpson 1996).

Central urban areas, on the other hand, have become hubs of growth and commerce with adjacent suburban communities absorbing the influx of new residents and workers. These changing demographics are causing significant social and economic change for these destination residencies (Cromartie, Nelson, and Barkey 2010). Income and employment outlooks are improving, but infrastructure and health care costs for local governments are being driven up as well. Balancing such growth and increasing costs becomes a policy choice with no clear answer.

At one end of the spectrum, all-volunteer fire departments are often central pillars of community social life, ranking alongside the local church, as well as protecting life and property. Local volunteer fire departments are mostly found in rural America and protect the vast majority of land area in the United States (Simpson 1996). In this sense, volunteer fire departments truly represent collective action addressing a local community problem. However, as the community demographics change and service demand increases, the form of collective action transforms from one of direct contribution to one of indirect contribution in the form of taxes. Fire departments become goods to be exploited.

All-career fire departments lie at the other end of the continuum and now protect the bulk of the U.S. population. Career firefighters are less often members of the protected community and they more rarely lack clear social ties to their protected community. All-career departments vary greatly in size, but generally are marked by higher levels of training and a wider array of services. As a rule of thumb, all-career departments protect higher population densities, more industrialized communities, and protect against more diverse hazards. Since services are funded through tax dollars, citizen expectations of service are also much higher.

Between these two poles lie mostly-volunteer and mostly-career fire departments. Fire departments will begin to transition from all-volunteer to mostly-volunteer, then to mostly-career and all-career in reaction to service demand. This does not imply that all fire departments will eventually become all-career. Transition stops at any point along the spectrum when the community is satisfied with the level of fire protection provided. I expect that service satisfaction is represented by the type of fire department providing protection, as well as the extent of 3E services provided. How service is provided and which services are provided will also restrict the cutback strategies available during times of economic hardship. This brings me to my second hypothesis:

> $H_{2a}$ – Fire service provision and cutback strategies for Education, Engineering, and Enforcement (3E) activities are associated with the institutional structure of the department.

Explaining Cutbacks in 3E Services – Services Provided

Fire departments are not the only providers of 3E services. Other entities, such as building, permitting, and inspection departments, stand-alone fire marshal offices, and state and local police services also provides limited scope 3E services. Some services may be contracted to the private sector or not provided at all. Local configuration of how 3E services are delivered can be traced to political and community beliefs and desires, historic development and capabilities of the local fire department, as well as legal mandates. Communities will settle on different mixes and configurations of 3E services, depending upon prevailing community characteristics. The services provided will be those demanded by the community to realize a desired level of fire protection. Thus, one would expect that the arrangement of 3E services provides an indication of community satisfaction with that level. Once a community has established a desired level of fire protection, it will try to

maintain those services that are targeted. From this perspective, cutbacks would likely be made across the board to preserve those services to the extent possible.

Each of the five 3E services is targeted toward different clientele within the community and each affects fire safety in a unique manner. Plan review and new construction inspections primarily serve developers, designers, and builders in the construction industry. These services generally occur out of sight of most of the community, but develop keen political interest when requirements are perceived to result in excessive costs. Existing building inspections serve the owners and occupants of buildings. These services can be very visible to the community, though perceived in a different frame. From a building or business owner's perspective (e.g., a high-rise apartment building or a local restaurant), the existing building inspection can be seen as a nuisance and an attempt to interfere with owners' property rights. These owners tend to have stronger political ties that incurs political interest. Within complaint driven response, the public views this service as appropriate government behavior meant to address their concerns. Complaints only are generated from political interests when those complaints are left unresolved.

The clientele for public education is the entire community. It tends to have high public saliency, since much of the effort is directed at children and the elderly. It focuses on the human behavior aspects of fire safety and it is not limited to the built environment. Fire-arson investigation is unique in that the primary clientele is the government and insurance industries. Identifying fire incidence trends to improve resource allocation and pursuing criminal activity occurs mostly out of sight of the general community.

A community's perception of fire risk is seldom accurate since fires are relatively rare events in a given population. Most community members, particularly those in larger

communities, will rarely have a personal experience with fire (Chubb 2005). Further, most fire prevention activities occur out of sight of the public, so most of the public is unaware of the interplay of the 3E services in controlling the costs of fire risk. As rare events, fires are certain to make the local news. Fire prevention services do not. Thus, public perception of fire risk is largely formed by the level of emergency response of the fire department and the public is likely to resist any cuts to that emergency response. From the political perspective, the provision and arrangement of 3E services will likely follow the path of least resistance.

Services that are not directly provided cannot be cut. Services that the public or political actors place high value in will be resistant to cuts. Services that are provided by other levels of government or the private sector limits the scope of political and budgetary interference. Services that generate pushback at the political level and have powerful constituencies, but are mostly out of sight of the public will influence service and budget priorities. One can easily conclude that cutback strategies will reflect community desires and political desires, as well as how services are delivered, thereby limiting the choice of cutback strategies available. My third hypothesis tests this choice limitation:

> $H_{3a}$ – Fire service cutback strategies for the provision of Education, Engineering, and Enforcement (3E) activities are associated with the internal and external sourcing of the 3E services.

These three hypotheses form the basis investigating my research questions. I begin by looking at how the demographic variables of fire departments affect the provision of 3E fire prevention services. Factors such as size of population served, department size, and department type are thought to influence the choice of services provided, as well as the strategic cutback choices available. I then turn to the provision of those services themselves. The arrangement for the provision of services, grounded in prevailing community and political desires will also limit the strategies available to implement cuts.

# CHAPTER III

## RESEARCH DESIGN

The premise of this study is to evaluate fire prevention services within times of severe economic stress. The common wisdom on this topic is that fire prevention is the first service sacrificed when fire departments are faced with large budget cuts (Schaenman et al. 1987, Scott 1997, Chubb 2005). Thus, my dissertation begins by classifying 3E provision strategies into an ordinal ranking of common configurations to better understand how these services are provided across different communities and departments. It then examines which of these service configurations are most vulnerable to budget cuts. Finally, it examines the alternative strategies utilized for cutback management.

Local government provides community services through departments with defined missions and they are generally free to configure themselves to maximize effectiveness and efficiency. Cutback implementation decisions are also made at this level within the boundaries of resource availability provided by political decision-makers. Accordingly, this study utilizes the local government department or organization as the unit of analysis

**Vision 20/20 Fire Prevention Cuts Survey**

The data for this analysis stems from the Vision 20/20 Fire Prevention Cuts Project – a survey of fire service leaders that took place in the Spring of 2012. The project began in 2010 with months of discussion on an electronic information exchange bulletin board shared by fire marshals, fire code enforcement officials, and other fire prevention services providers. Discussion participants were concerned about the cuts to fire prevention programs affecting their various departments stemming from the Great Recession. In the March 2011, I volunteered to lead a working-group to develop a survey with the intent of determining the recession influenced status of fire prevention. The group consisted of eight persons from across the United States with extensive career fire prevention experience at the national and local level. One member of the work group sits on the Vision 20/20 Executive Committee and secured sponsorship and staff support for the effort. The project contributes to Vision 20/20's *Strategy 1* of greater advocacy for fire prevention,[2] but no direct funding was provided for the survey itself. The Vision 20/20 project, however, is supported through U.S. Department of Homeland Security, *Assistance to Fire Fighters Fire Prevention and Safety Grant* program, and the Institution of Fire Engineers US Branch. Survey work group members served voluntarily as part of their normal career duties, so data remains entirely in the public realm. Work was conducted entirely by email or phone.

Survey Sampling Method

The FPC Survey used a nonprobability convenience sampling strategy. As such, it is not representative of the population of fire prevention providers or fire departments in general. Results are not generalizable to the population of fire departments (Johnson and

[2] Vision 20/20 proposes six strategies for improving fire prevention actions in the United States. Strategy 1 is to "Increase advocacy for fire prevention". Additional information can be found at http://toolkit.strategicfire.org .

Reynolds 2012), but the effort represents an initial step toward better understanding the balance between fire response and 3E services in the context of significant budget constraint.

The sampling method for the survey was based strictly on ready access to contact information. Random sampling was discussed early in the project time line, but a mechanism for such an effort was not available. At the time of the survey, there were approximately 30,170 fire departments in the United States (USFA 2010). No comprehensive index of departments and contact information existed with which to gather information on the greater population for a random sample study. While results are not generalizable, Johnson and Reynolds (2012, 240) note that nonprobability convenience sampling is "most appropriate during exploratory research or when the population is too ill-defined to permit probability sampling."

The working group decided that the most feasible approach to a survey was to utilize the existing ePARADE (electronic Prevention Advocacy Resources and Data Exchange) and NFLSE (National Fire and Life Safety Educators) electronic bulletin boards. Membership and participation on these bulletin boards takes place on an individual level (not the organization / department level). At the time of the survey, ePARADE had a membership of 937 registered participants and NFLSE had a membership of 451 registered participants, providing total distribution of 1388 individuals. The registered participants include members representing fire departments, state fire marshal offices, the International Association of Fire Chiefs, United States National Fire Academy, National Fire Protection Association, other federal departments, and private sector corporations and consultants. Participants are screened prior to gaining access to either bulletin board site, therefore I am reasonably

assured that our responses are associated in some way with the provision of fire prevention services.

Survey Instrument

Construction of the survey instrument is important to capturing the intended data. Open-ended questions may solicit unanticipated, but vital information. However, they pose certain analytic challenges, including interpretation and coding of responses. Closed questions, on the other hand, increase answer reliability, answers are easy to interpret, and they lend themselves to easing computer-aided analysis. Regardless, survey questions should be succinct, single topic, and use terminology appropriate for the intended audience (Fowler 2009).

Focus groups can play an important role in developing a survey. They help develop and clarify the purpose behind a survey. In certain cases, they help develop survey questions with an eye towards later analysis (Fowler 2009). The original format of the FPC Survey was for a two-part survey. The first ten questions were used to establish organizational control variables. The remainder of the questions were intended to develop information that quantified the level of cutbacks to fire prevention activities, quantified the effect of those cuts on program resources and outputs, and identify any strategies undertaken to compensate for the program cuts (Donahue 2011). The second part of the survey was to look at community loss impacts and identify jurisdictions for case study. However, this second part was never fully developed or implemented.

The draft FPC Survey instrument went through four separate iterations during which organization and community demographic questions were added. The survey work group selected base-line factors according to perceived resource availability. Community

population should be generally reflective of the available tax base and service demand. Total fire department staffing is likely associated with available departmental resources and service demand. Fire department type was thought to associated with resource levels, particularly in the case of all-volunteer and mostly-volunteer who are probably not or minimally supported by tax dollars, as well as facing legal and technical restrictions on which 3E services they can deliver. For example, plan review requires deep technical knowledge of code intent and requirements that takes years to master.

The survey instrument draft was tested by the January 2012, *Leadership Strategies for Community Risk Reduction* class at the National Fire Academy. This resulted in additional revisions to the draft instrument to make it more easily understood (Donahue 2012). The final survey instrument consisted of 28 questions in a self-administered, closed-end format. This length falls within that recommended by Fowler (2009) to avoid survey fatigue. The final survey instrument is found in Appendix A. The survey was posted electronically on Survey Monkey in mid-April, 2012. Introduction emails were sent on April 15, 2012, with reminder emails approximately every two weeks to improve the number of responses. Copies of the introductory emails are found in Appendix B. The survey remained open through June 15, 2012.

The first of four sections of the FPC Survey solicited organizational information about fire prevention service delivery. In this section, the first group of questions asked which agency within the local government provides each of the 3E fire prevention services. The second group of questions sought information on demographic features that were thought to influence which agencies provided fire prevention services and the likelihood of fire prevention cutbacks, including department size and type, and population served. The

second section of the survey instrument asked whether the budget had been cut and if these cuts were the result of tightened budgets. Questions in the third section of the survey instrument focused on identifying the magnitude of any fire prevention budget cuts within the context of overall agency budget cuts. Finally, questions in the last section of the survey were aimed at identifying specific programmatic impacts of any budget cuts.

The survey's 28 questions generated a considerable amount of data. However, not all the data collected is immediately germane to the topic of this study. I am investigating the basic strategic approaches to cutback management that were used as a result of the Great Recession. Accordingly, I limited my analysis to those survey questions which provided data addressing my central theme. Table 3.1 provides a truncated list containing only those survey questions used in this study.

Survey Results

Introductory and reminder emails were sent to 1388 individuals. Of these, 1321 survey starts were returned for an overall 95.2% response rate. Fowler (2009) observes that response rates for surveys can vary considerably, with lower rates associated with mail and internet-based surveys. That said, there is no established standard for response rates. The federal Office of Management and Budget looks for procedures that will lead to response rates of at least 80%, while academic survey institutions occasionally reach 70% rates. The FPC Survey response rate exceeded these rates. This is probably due to the fact that the survey used a convenience sample comprised of known and engaged fire prevention practitioners in all the 3E services. Individual subjects within the target sample represented a wide array of community and organizational sizes from across the country. Respondents also represented a host of different organizations in the private and public sectors, with 91% of

| Table 3.1: FPC Survey Response Count by Question | | | | | | |
|---|---|---|---|---|---|---|
| Survey Question No. | Survey Question / Variable | Survey Respondents | Sample Size (N) | Sample Min. | Sample Max | Sample Std. Dev |
| 1 | Which governmental agency provides the fire prevention service of plan review for new construction in your community? | 1321 | 1200 | 1 | 5 | 0.88 |
| 2 | Which governmental agency provides the fire prevention service of inspections for new construction in your community? | 1321 | 1200 | 1 | 5 | 0.81 |
| 3 | Which local governmental agency provides the fire prevention service of existing occupancy inspections in your community? | 1321 | 1200 | 1 | 4 | 0.77 |
| 4 | Which local governmental agency provides the fire prevention service of public education in your community? | 1321 | 1200 | 1 | 4 | 0.53 |
| 5 | Which local governmental agency provides the fire prevention service of fire/arson investigation in your community? | 1321 | 1200 | 1 | 4 | 1.18 |
| 6 | What is your organization? | 1321 | 1200 | 1 | 4 | 0.55 |
| 7 | What is the population of the community your department serves? | 1321 | 1200 | 1 | 8 | 1.78 |
| 8 | What is the total staffing of your department including civilian and uniformed personnel? | 1321 | 1200 | 1 | 8 | 1.52 |
| 9 | Is the fire department serving your community (all career, mostly career, mostly volunteer, all volunteer)? | 1321 | 1200 | 1 | 4 | 1.12 |
| 10 | Does your department have one or more work units dedicated to providing a fire prevention service? | 1321 | 1200 | 1 | 2 | 0.46 |

**Table 3.1: FPC Survey Response Count by Question**

| Survey Question No. | Survey Question / Variable | Survey Respondents | Sample Size (N) | Sample Min. | Sample Max | Sample Std. Dev |
|---|---|---|---|---|---|---|
| 11 | What is the total staffing of your combined fire prevention work units including civilian and uniformed personnel? | 889 | 823 | 1 | 7 | 1.34 |
| 12 | Has your organization made cuts to fire prevention services in last two years? | 893 | 827 | 1 | 2 | 0.50 |
| 14 | What percent of the overall department budget was cut? | 413 | 381 | 1 | 6 | 1.74 |
| 15 | What percent of the fire prevention work unit(s) budget was cut? | 415 | 383 | 1 | 6 | 1.75 |
| 16 | Which fire prevention services were affected by the budget cuts? Check all that apply. | | | | | |
| 16-A | Fire investigations | 125 | 120 | 1 | 1 | 0.00 |
| 16-B | Fire/building code inspections | 258 | 242 | 1 | 1 | 0.00 |
| 16-C | Fire/building plan review | 146 | 136 | 1 | 1 | 0.00 |
| 16-D | Public education | 321 | 295 | 1 | 1 | 0.00 |
| 16-E | Other | 35 | 29 | 1 | 1 | 0.00 |
| 17 | Were personnel cut from the fire prevention work unit(s)? | 876 | 812 | 1 | 2 | 0.47 |
| 20 | Did any other work units in the department experience budget cuts? | 281 | 263 | 1 | 2 | 0.44 |
| 25 | Did your department take steps to compensate for fire prevention activity cut backs? | 1262 | 1148 | 1 | 2 | 0.47 |

Note: This table contains only counts and descriptive statistics for questions that are directly applicable to this study and not the full range of questions asked in the FPC Survey.

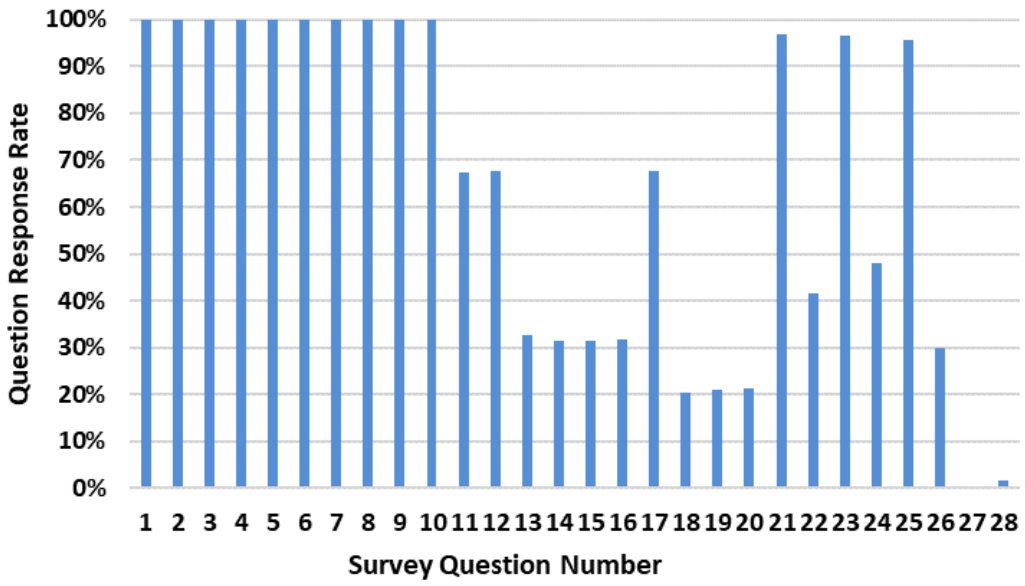
| Table 3.2: What is your organization? | | | |
|---|---|---|---|
| | **Response Count** | **Response Percent** | **Cumulative Percent** |
| Local fire department | 1198 | 90.7% | 90.7% |
| Local building department | 23 | 1.7% | 92.4% |
| State Fire Marshal's Office | 12 | 1.4% | 93.8% |
| Other local department | 44 | 3.3% | 97.1% |
| Other department (Federal, State, or Private) | 37 | 2.8% | 99.9% |
| Other (please specify) | 74 | 5.60% | 105.5% |
| Total answered question | 1321 | 105.5% | |

Notes: Percent total is greater than 100% due to respondents providing double answers using "Other – please specify" which allowed for duplication of responses. These were filtered out when selecting the study sample. Without this duplication, total responses are less than 100% due to rounding errors.

respondents coming from local fire departments (n = 1198), 1.7% coming from local building departments (n = 23), and 3.3% coming from other local departments (n = 44). The remaining survey responses came from federal, state, and private entities (n = 56). Table 3.2 contains the breakout of organization orientations for all respondents.

As with all surveys, individual question response rates will vary. Response rates for individual questions were generally acceptable and can be found in Figure 3.1. Individual question response rates varied from 20% to 100%, though over half had response rates exceeding 60%. All the questions concerning department demographic characteristics and who provides a particular service were answered at a 100% rate. Questions that asked

**Figure 3.1: FPC Question Response Rate**




Note: FPC Survey question response rates are important for providing some level of credibility in later analysis of the study questions. Missing values are handled by listwise exclusion in calculations. This particularly important in questions 12 (Were cuts made to FP in the last two years?), 17 (Were personnel cut from the FP work unit?), 21 (Were FP activities cut back?), 23 (Were FP activity resources cut back?), and 25 (Did the department take any compensatory action?). These questions provide the basis for dichotomous variables in the second and third study questions.

general information about cuts to personnel and services all ran above 60%. Response rates for questions that asked specifics about cuts ranged between 20% and 30%, but those were subordinated questions on the basis of those departments experiencing cuts. In a general sense, the survey worked as intended and yielded useful responses. Most importantly, the survey generated a high response rate, contrary to historical email survey results (Johnson and Reynolds 2012).

Bias and Error

Limitations placed on sample selection create several inherent biases within survey results. Johnson and Reynolds (2012) observe that email or web-based surveys are known for low sample-population congruence. Bias is introduced through the initial selection of respondents. Johnson and Reynolds (2012) also note that web-based surveys suffer from incomplete or non-response for reasons of non-contact, refusal or not-able. Such responses are difficult to follow up and complete. Furthermore, respondents may not know the answer and simply choose a random answer. Weisberg, Krosnick, and Bowen (1996) note other potential biases with using bulletin boards to access sample populations. First, not everyone has access to the technology or site. Local governments place many restrictions on which sites are accessible, precluding participation by those who might be interested. Given that the FPC survey was e-mail driven, providers from volunteer departments may not have been aware of the survey. Second, the technological capability of the respondents plays a role in response. For the FPC Survey, participation on the bulletin boards may be limited to providers who are more technologically progressive, possess a high interest in the subject matter, and have internet access. Third, these bulletin boards are not extensively advertised. Participation follows from word of mouth. Taken together, these conditions set up a self-

selection bias and non-representative sampling frame (Weisberg, Krosnick, and Bowen 1996).

Bias was introduced into the survey through the use of its targeted audience of fire prevention providers, but it also led to the extraordinary response rate. The overwhelming number of survey respondents were from local fire departments (n = 1198, 90.7%). Though steps were taken to identify other 3E service providers, the survey work group assumed that the respondent was fully aware of who those other service providers were. This assumption may be acute in the case of respondents from mostly and fully volunteer departments, who tend to be response oriented and possess limited capacity or authority to provide other services. This identifies another potential bias among survey respondents. All career fire departments are over represented. While all-career fire departments represent only 8.5% of the fire departments in the United States, they comprise 43% (n = 568) of survey respondents. On the other end of the spectrum, 67% of the fire departments in the United States are all volunteer, yet comprise only 17% (n = 224) of my survey respondents.

Study Sample

This study is concerned with the local government environment. Inclusion of federal, state, and private actors, while relatively small in number, has the potential to skew results since budget pressures and characteristics are different for these organizations. Accordingly, respondents from these organizations were removed from the final sample examined. In addition, this study is concerned with how local fire departments react to economic downturns in their delivery of the 3E fire prevention services. The final study sample was derived from survey respondents who answered the first five questions regarding who provided each 3E service, as well as question 6, which asked for the respondent's own

organization orientation. Individual cases were filtered and a count of respondents answering the first six of FPC survey questions derived (n = 1321). The study sample including question 6 yield 1200 observations. This level provides sufficient cases for a large-N study and captures 94.9% of the local government survey respondents. This is shown in columns four through six of Table 3.1, along with descriptive statistics.

Quantitative Approach

To answer the research questions and hypotheses posed I use a quantitative approach to analyze the data gathered in the FPC survey. I cannot make accurate assumptions about the distribution of the true population from which my sample was drawn since I use a convenience sample. Therefore, I use non-parametric techniques for my analysis (Pallant 2016, Moore, McCabe, and Craig 2012). A word of caution is appropriate here. O'Sullivan, Rassel, and Taliaferro (2011) observe that the statistical results from nonprobability samples, such as the basis for this study can yield unreliable results. However, that does not mean that statistical testing is inappropriate, only that results should be viewed with a measure of caution.

As previously stated, a nonprobability convenience survey forms the basis for this study. The FPC survey consisted of 28 closed end questions, which asked for fact-based data rather than opinion-based data. The structured answers lent themselves to easy development of nominal, ordinal, and interval data and quantitative analysis (Fowler 2009). I recoded answers as necessary to allow for statistical analysis. In the cases of community size and total department staffing, I collapsed the highest three and four categories of survey answers, respectively, into single categories to provide sufficient observations for analysis. The larger numbers of observations in these two categories make for more robust independent variables.

My analysis focuses on identifying relationships between categorical variables and trends within those relationships, but does not attempt to identify causation.

My analysis begins with visual presentation and descriptive statistics. This provides a general overview of the data, but more importantly the number of missing values from that particular variable in the study sample. While normally concerned with random sampling, missing values are handled through listwise deletion. Allison (2002) notes that listwise deletion is the preferred method as it does not affect measures of central tendency. However, standard errors are likely to increase since analysis is based on a smaller portion of the study sample. Given that my research is based on a convenience survey, I cannot state how representative the study sample is of the 3E fire prevention service providers population. However, I treat missing values as if this study is based on a random sample.

I provide visual presentation of graphs and tables to clarify the relationships hypothesized in this study. Hartwig and Dearing (1979) state that visual representation of data is appropriate for exploratory analysis. It is often more effective than strictly numeric data presentation for examining data distribution. Graphics should reveal several data characteristics in an easy to understand format. While each type of chart has its strengths, they should convey central tendency, data dispersion, distribution shape, tails, symmetry, outliers, comparison, and relationships (Johnson and Reynolds 2012, 377).

Clustered error bar charts provide visual representation of point estimates of mean values, trends, and confidence intervals indicating the precision of point estimates (Cumming and Finch 2005, Pallant 2016). The data presented by error bars is not resistant to outliers. On the other hand, box and whisker plots summarize interval and ratio data distribution, including range, median, interquartile range, and outliers. The data presented is resistant to

extreme value influences and supports ready comparison between categories of data (Johnson and Reynolds 2012). Cross tabulation tables identify relationships between categorical nominal and ordinal variables, as well as the strength of those relationships (O'Sullivan, Rassel, and Taliaferro 2011, Johnson and Reynolds 2012).

Several survey questions asked for Yes/No answers and these provide dichotomous dependent variables for analysis, while answers to other questions provide discrete categories appropriate for independent variables. These are examined via logistic regression to identify the probability of each condition existing and how a one unit change in the independent variable generates change in the dependent variable (Pampel 2000). Because I am using a nonprobability sample, I base the results of my logit models on maximum likelihood estimation (MLE), which returns an iterative approximation of model parameters that best fit the data (Pampel 2000). I test relationship strength and direction, goodness of fit, and significance through chi-square and gamma statistics, maximum likelihood value, probability, and odds ratios, as appropriate (Freund and Wilson 2003).

**Dependent Variable and Estimation Strategies**

Fire threat has been defined as a local problem since President Truman's *National Conference on Fire Prevention* (Continuing Committee on Fire Prevention 1947). This conference introduced the concept of the 3E's in fire prevention. While making clear that prevention is a key element of fire safety, the conference attendees reasoned that different communities faced different fire risks. It follows then, that different communities will emphasize different applications of the 3E's. Communities are free to decide the level of fire risk tolerated and which 3E services to provide as part of their fire safety efforts. I investigate how different communities apply the 3E concepts in my research questions.

How Are 3E Fire Prevention Services Provided Across Different Communities?

My first research question focuses on how 3E services are delivered across various communities. It necessarily consists of two parts: 1) developing a common tool for comparison, and 2) applying that tool across the various communities in my sample. In the first part, I derive a common platform for comparison by applying an ordinal scale to delivery of each of the 3E services. Questions one through five of the FPC survey ask which entity provides the five fundamental 3E services of plan review, new construction inspections, existing building inspections, public education, and fire-arson investigation (if these services are provided at all). These are shown under Research Question 1 of Table 3.3. Respondents who answered "Not applicable" or "Other – please specify" were listwise deleted during development of the study sample. I assign each possible categorical answer for each of questions one through five a value of one through four depending on who provides the service or if the service is not provided. Categorical answers for each of these questions included: 1) local fire department, 2) local building department, 3) other local department, 4) service is contracted out, 5) service is not provided.

My rational for values in the ordinal scale is based on Schaenman and Swartz (1974), who observe that prevention services affect the core mission of the fire department and should be included in any effectiveness and efficiency evaluation regardless of who provides the service. Assuming budgets are representative of departmental priorities (Rubin 2010), the ordinal scale represents where the locus of budgetary control is located relative to the fire department and potential to impact the fire department's mission. In essence, the higher the number, the closer the service is to fire department control. The ordinal scale provides a means of comparing individual 3E services across communities, but not overall community

**Table 3.3: Dependent Variables of Analysis**

| Survey Question No. | Survey Question / Variable | Sample Count | Sample Min. | Sample Max | Sample Std. Dev |
|---|---|---|---|---|---|
| Research Question 1: How are 3E fire prevention services provided across different communities? | | | | | |
| 1 | Who provides plan review? | 1200 | 1 | 5 | 0.88 |
| 2 | Who provides new construction inspections? | 1200 | 1 | 5 | 0.81 |
| 3 | Who provide existing building inspections? | 1200 | 1 | 4 | 0.77 |
| 4 | Who provides public education services? | 1200 | 1 | 4 | 0.53 |
| 5 | Who provides fire/arson investigation? | 1200 | 1 | 4 | 1.18 |
| 10 | Dedicated fire prevention work unit? | 1200 | 1 | 2 | 0.46 |
| 11 | What is total staffing of FP work unit? | 823 | 1 | 7 | 1.34 |
| Research Question 2: Which departmental provision schemes were affected by the Great Recession cutback? | | | | | |
| 12 | Organization made cuts to FP in last two years? | 827 | 1 | 2 | 0.50 |
| Research Question 3: How did departments with different provision schemes strategically approach cuts to 3E services? | | | | | |
| 15 | What percent of FP work unit budget cut? | 383 | 1 | 6 | 1.75 |
| 16 | Which FP services were affected by budget cuts? | | | | |
| 16-A | Fire investigations | 120 | 1 | 1 | 0.00 |
| 16-B | Code inspections | 242 | 1 | 1 | 0.00 |
| 16-C | Plan review | 136 | 1 | 1 | 0.00 |
| 16-D | Public education | 295 | 1 | 1 | 0.00 |
| 17 | Were personnel cut from the FP work unit? | 812 | 1 | 2 | 0.47 |
| 25 | Did the department take compensatory action? | 1148 | 1 | 2 | 0.47 |

Notes: This table contains only counts and descriptive statistics for questions used directly as or to develop dependent variables from the study sample (n=1200) and not the full count of survey respondents. FP = fire prevention.

fire prevention programs. To realize a programmatic comparison tool, I distill a single variable by combining the scores from each of the 3E services provided in a community and weight each service score equally. The ordinal scale becomes my 3E score for individual services, while the distilled scores become my summation 3E Index.

The literature is convincing that the operating environment greatly influences the service demand placed on a fire department (Jennings 1999, Subramaniam 2004, Shai 2006, National Fire Data Center 2016). While this literature addresses the emergency response service of the fire department, this observation can be extended to fire prevention services as well (Duncombe and Yinger 1993). This leads me to my dependent variables for this first research question. These consist of the same five 3E services used to develop the 3E Index. These are identified in Table 3.3 in column one, survey questions one through five, in addition to the 3E score and 3E Index just discussed.

In the second part of the first research question, I evaluate the response of these dependent variables to the three environmental (demographic) conditions that serve as my independent variables. These variables are community population size, department size, and department type, and are found in survey questions seven, eight, and nine (see Table 3.1). I begin my evaluation looking at how the 3E Index is affected by population size, department size and department type. I illustrate my comparisons to the 3E Index through simple box and whisker charts, which visualize several descriptive statistics concerning data distribution and central tendency. Importantly, box and whisker charts are not sensitive to outliers and ease comparisons between data categories.

After evaluating the 3E Index response to the independent variables, I look at how the individual 3E services are influenced by the independent demographic variables. For this

analysis, I use simple error bars. While error bars are sensitive to outliers, they are appropriate for identifying point estimates of means, trends, and confidence intervals. In this evaluation, I use 95% CI error bars, which corresponds to $\alpha = .05$ (Cumming and Finch 2005). I expect that different size communities and departments, as well as department types will have different influences on my dependent variables. Accordingly, I also cluster my error bars by the categories provided for my three independent variables in the FPC survey.

The last part of answering my first research question centers on a variation of delivering 3E services. In many communities, fire prevention is considered a specialized set of tasks with unique knowledge requirements. The level and complexity of service demand drive the implementation of a dedicated fire prevention unit (Crawford 2012). Thus, I expect that dedicated fire prevention units will be associated more with larger communities and larger departments supported by career staffs. To test this supposition, I turn to survey question 10 in Table 3.3 (i.e., Dedicated fire prevention unit?) which presents a dichotomous dependent variable. I code the responses according to convention with No = 0 and Yes = 1. As previously mentioned, I run an MLE of a logit model against my control variables of community size, department size, and department type as predictors on the presence of a dedicated fire prevention unit to deliver 3E services.

If fire departments have dedicated fire prevention units, it is likely that different size communities will have different capacity needs from these units. So, to close out this research question, I look at the staffing associated with dedicated fire prevention units. Here again, I rely on visual data presentation for analysis through 95% CI error bar charts. To make my analysis of dedicate fire prevention unit size I compare responses to survey question 11 (i.e. What is the total staffing of the FP work unit?) to the various demographic

categories in my independent variables. Not all respondents provided answers to this question, so there is a smaller study sample available (n = 823), which can be seen in Table 3.3 under Research Question 1. Respondents that did not answer question 11 were listwise deleted from the analysis. Question 11 allowed seven possible choices, ranging from no personnel assigned to over 50 personnel assigned. These variables were not recoded. These values reflect the number of personnel assigned: no personnel = 1, 1-5 personnel = 2, 6-10 personnel = 3, 11-20 personnel = 4, 21-30 personnel = 5, 31-50 personnel = 6, and >50 personnel = 7. Overall, examination of the dependent variables described above and how they are influenced by the demographic categories in the independent variables will contribute to my understanding of how different communities and departments organize and deliver 3E fire prevention services. Chapter 4 contains the detailed examination of these relationships.

Which Departmental Provision Schemes Were Affected by the Great Recession Cutback?

My second research question examines which 3E service configurations were affected by the Great Recession cutback environment. FPC question 12 on whether or not fire prevention budget cuts were made provides the sole dichotomous dependent variable for this question. Again, I have a smaller study sample (n = 827) due to non-response, which were listwise deleted from the analysis. Question 12 is also found in Table 3.3 under Research Question 2. I recode the answers to question 12 according to convention with No Cuts = 0 and Budget Cuts = 1. The recoded variable is labeled *Budget Outlook*.

I start my analysis here by looking for relationships between the demographic data gleaned from survey question 7, population served, question 8, department size, and question 9, department type and whether departments made or did not make budget cuts to 3E fire

prevention services. These demographic categories provide the independent variables discussed in greater detail under the section on independent variables. I present this data through crosstabulation in the form of percentages rather than counts under each category in community population, department staffing, and department type. Given that each of these categories has a different number of cases, percentages make trends easier to identify.

I then turn to examining the likelihood of budget cuts against the individual 3E services and first present this data in the form of 95% CI error bars charts. As previously mentioned, error bars are appropriate for identifying point mean estimates, trends, and confidence intervals. I use the same recoded dichotomous dependent variable of budget outlook and cluster the results based on this variable. I examine and present each recoded 3E service separately. In this analysis, I present only the recoded independent variables of department staffing and department type due to the established correlation between population size and department size.

In the last part of answering this second research question, I model the likelihood of budget cuts based using an MLE-logit regression. Again, I use the recoded dichotomous variable of budget outlook to test the influence of my independent variables. As with the last section, I drop the demographic variable of population size and examine only department size and department type. However, I also include the 3E Index and the recoded individual 3E services. I run two models. The first regresses total department staffing, department type, and the summary 3E Index against budget outlook. The second model regresses total department staffing, department type, and the five individual 3E services against budget outlook. I expect that the 3E Index will provided more of an overview of likelihood, while the individual 3E services will provide some nuance on the likelihood of cuts. I believe that

it is reasonable to expect that individual services will generate different budget cut probabilities. Chapter 5 provides details of these examinations.

How Did Departments with Different Provision Schemes Strategically Approach Cuts to 3E Services?

My third research question focuses on the strategies employed by departments making cuts to fire prevention 3E services. Stipak and O'Toole (1993) summarize four basic reactions available to local government in the face of fiscal stress. These are reduced services, raise revenues, improve productivity, and shift services. I begin by examining whether cuts were strategic or not by comparing department level cuts against cuts to fire prevention services. I present this data in cross tabulation form since I am interested in the relationships of ordinal data categories. Cross tabulation frequently reveals trends in data, by showing the number of cases in each cell. FPC survey question 15 (see Table 3.3) asked what percent of the fire prevention work unit was cut. The survey allowed for six categories of answers ranging from <5% to 20-25%, and "other". Respondents answering other generally indicated cuts greater than 25%. I recoded and retitled the variable categories <5%, 5-9%, 10-14%, 15-20%, 20-25%, and 25%+.

My research for this question also utilizes several models with dichotomous dependent variables. In particular, I examine the likelihood of cuts to individual 3E services, likelihood of cuts by 3E index, likelihood of cuts by department size and department type, and whether cuts were made to personnel, and whether compensatory action was taken. I run a logit regression for each of these dependent variables, which can be found in Table 3.3 under Research Question 3. It is important to note that the FPC Survey in question 16, consolidated new construction inspections and existing building inspections under a single category *code inspections.* I expect that these models will reveal an approximation of

priorities according to department size and type, at the organization level, the program level, and the service level. Chapter 6 addresses the details of this investigation.

**Independent Variables for Hypothesized Relationships**

After calculating the 3E Index, the next step in answering the central premise of my research questions is to examine the response of the 3E Index to different communities. The FPC survey collected data on four characteristics thought to most likely influence the policy choices of 3E service delivery. These were community population, total department size, fire department type, and the presence of a dedicated fire prevention unit. There are many more known variables that influence the fire department's emergency and prevention services delivery, including socio-economic conditions, age, and condition of housing stock (Jennings 1999, Shai 2006, Schachterle et al. 2012, Jennings 2013). However, while the survey working group was well aware of these factors, they were beyond the scope of the survey's intent.

Three of the four characteristics community population, department size, and fire department type are common to all three research questions, though I drop community population during research question two due to high congruence with department size. In addition to the demographic characteristic questions, the survey contains questions that add data pertinent to addressing my research questions and underlying hypotheses. These survey questions can be found in Table 3.4. The 3E Index and 3E scores also provide useful control variables in the second and third research questions. The importance of these independent variables and their application is described in the section immediately below, but also carries through to hypotheses two and three. I will describe the other identified independent variable questions seen in Table 3.4 in the sections following.

**Table 3.4: Independent Variables for Hypothesized Relationships**

| Survey Question No. | Survey Question /Variable | Sample n | Min. | Max | Std. Dev |
|---|---|---|---|---|---|
| H1: Provision and cutback strategies for 3E activities are associated with the relative size of the community and its fire department. | | | | | |
| 7 | What is the population of the community served? | 1200 | 1 | 8 | 1.78 |
| 8 | What is total department uniformed & civilian staffing? | 1200 | 1 | 8 | 1.52 |
| H2: Provision and cutback strategies for 3E activities are associated with the institutional structure of the fire department. | | | | | |
| 1 | Who provides plan review? | 1200 | 1 | 5 | 0.88 |
| 2 | Who provides new construction inspections? | 1200 | 1 | 5 | 0.81 |
| 3 | Who provide existing building inspections? | 1200 | 1 | 4 | 0.77 |
| 4 | Who provides public education services? | 1200 | 1 | 4 | 0.53 |
| 5 | Who provides fire/arson investigation? | 1200 | 1 | 4 | 1.18 |
| 9 | FD is all-career => all-volunteer? | 1200 | 1 | 4 | 1.12 |
| 10 | Dedicated fire prevention work unit? | 1200 | 1 | 2 | 0.46 |
| 11 | What is total staffing of FP work unit? | 823 | 1 | 7 | 1.34 |
| H3: Cutback strategies for the provision of 3E activities are associated with the internal and external sourcing of the 3E Services. | | | | | |
| 1 | Who provides plan review? | 1200 | 1 | 5 | 0.88 |
| 2 | Who provides new construction inspections? | 1200 | 1 | 5 | 0.81 |
| 3 | Who provide existing building inspections? | 1200 | 1 | 4 | 0.77 |
| 4 | Who provides public education services? | 1200 | 1 | 4 | 0.53 |
| 5 | Who provides fire/arson investigation? | 1200 | 1 | 4 | 1.18 |
| 8 | What is total department uniformed & civilian staffing? | 1200 | 1 | 8 | 1.52 |
| 9 | FD is all-career => all-volunteer? | 1200 | 1 | 4 | 1.12 |
| 14 | What percent of the department budget was cut? | 381 | 1 | 6 | 1.74 |

Notes: FPC survey questions 1 – 5, under H2 and H3 are dependent variables and used to develop the 3E Index under research question 1, "How are 3E fire prevention services provided across different communities?". This index is also used as an independent variable to evaluate H2 and H3 above.

Provision and Cutback Strategies for 3E Activities – Community and Fire Department Size

This section addresses both research question one and my first hypothesis regarding the effect of population and department size. Data on community size serves as a proxy measure for both the external resources available to and service demand placed on local government. In general, available local government revenues are a function of population size and associated assets (Lee, Johnson, and Joyce 2013). Most local governments rely on property tax, income tax, and sales tax to fund the services provided (Thompson 2013). In general, the larger the population base, the more revenue the local government likely takes in to provide services. Economic conditions have a significant effect, however. Fire department service demand also increases as a function of population protected. This applies to both emergency response and fire prevention services. Overall population, as well as density and diversity have been linked to increased service demand and complexity (Jennings 1996, Corcoran, Higgs, and Higginson 2011). Controlling for population size could reveal how service provision is differentiated in different sized communities. Table 3.5 provides a breakout of community sizes within the study sample.

**Table 3.5: Community Populations in Study Sample**

| Community Size | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| <10K | 208 | 17.3 | 17.3 | 17.3 |
| 10K-25K | 257 | 21.4 | 21.4 | 38.8 |
| 25K-50K | 233 | 19.4 | 19.4 | 58.2 |
| 50K-100K | 209 | 17.4 | 17.4 | 75.6 |
| 100K-250K | 149 | 12.4 | 12.4 | 88.0 |
| 250K+ | 144 | 12.0 | 12.0 | 100.0 |
| Total | 1200 | 100.0 | 100.0 | |

Note: This table represents total valid survey responses where local government respondents answered all five questions regarding the 3E services provided. This table provides the data broken out by community size. n = 1200.

Department size also serves as a proxy measure, but in this case for the availability of internal agency resources. Larger departments are expected to have greater flexibility in the allocation and support of work assignments. Size effects 3E service delivery in two ways. First, funding resources are a function of department size and relative importance to a public (Giroux, Mayper, and Daft 1986). In this respect, the fire department is able to exert considerable influence on budget decisions. They are generally one of the larger line departments in local government and provide direct public service. This makes their performance highly salient to politicians and the public. Second, size also reflects service demand. As communities grow and departments grow to meet new demands, they become more complex and the need for service specialization increases to improve effectiveness and efficiency (Young 2012). Table 3.7 provides the distribution of respondents in the study sample by total staffing category.

**Table 3.6: FPC Survey Responses by Total Fire Department Staffing**

| Total Staffing | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| <24 | 185 | 15.4 | 15.4 | 15.5 |
| 25-49 | 326 | 27.2 | 27.2 | 42.6 |
| 50-99 | 308 | 25.7 | 25.7 | 68.3 |
| 100-250 | 212 | 17.7 | 17.7 | 85.9 |
| 250+ | 169 | 14.1 | 14.1 | 100.0 |
| Total | 1200 | 100.0 | 100.0 | |

Note: This table represents total valid survey responses where local government respondents answered all five questions regarding the 3E services provided. This table provides the data broken out by total fire department staffing including uniformed and civilian members. n = 1200.

To facilitate analysis using community size as an independent variable, I recoded these variables from nominal categorical values to scalar values. FPC Survey question 7 (see Table 3.4), broke community population served into eight categories (<9,999; 10,000-24,999; 25,000-49,999; 50,000-99,999; 100,000-249,999; 250,000-499,999; 500,000-999,999; and >1,000,000).

Question 8 broke total department size into eight categories as well (<24, 25-49, 50-99, 100-249, 250-499, 500-999, 1000-1999, and >2000). For both these questions, the number of respondents fell off sharply in the upper categories, ranging from 1.1% (n=13) to 6.7% (n=80) of the total study sample (n=1200). Johnson and Reynolds (2012) point out that the number of indices must balance desire for accuracy versus the risk of over-specification. The number of groups should be determined by providing sufficient observations for statistical analysis.

Accordingly, I collapsed and recoded the upper three categories for population into a single category. This provided me with six categories of population labeled: <10K (n = 208), 10K-25K (n = 257), 25K-50K (n = 233), 50K-100K (n = 209), 100K-250K (n = 149), and 250K+ (n = 144). I also collapsed the top four categories for question 8 into a single category. I then recoded and labeled the resultant five categories: <24 (n = 185), 25-49 (n = 326), 50-99 (n = 308), 100-250 (n = 212), and 250+ (n = 169).

Provision and Cutback Strategies for 3E Activities – Fire Department Type

This section also addresses research question 1 and my second hypothesis. Here, I examine the effect of fire department type. Data on fire department type is collected in FPC Survey question 9 (see Table 3.4.). Fire department types include all-career, mostly career, mostly volunteer, and all-volunteer. These categories were drawn from the ICMA discussion of fire department types (Young 2012). I recoded each of the four available survey choices in reverse order of presentation in the FPC Survey: all-volunteer = 1 (n = 182), mostly volunteer = 2 (n = 225), mostly career = 3 (n = 251), and all-career = 4 (n = 542). Table 3.7 provides this information in tabular form.

**Table 3.7: FPC Survey Responses by Fire Department Type**

| Fire Dept Type | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| All Volunteer | 182 | 15.2 | 15.2 | 15.2 |
| Mostly Volunteer | 225 | 18.8 | 18.8 | 33.9 |
| Mostly Career | 251 | 20.9 | 20.9 | 54.8 |
| All Career | 542 | 45.2 | 45.2 | 100.0 |
| Total | 1200 | 100.0 | 100.0 | |

Note: This table represents the totality of valid survey responses where local government respondents answered all five questions regarding the 3E services provided. This table provides the data broken out by the type of fire department serving the community. n = 1200.

Organizational charters, state and local laws, citizen expectations, and available resources dictate the services provided. For example, the Annotated Code of Maryland limits enforcement of the fire code to specific fire officials of a county or municipal corporation (Fire Prevention Commission 2004). This has been interpreted to restrict volunteer firefighters from enforcing the state fire prevention code through the 3E services of plan review and inspections. Maryland is not unique in these limitations.

Department type also reflects the anticipated internal resources available to provide services. I expect that career-oriented departments, even during economic downturns, are able to tap into a greater resource pool, largely supported through tax dollars and fees. Volunteer-oriented departments rely on alternate funding sources which may shrink during economic hard times, though some may be partially supported by tax revenue or fees. All-in-all, career-oriented departments should have greater opportunity to dedicate resources to 3E fire prevention services and engage alternate cutback strategies.

Cutback Strategies for 3E Activities – Internal and External Sourcing In this section, I briefly discuss the independent variables thought to influence cutback strategies based on who is delivering the 3E service and my third hypothesis. As seen in Table 3.4, FPC Survey questions one through five provide these variables. These questions asked who provides

each 3E service and provides for a series of possible choices, as covered in previous sections. These questions were dependent variables in research question one, but the recoded variables are used as independent variables here. Whether services are provided internally or externally strongly influences the choice of strategies available to a department. A department cannot cut what it does not provide. Further, there may be external pressures and internal opportunities that influence whether to take a short- or long-range perspective. I expect that the analysis of these survey questions, along with the 3E Index will give an indication of whether departments approach cutbacks from the basic strategy of across the board or targeted cuts, as well as what perspective they have adopted.

Other Independent Variables

My exploration of my research questions utilizes FPC survey questions one through five initially as dependent variables in the course of developing the 3E Index in research question one. However, the questions also provide independent variables while analyzing research questions two and three. I also use the 3E Index as an independent variable in analyzing these questions. They have been discussed previously, so I will not cover them again here. They are provided in Table 3.8.

However, there is one additional question, 14, also in Table 3.8, which asks about total department budget cuts. This question is important to understanding strategic approaches used by departments when compared to the percentage of the fire prevention work unit budget cuts. This question provided six categories of answer in 2.5% ranges for the first four questions, a five percent range in the fifth category (10-15%), and >15% for the last category. I did not recode these questions.

| **Table 3.8: Other Independent Variables in Research** | | | | | |
|---|---|---|---|---|---|
| Survey Question No. | Survey Question /Variable | Sample n | Min. | Max | Std. Dev |
| Research Question 1: | | | | | |
| N/A | 3E Index | 1200 | n/a | n/a | n/a |
| Research Questions 2: | | | | | |
| 1 | Who provides plan review? | 1200 | 1 | 5 | 0.88 |
| 2 | Who provides new construction inspections? | 1200 | 1 | 5 | 0.81 |
| 3 | Who provide existing building inspections? | 1200 | 1 | 4 | 0.77 |
| 4 | Who provides public education services? | 1200 | 1 | 4 | 0.53 |
| 5 | Who provides fire/arson investigation? | 1200 | 1 | 4 | 1.18 |
| N/A | 3E Index | 1200 | n/a | n/a | n/a |
| Research Question 3: | | | | | |
| 14 | What percent of the department budget was cut? | 381 | 1 | 6 | 1.74 |

Notes: FPC survey questions 1 – 5, as well as the 3E Index developed under research question 1, are used as independent variables. This index is also used as an independent variable to answer research question 2 and 3 as are the individual service scores derived from survey questions 1 – 5.

**Institutional Review Board**

Participation in the FPC Survey was completely voluntary. Participants were asked to voluntarily help the Vision 20/20 organization in an introductory email (Appendix B) by participating in the survey. At the end of the survey, they were also asked to provide contact information for follow-up for the second of two survey parts. The FPC Survey is public work product from the author of this study, as well as the other members of the work group. Further, the sample used in this study is directed only at local government organizations. All the data used would be discoverable through FOIA requests at much greater expense. Use of the fire prevention cuts survey data in this study was approved by the Institutional Review Board. Appendix C provides a copy of the IRB Approval Form.

# CHAPTER IV

## HOW ARE 3E FIRE PREVENTION SERVICES PROVIDED ACROSS DIFFERENT COMMUNITIES?

In Chapter 1 and Chapter 3, I established that there is no single model for the provision of 3E fire prevention services across departments within the United States. Instead, the legal standards and adopted practices tend to vary across states and localities and it is only within the past seven years that a serious attempt has been made to define the organization and deployment of these services. The first standard was published in 2016 by the National Fire Protection Association and addresses the "strategic and policy issues involving organization and deployment. It does not, however, address specific methods for the delivery of services (National Fire Protection Association 2016). Unlike the available research on emergency operations, the relative dearth of guidance and standardization on 3E services has acted to hinder the empirical study of this critical topic. Thus, an important first step is to evaluate how various communities choose to organize and deploy their prevention resources.

**Ordinal index development**

Development of a classification of phenomena is the "most important and basic step" of scientific study (Carper and Snizek 1980, 65). Classification standardizes terms describing and analyzing observable fact into a common platform. The first question in this study, "*How are 3E fire prevention services provided across different communities?"* establishes a framework for discussion. No classification of fire prevention service provision is found within the existing literature. Thus, the creation of a service provision index may prove useful for future study of this topic. This indexing system is critical to the scope of my research. It serves as an important dependent variable in the second part of this first question, and is used as an independent / explanatory variable in the second and third questions of this study.

Delineating the characteristics of 3E services begins with development of an ordinal scale of provision of these services. Weisberg, Krosnick, and Bowen (1996), O'Sullivan, Rassel, and Taliaferro (2011) note that ordinal scales rank the values of a variable without defining the extent of difference between classifications. For example, low, medium, or high. Such scales simply evaluate whether one element has more or less of a particular characteristic than another element. Characteristics selected for evaluation must be sequenced and placed upon an ordered continuum. This study, however, develops and evaluates 3E fire prevention services to determine the impact of the Great Recession and to extend our understanding to the potential effects of future economic downturns on different approaches, not to evaluate which fire prevention schemes are better.

For the current study, I use the first five questions in the FPC Survey, which apply to the individual fire prevention services to calculate the 3E fire prevention provision index.

These questions asked which agencies provide the particular 3E service in or for the local government. As can be seen in Table 4.1, the first five questions provided a series of

**Table 4.1: FPC Survey Questions in 3E Index Development**

| Survey Question No. | Survey Question / Variable | Sample Resp. (n) | Sample Min. | Sample Max | Sample Std. Dev |
|---|---|---|---|---|---|
| 1 | Who provides plan review? | 1200 | 1 | 5 | 0.88 |
| | Local fire department | 815 | | | |
| | Local bldg. department | 258 | | | |
| | Other local department | 70 | | | |
| | Service not provided | 34 | | | |
| | Service is contracted out | 23 | | | |
| 2 | Who inspects new construction? | 1200 | 1 | 5 | 0.81 |
| | Local fire department | 864 | | | |
| | Local bldg. department | 225 | | | |
| | Other local department | 64 | | | |
| | Service not provided | 32 | | | |
| | Service is contracted out | 15 | | | |
| 3 | Who inspects existing buildings? | 1200 | 1 | 4 | 0.77 |
| | Local fire department | 966 | | | |
| | Local bldg. department | 113 | | | |
| | Other local department | 69 | | | |
| | Service not provided | 52 | | | |
| 4 | Who provides public education? | 1200 | 1 | 4 | 0.53 |
| | Local fire department | 1139 | | | |
| | Local bldg. department | 11 | | | |
| | Other local department | 23 | | | |
| | Service not provided | 27 | | | |
| 5 | Who provides fire/arson investigation? | 1200 | 1 | 4 | 1.18 |
| | Local fire department | 889 | | | |
| | Local bldg. department | 11 | | | |
| | Other local department | 98 | | | |
| | Service is contracted out | 202 | | | |

Note: Responses by agency providing the service is from the study sample after listwise deleting non-responses and options to answer "Other – please specify" and "Not applicable".

options regarding who provided the particular 3E service.[3] I recoded each option from a nominal value to an ordinal value to permit quantitative results in the analysis (Johnson and Reynolds 2012).

Table 4.2 depicts how I recoded and ranked the provision of each particular 3E service on a scale between 1 and 4. Higher scores are indicative of greater fire department control over fire prevention budget decisions. If the local fire department provided the service, it was recoded as 4. If another local department provides the service, it was recoded as 3. Services contracted out, including those provided by another level of government were recoded as 2, and services not provided were recoded as 1. This provided me with a 3E score for each fire prevention service.

The next step in development of the classification index was simply to combine and calculate the mean value across these different services to create an aggregate or summary service score (3E Index) for each observation. For example, respondent number 11 revealed that their community did not provide plan review, new construction inspections, or existing building inspections. The local fire department provides public education and an outside entity provides fire-arson investigation. Thus, their 3E Index is 1.80 ((1+1+1+4+2)/5 = 1.80). Respondent number 46, on the other hand, indicated that another local government department provides plan review and new construction inspection, while the local fire department provides existing building inspections, public education, and fire-arson investigation. Their 3E Index is 3.60 ((3+3+4+4+4)/5 = 3.60).

[3] Respondents who selected "Other – please specify" or "Not applicable" were listwise deleted from the study sample.

**Table 4.2: Calculation of the Ordinal Index of 3E Service Providers**

| FPC Survey Question | Response Set | Valuation |
|---|---|---|
| 1) Who provides plan review? | Local Fire Department | 4 |
| | Local Building Department | 3 |
| | Other Local Department | 3 |
| | Contracted Out | 2 |
| | Not Provided | 1 |
| 2) Who provides new construction inspections? | Local Fire Department | 4 |
| | Local Building Department | 3 |
| | Other Local Department | 3 |
| | Contracted Out | 2 |
| | Not Provided | 1 |
| 3) Who provides existing building inspections? | Local Fire Department | 4 |
| | Local Building Department | 3 |
| | Other Local Department | 3 |
| | Not Provided | 1 |
| 4) Who provides public education services? | Local Fire Department | 4 |
| | Local Building Department | 3 |
| | Other Local Department | 3 |
| | Not Provided | 1 |
| 5) Who provides fire/arson investigation? | Local Fire Department | 4 |
| | Local Building Department | 3 |
| | Other Local Department | 3 |
| | Other St. Fed. Private | 2 |

Note: The first five questions of the FPC Survey ask who provides the particular 3E fire prevention service. n = 1200. Numeric values were assigned by the author to develop the ordinal index. The basis of the ordinal index is the location of budgetary control relative to the fire department. It does not presume that delivery of a 3E service by other departments or organizations is inherently better than any other.

Indexing the 3E services is critical to this overall study of 3E provision in the midst of the Great Recession cutbacks with implications for future cutback environments. First, the 3E Index and individual 3E services comprise the dependent variables for this first research

question. I evaluate the effect of the independent demographic variables of community size, department size, and department type. Second, the 3E Index provides an important independent variable in the second and third research questions. On a wider scope, understanding which variables affect the index score potentially helps researchers and practitioners better understand the policy implications of fire prevention service delivery.

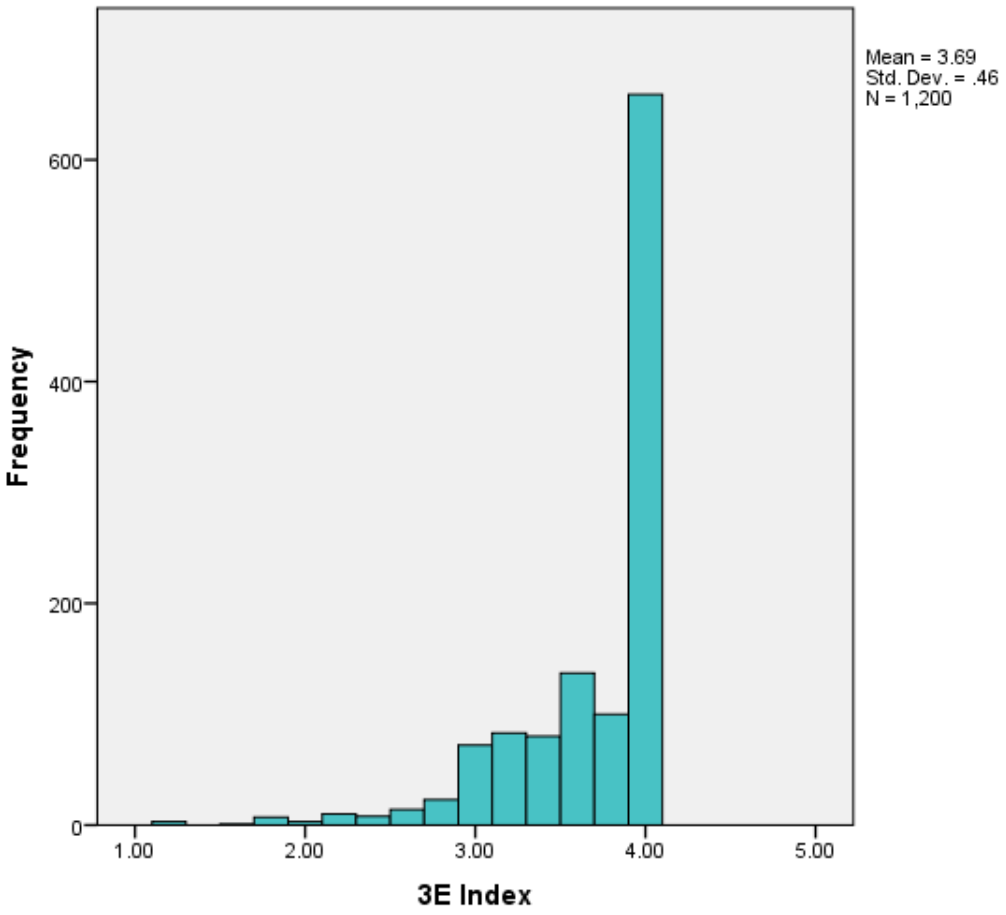
The 3E Index provides an important interval variable for measuring the level and distribution of fire prevention services in various communities. Lower 3E Index scores imply fewer services are provided and are spread out over greater number of service providers. As the scores move up the scale, the 3E Index indicates more services are provided with greater levels of consolidation within the fire department. Lower 3E index scores may be indicative of increased vulnerability to budget cuts. Following from Rubin (2010), outside departments may not place the same budgetary priority on fire prevention as the fire department. For example, many building departments operate as self-supporting enterprise funds. 3E services that do not generate revenue (e.g., public education) are at a much higher risk of being cut during economic downturns.

Alternatively, fewer services may decrease vulnerability since cuts could be seen as not generating sufficient savings. Furthermore, embedding some services into emergency response force responsibilities (e.g., existing building inspections) makes it difficult to breakout funding specific to fire prevention. Departments with higher scores likely have greater opportunity to engage in smoothing strategies during times of cutback management, such as transfer of 3E service responsibility.

The distribution of 3E Index scores is found in Figure 4.1, which displays unit of observation level data. Remember that the scale range for the dependent variable is: 1,

service is not provided; 2, service is contracted out; 3, service is provided by other local government departments; and 4, service is provided by the local fire department. This appears on the vertical axis, while the independent variables appear on the horizontal axis.

**Figure 4.1: Distribution of 3E Index Across Provider Orientations**




Note: Results are from a convenience sample of local government respondents answering all five 3E service questions. It displays unit of observation level data. An index score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by another local department, and 4 = service is provided by the local fire department. n = 1200.

Index scores range from a minimum of 1.20 to a maximum of 4.00, with a mean of 3.69 and standard deviation of 0.46 and are oriented on the X-axis. Frequency is found on the Y-axis. Inspection of Figure 4.1 reveals that over half of the communities surveyed

receive all five 3E services and there is a high degree of consolidation under the local fire department. However, an important caveat should be considered when interpreting Figure 4.1. The study sample is derived from a convenience survey of fire prevention practitioners, so it lacks any external validity. Results cannot be considered representative of an unknown population. Nonetheless, the information contained here provides a useful perspective of fire prevention provision. The number of fire departments providing all five 3E services may seem a bit inflated due to a career fire department bias and underrepresentation of all-volunteer fire departments in the survey audience. Despite the bias, it is likely true that a plurality of fire departments with career personnel provides the bulk of 3E services in those communities. Further, these department types are more likely found in larger communities. The lower end of the scale in Figure 4.1 is probably more reflective of the truth in many smaller communities that lack the resource base to provide more than essential services.

Moreover, the 3E Index appears to work as intended. It differentiates between levels of service as defined by budgetary locus, particularly when applied to a single fire prevention service, so I can assert a level of face validity. Considering also that the FPC survey was developed and reviewed by experienced practitioners as appropriate for identifying which 3E services are provided and how they might be provided, I will also assume a level of content validity in the index (Carmines and Zeller 1979). When combined into a summary 3E Index, it exposes some meaningful data on how different communities approach fire prevention. For example, those communities with index scores below 2.00 do not provide one or more of the 3E services and those with scores between 2.00 and 3.00 likely do not receive one or more of the 3E services or the local government has chosen to forego direct control over service delivery to an outside entity. Finally, while it is not intended to be a measure service

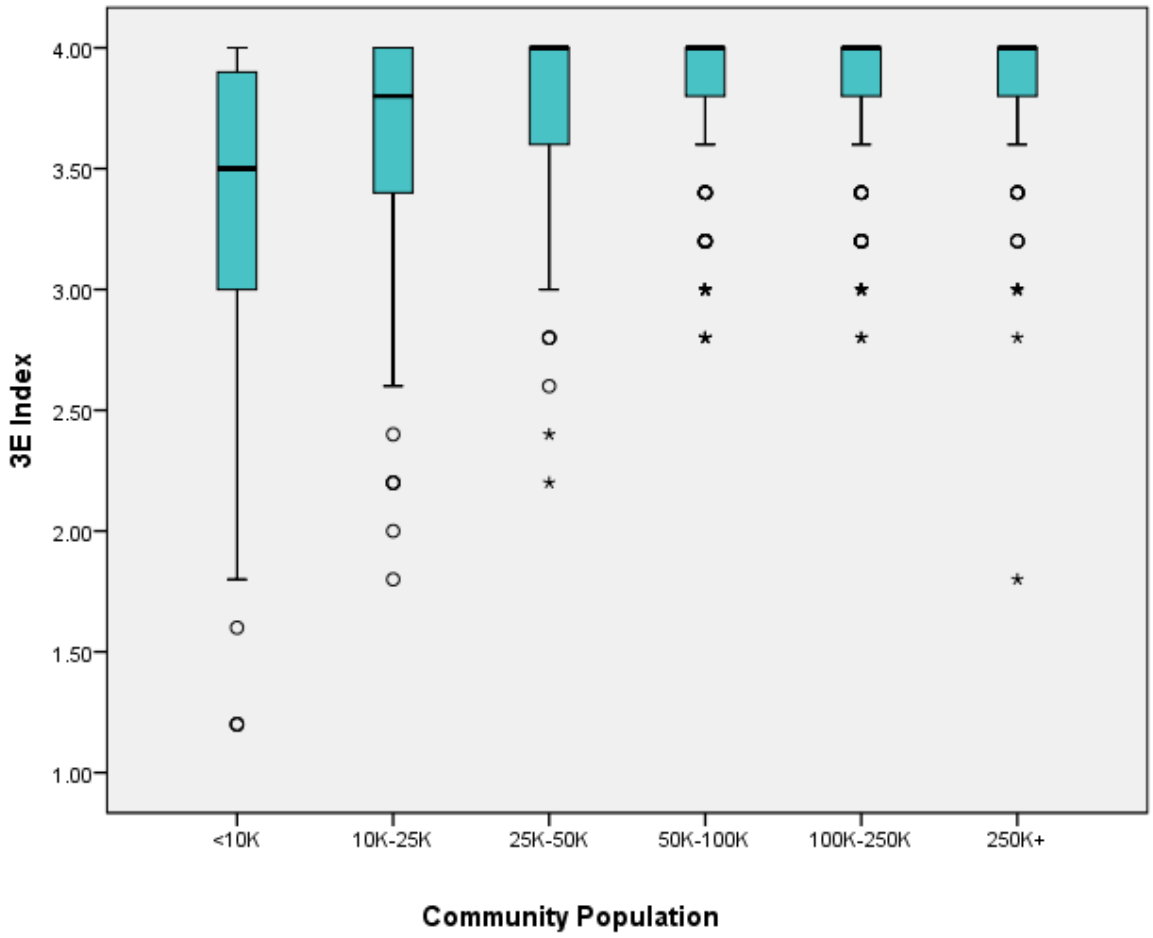
quality, following from Rubin (2010), the 3E Index may provide some insight into differing levels of service quality.

**The 3E Index – Contextual Relationships**

Having developed a means of comparing 3E services across communities, I examine how the 3E Index is influenced by the independent variables of community size, department size, and department type. Hartwig and Dearing (1979) state that particular attention should be paid to resistant statistics in exploratory research, such as median and midspread, lowspread, and highspread ranges. These values minimize the effect of any unforeseen outliers on measures of central tendency. Box plots provide distribution information in visual form, including median, quartiles, spread, and location of outliers (Moore, McCabe, and Craig 2012). They are preferred for the presentation of data that does not assume a normal distribution (Hartwig and Dearing 1979) which is clearly illustrated in Figure 4.1. I use simple box and whisker charts to provide visual comparison of 3E Index provision across each of the independent variables.

Further support the effect community population has on service provision differences is found in Figure 4.2. The greatest distribution of 3E Index values falls in the less than ten-thousand population category. Fifty percent of the study sample in this population group lies between the index values of 3.00 and 3.80, with a median value of 3.50. Whiskers extend from a low value of 1.80 to the maximum 4.00 value. The distribution also shows two outliers at values of 1.20 and 1.60. The next category of communities, 10-25 thousand population finds that the interquartile index values fall between 3.40 and 4.00, with a median value of 3.70. There is no upper whisker and the lower whisker extends to an index value of 2.60. There are four outlier values of 1.80, 2.00, 2.20, and 2.40.

**Figure 4.2: 3E Index by Community Population Served**




Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. n = 1200. Confidence interval = 95%.

This trend of increasing 3E Index values continues through the next four categories of larger population groups. In each case, the median lies at the index value of 4.00, so there are no third or fourth quartiles shown. For the 25-50 thousand population category, the lower whisker extends to the 3.00 value, with outliers at 2.80 and 2.60, and extreme values at 2.40 and 2.20. As with the previous two groups discussed, this demonstrates that fewer 3E

services are provided and the local fire department is less involved in fire prevention. However, there are relatively few of these cases. In the three largest population groups, the lower boundary of the interquartile range falls at the index value of 3.80 and the bottom quartile index value falls at 3.60. In each category, there are outliers at 3.40 and 3.20 values, and extreme values at 3.00 and 2.80. For the largest population group, those above 250 thousand population there is an additional extreme value at 1.80.

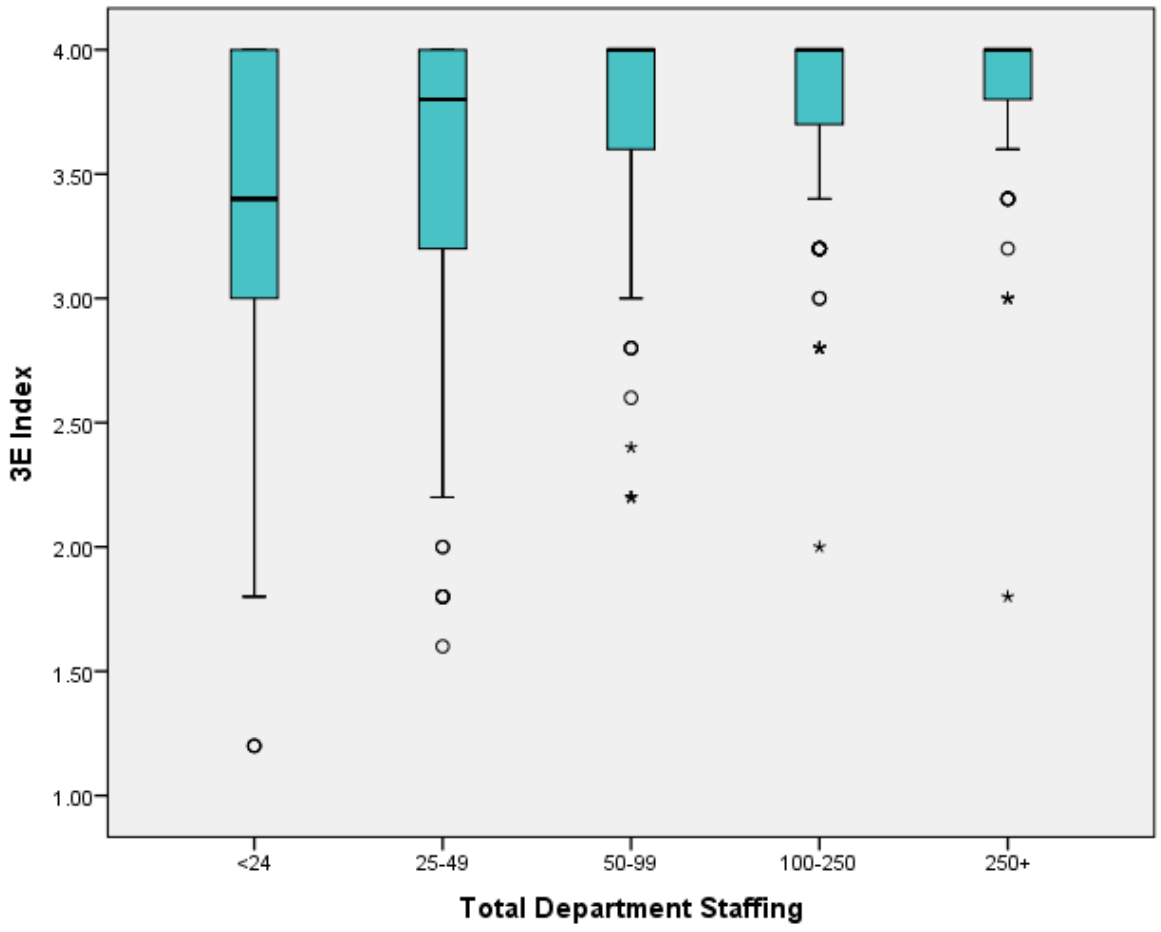
Communities below the median value, in the second quartile, likely receive all five 3E services and the local fire department provides at least two and the others are provided either by another local government entity or contracted out. It is only in the bottom quartile that 3E service provision drops off and the local fire department is less involved in 3E service provision. In rather few cases, shown by the outliers and extreme values, one or more 3E services are not provided. Remaining services are provided by some agency of local government or contracted out, as shown by the previously cited respondent number 11 with an index score of 1.80.

Taken together, Figure 4.2 clearly shows that as populations get larger, the predominant 3E Index score increases as well. Furthermore, there is an obvious transition point at 50,000 population. Below this point, there is greater variation in 3E provision. Above this population level, 3E delivery schemes are remarkably similar. This lends support to the hypothesis that community size affects the provision of 3E services.

The 3E Index broadly describes how fire prevention services are arranged by a local government. Any arrangement except *Service is Not Provided* consumes resources (Mohr, Deller, and Halstead 2010), so I expect that total department staffing influences service

provision. Figure 4.3 provides box plots of the 3E Index values for the five categories of total department staffing.

**Figure 4.3: 3E Index by Total Fire Department Staffing**




Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. n = 1200. Confidence interval = 95%.

Three observations are immediately clear in Figure 4.3. First, across all five categories, the interquartile range decreases with an increase in department size demonstrating less variation in how 3E services are provided. Second, the positioning of the median value increases with an increase in department size indicating greater consolidation

of services and increasing involvement of the local fire department. Third, the plot whisker length decreases noticeably as department size increases, as do the values of outliers and extreme observations. This points to fewer communities not providing all five 3E services as department size increases. These observations reinforce the previous contention that department size influences fire prevention service provision.

Similar to the population categories, the largest distribution lies in the box plot for the smallest staffing category, those with 24 or fewer employees or members, indicating the greatest variation in service provision. The least variation in service provision shows up in the largest department size category. Median values of 4.00 for the largest three department sizes show at least half of the survey sample in these groups receive all five 3E services from the local fire department. In addition, the second quartile range and bottom quartile range decrease in size. Corresponding with less variation in how services are provided, the plots suggest another transition point. Once departments reach the 50-99 personnel size, 3E service provision transitions mostly to the local fire department. This is probably the point at which fire departments are sufficiently sized to assume more 3E responsibilities, while other local government entities begin to drop out of the sample pool.

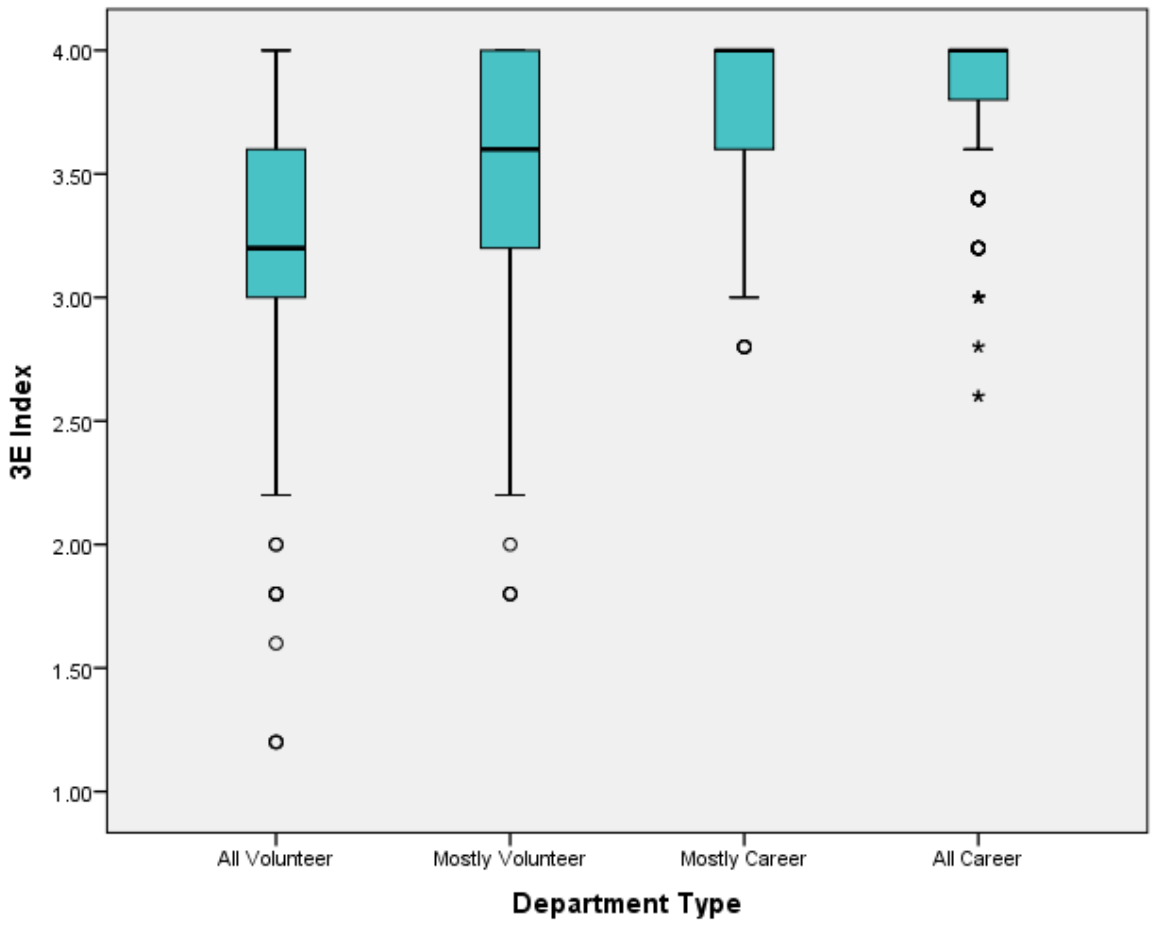
Plot whiskers, outliers, and extreme observations extend to small 3E Index values across all five department sizes. While not predominant, scale values below 3.00 indicate a mix of local government provision, contracted services, and services not provided. While it is possible that communities with a 3E Index value of 2.00 receive all five 3E services, they would all be contracted out. This is highly unlikely. The more likely scenario is that local government does not provide one or more of these services and this occurs across all department sizes. For example, it is not unusual for the state fire marshal/state police to have

responsibility for investigation of suspicious fires, while insurance companies investigate fires for loss claims.

Consistent with the other independent variables, I expect the 3E Index reveals additional understanding of how fire prevention services are delivered across the four department types of concern. Figure 4.4 reveals important information about service delivery. First, and probably most important, is that some limited number of volunteer departments provide the full suite of 3E services. While the interquartile range extends from 3.00 to 3.60, the upper range extends to the 4.00 value. This implies that some all-volunteer departments provide service outside of their traditional focus on emergency response. More importantly, the all-volunteer box plot shows that 75% of communities protected by all volunteer departments still receive most, if not all of the 3E fire prevention services, just not through the local fire department. The lower range for all volunteer departments extends to 2.20 and also shows four outliers with values between 1.20 and 2.00. For mostly-volunteer departments, the median value is 3.60.

For mostly-volunteer, mostly-career and all-career departments the interquartile range extends to the 4.00 value. Further, the range of the interquartile boxes decreases, as does the range of the lower whiskers, with values at 2.20, 2.80, and 3.60, respectively. Figure 4.4 displays outliers for each of these three department types. This is expected given the ranges shown in community size and department size. What is not expected is that the box plot for all-career departments shows three extreme values at 2.60, 2.80, and 3.00. I interpret this to mean that the fire departments displaying these values are minimally involved in providing 3E services. I expect this has a great deal to do with department size as indicated in Figure 4.3.

**Figure 4.4: 3E Index by Fire Department Type**




Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. n = 1200. Confidence interval = 95%.

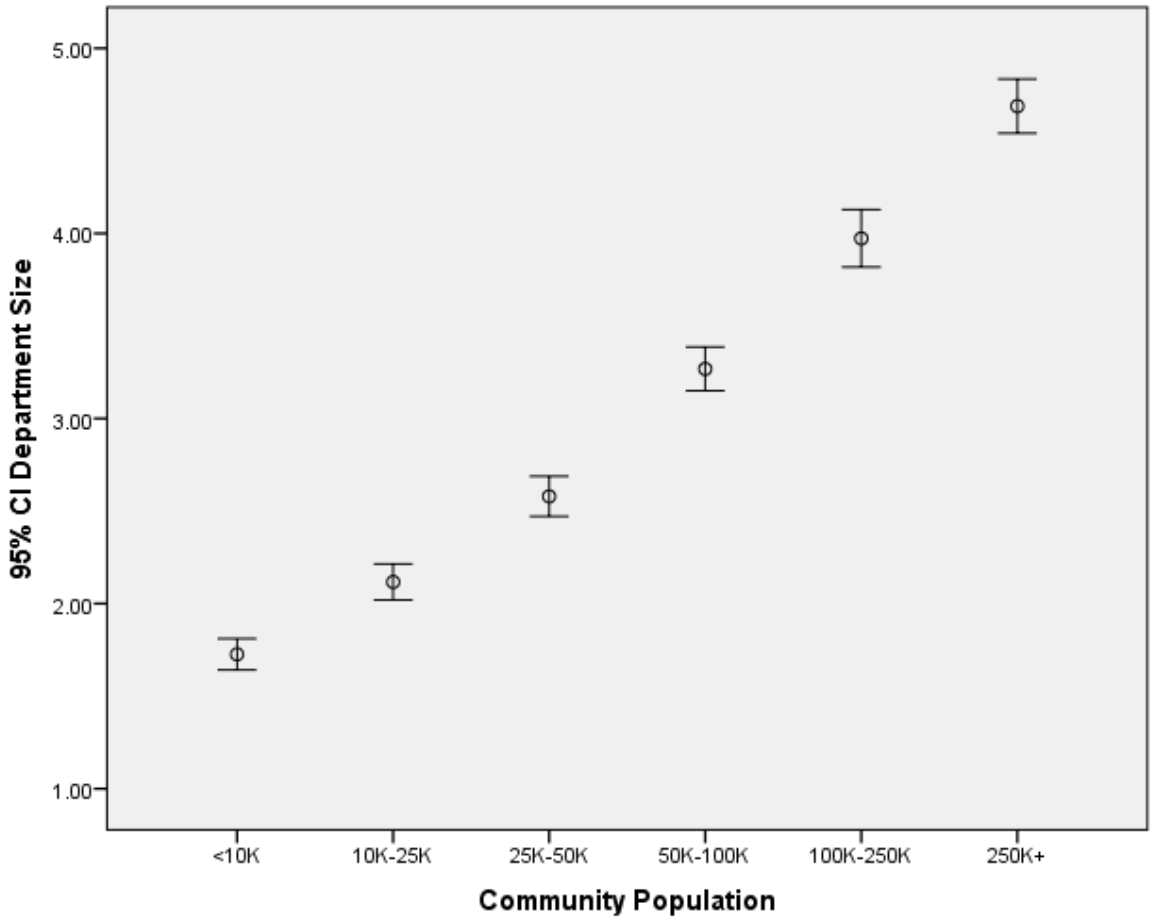
However, there are two distinct observations drawn from Figure 4.4 that demonstrate department type influences the 3E index of communities. First, it is clear there is less variation in the provision of services as fire departments change from all-volunteer to all-career. Interquartile boxes shrink by roughly half between mostly-volunteer and mostly-career revealing less variation in service distribution. The decrease in variation repeats between mostly-career and all-career. Second, the median value for each department type

increases through all-volunteer, mostly-volunteer, and mostly-career. Most importantly, Figure 4.4 reveals a third transition point between mostly-volunteer and mostly-career. Once the surveyed departments become mostly-career, at least half of the survey sample in mostly-career and all-career protected communities received all five 3E services through their local fire department. The lower median values for all-volunteer and mostly-volunteer indicate a larger blend of service provision approaches.

In a nutshell, there are three transition points affecting the provision of 3E services. In population size, when communities reach 50,000 persons, they are more likely to receive all five services through the local fire department. For department size, transition seems to occur at 50 employees. Fire departments at or above this size are more likely to provide all five 3E services. Finally, the provision of 3E services transitions to between mostly-volunteer and mostly-career fire department types. These transitions imply that in all probability, communities above 50,000 population protected by a mostly-career or all-career fire department of at least 50 employees receive the full range of 3E fire prevention services. Smaller communities, protected by smaller all- or mostly-volunteer departments more than likely do not provide one or more of the 3E services.

These transition points probably represent a combination of external and internal resource availability, as well as service demand. One thing to point out is the inescapable correlation between population size and department size, as seen in Figure 4.5. This speaks to the resources a community invests in the local fire department as a reaction to population growth. It appears that the slope becomes steeper above the 50,000-population and department size more than likely crosses the 50-employee threshold.

**Figure 4.5: Community Population Compared to Department Staffing**

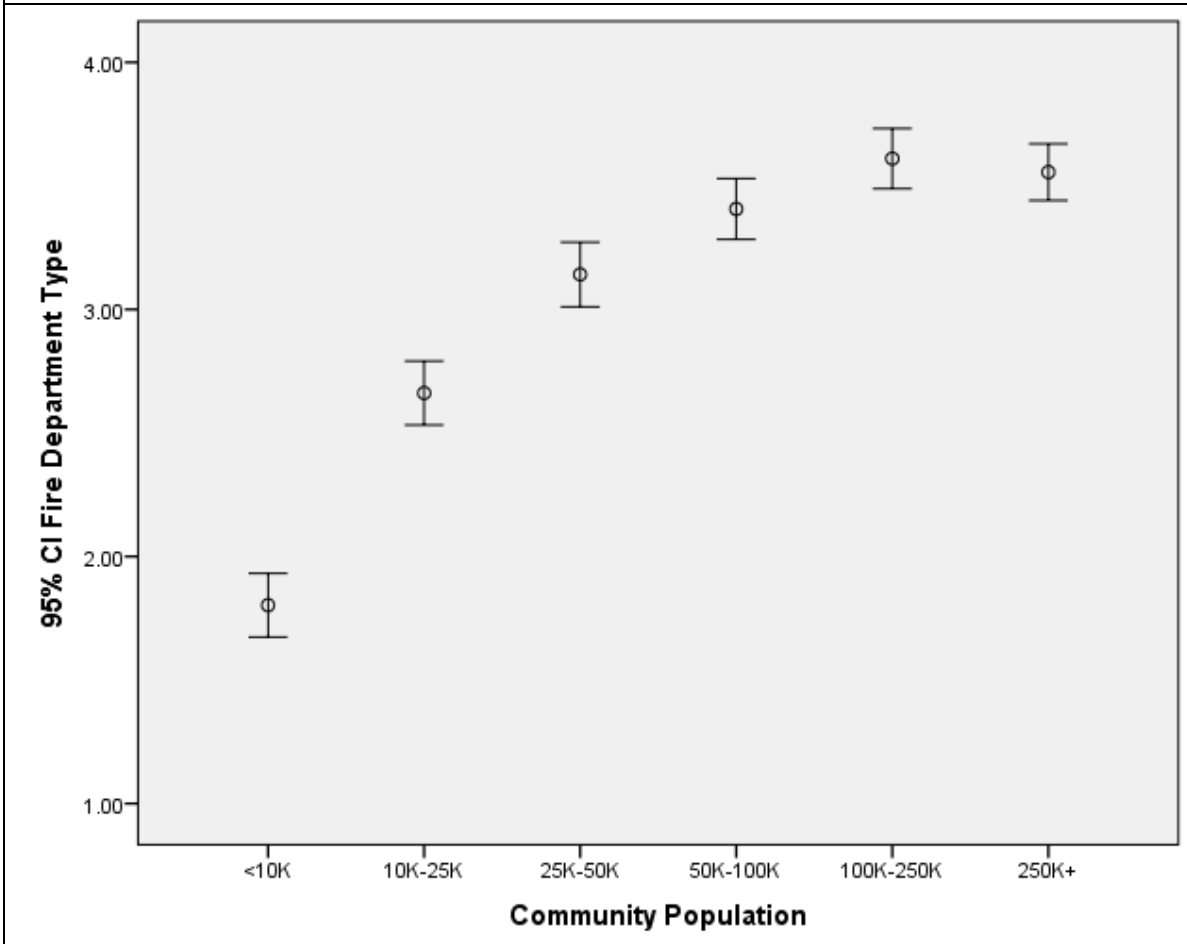



Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. Department Staffing: 1 = <24 personnel, 2 = 25-49 personnel, 3 = 50-99 personnel, 4 = 100-250 personnel, 5 = 250+ personnel. n = 1200. Confidence interval = 95%.

There is one more item to consider regarding the transition points that appear in Figures 4.2 through 4.4. That is department type and how it may affect these transitions. Figure 4.6 demonstrates that when community populations reach 25,000-50,000 persons, the fire department transition from mostly-volunteer to mostly-career. It appears that all three factors, community size, department size, and department type converge to influence how the five 3E services are provided and support the first and second hypotheses. Above this point, 3E service delivery is increasing uniform with greater consolidation under the local fire

department. Below this point, 3E service provision is increasingly varied and incomplete. Further, the confidence intervals shown by the spread on each side of the point estimates for the means are quite close, indicating there is not much variation in the data. This may be the point where communities start examining alternative means of addressing fire department service demand beyond response and bringing all the 3E services under one management umbrella.

**Figure 4.6: Community Population Compared to Department Type**




Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. Fire department type: 1 = all-volunteer, 2 = mostly-volunteer, 3 = mostly-career, 4 = all-career. n = 1200. Confidence interval = 95%.

**The 3E Index – Refining the Provision Narrative**

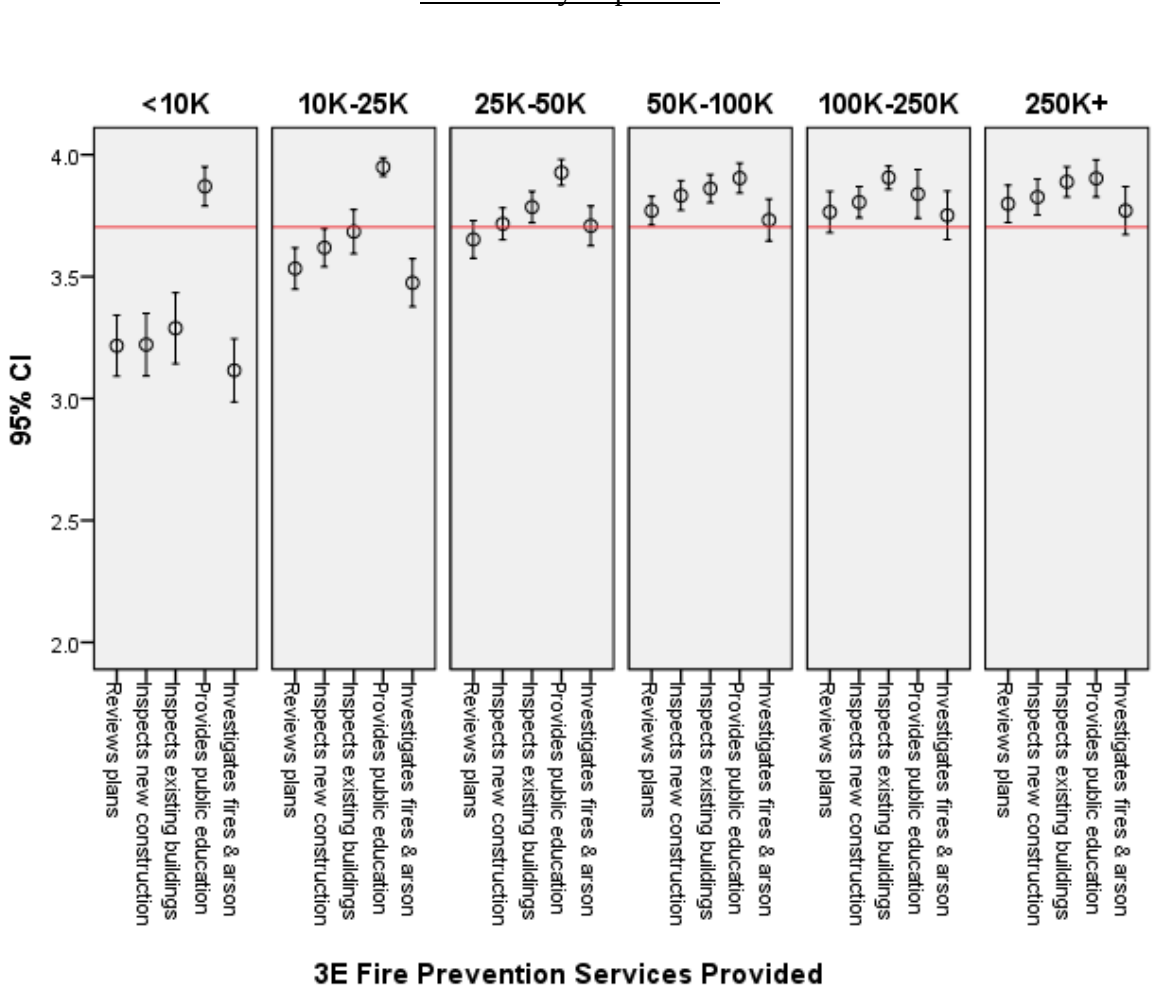
Having examined the more programmatic level relationship between the 3E Index and the independent variables, I start my analysis by exploring how the individual 3E services are provided in comparison to the various community sizes, department sizes, and department type. Results are presented at the organization level. As previously noted, visual presentation of data is appropriate and often reveals patterns not easily discernable through tabular presentation. Looking at community size, Figure 4.7 immediately shows that the public education service mean[4] is well above the combined mean of 3E services across all population groups[5]. The combined mean is shown as a red line across each of the population size panels and means below this line indicate many of the 3E services are provided by other local government departments, contracted out, or not provided. For public education, this suggests that primary responsibility lies with the local fire department regardless of community size. Moreover, the confidence intervals indicate no statistically significant difference across the spectrum of population sizes. For public education, community population appears to have no influence in service provision.

Another public education observation worth noting is the drop in the mean for the 100-250 thousand population group before rising again in the 250+ population group. Figure 4.2 also shows that for the 100-250 thousand population group, the confidence interval spread increased before narrowing again in the 250+ population group. The combined dip in mean and larger confidence interval possibly signals that some fire departments may have

[4] The service mean is the average 3E score for all respondents to a particular 3E service within a single category of one of the independent variables of community size, department size, or department type.
[5] The combined mean is the average of all 3E service scores for each individual service provided and is calculated at the level of the independent variable. Inspection of observation level data confirms that this is the approximate point at which 3E service provision transitions from being provided by other agencies (including contracted out) or not at all, to being provided largely by the local fire department.

made the choice to focus on the other 3E services. These departments may provide only limited 3E services. For example, their focus may be on existing building inspections rather than public education. This focus may occur in communities with high multi-family or public housing rates.

**Figure 4.7: 3E Fire Prevention Services Provided by Community Population Served**




Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. n = 1200. Confidence interval = 95%. The red line indicates the combined mean (3.70) of all services provided across the population categories.

Beyond public education, Table 4.7 shows a clear upward trend of the individual 3E service means towards fire departments providing more of each 3E service as the population size increases. This is particularly evident with populations under ten thousand where the individual service means fall well below the combined mean (3.70) of all 3E services provided.

The provision of 3E services by other local government entities also shows up for the 10-25 thousand populations, though the individual service means fall much closer to the combined 3E service mean in this group. In the 25-50 thousand population group, the individual service means are clustered around the overall 3E service mean. This suggests that in communities of this size responsibility for 3E services begins to transition from other local entities to local fire departments. More globally with this transition, Figure 4.7 shows that existing building inspections are provided first, followed by new construction inspections, and plan review. This tells me there is some give and take over who in local government will provide these services. Above 50 thousand population, it appears that local fire departments assume greater responsibility for providing 3E services.

Figure 4.7 also shows that the 95% CI narrows for most, though not all of the individual 3E services as the population group increases. The narrowing of the CI signifies that the margin of error is smaller and therefore, the plausible range for the mean is much smaller. Data variability improves as population group size increases, as well as certainty of service provision (Cumming and Finch 2005, Krzywinski and Altman 2013). Furthermore, an examination of confidence intervals for particular 3E services in Figure 4.7 reveals a particularly noticeable statistically significant difference ($p>.05$) (Payton, Miller, and Raun 2000) between communities of less than ten thousand population and those of 10-25

thousand population. This difference is difficult to discern between other adjacent population groups.

Nevertheless, taken as a whole, there is an obvious statistically significant difference as population increases. Accordingly, I conclude that community size has a demonstrable effect on the provision of 3E services. The larger the population group, the more concentrated the service provision, be it with other local government departments or the local fire department.

**Table 4.3: Mean 3E Index Scores by Community Size**

| | Population Protected | | | | | | |
|---|---|---|---|---|---|---|---|
| | <10K | 10–25K | 25–50K | 50–100K | 100–250K | 250K+ | Service Mean |
| Plan Review | 3.22 | 3.53 | 3.65 | 3.77 | 3.77 | 3.80 | 3.62 |
| New Construction Inspections | 3.22 | 3.62 | 3.72 | 3.83 | 3.81 | 3.83 | 3.67 |
| Existing Building Inspections | 3.29 | 3.68 | 3.79 | 3.86 | 3.91 | 3.89 | 3.74 |
| Public Education | 3.87 | 3.95 | 3.93 | 3.90 | 3.84 | 3.90 | 3.90 |
| Fire-Arson Investigation. | 3.12 | 3.47 | 3.71 | 3.73 | 3.75 | 3.77 | 3.59 |
| Combined Mean | 3.34 | 3.65 | 3.76 | 3.82 | 3.82 | 3.84 | |
| Observations | 208 | 257 | 233 | 209 | 149 | 144 | |

Note: Mean 3E service scores calculated from convenience sample of survey respondents answering all five 3E service questions. 3E Index score is based on rank of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by another local department, and 4 = service is provided by the local fire department. n = 1200.

In regards to the effect of community size on individual 3E service provision, Table 4.3 demonstrates the transition in service provision across the different categories of population. Plan review, new construction inspection, and fire-arson investigation show a propensity to be delivered by other local government departments or contracted out, particularly in communities of less than 50-thousand population. Existing building

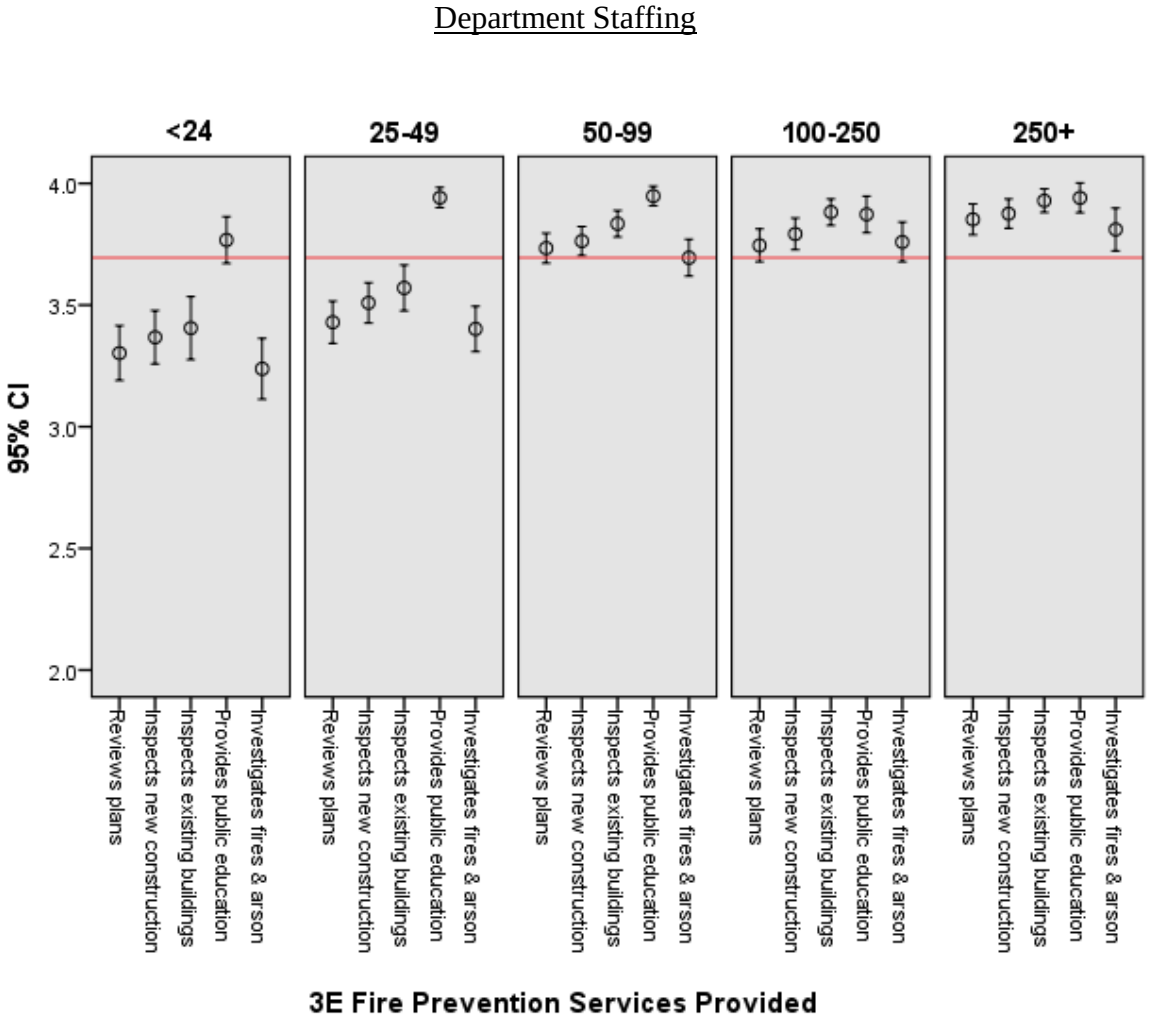
inspections are more likely the responsibility of local fire departments beginning at 25 to 50-thousand population. Fire-arson investigation shows a clear influence of being delivered by other local departments for all categories of population, though the local fire department greater responsibility in the population groups above 50-thousand population. Finally, population does not appear to affect the delivery of public education. It seems to be considered a universal service regardless of population, but the extent of these programs certainly going to vary by population.

Turning next to department size, Figure 4.8 provides visual representation of the service distribution across the five size categories which are seen on the X-axis. The first thing that is readily apparent is that the distribution of 3E service provision is decidedly similar to that of population size. This makes sense since population has been shown to be a service demand driver and effects department size (see Figure 4.5). The same trend for public education is seen in department size as in population size. Public education, if it is provided, seems to be the responsibility of the local fire department across all department sizes, though there is greater variability and uncertainty for departments below 24 personnel. Payton, Miller, and Raun (2000) caution against drawing conclusions about significant differences between groups when the range of the confidence intervals between groups fall so close. Consequently, I find that department size also has minimal influence on whether or not public education is provided by the local fire department.

The same dip in the public education service mean appears in departments in the 100-250 personnel category, as does a widening confidence interval. In departments with 25-49 personnel and 50-99 personnel, the confidence interval for public education is quite tight around the mean, unlike the other three categories. I suspect that departments of these two

sizes routinely invest more resources into public education and limit resources targeted towards the other 3E services.

**Figure 4.8: 3E Fire Prevention Services Provided by Total Department Staffing**




Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. n = 1200. Confidence interval = 95%. The red line indicates the combined mean (3.69) of all services provided across the categories of department size.

There is a clear upward trend in the number of 3E services provided and consolidated under the local fire department. In the two categories for departments with fewer than 49 personnel, individual 3E service means fall below the combined service mean (3.69) and the

confidence intervals are also much wider than for larger departments. This suggests more variability in who provides the particular 3E service, that the majority of services are provided by other entities in the community or, in some cases, not provided.

The transition to greater consolidation of services under local fire department staffing appears to be between departments of fewer than 49 personnel and 50 or more personnel. The same narrowing trend in the 95% CI is apparent with increasing department size indicating that the degree of data variability and certainty of provision improves with department size. Confidence intervals also point to an obvious statistically significant difference in service provision between departments with fewer than 49 personnel and those with 50 or more personnel. For the two categories below this point, the difference lies within the confidence intervals. For the three categories above this point, the difference lies within the confidence intervals. Above and below this transition point, there do not appear to be any statistically significant differences related to departments size. Because there is that distinct transition, I conclude that department size undoubtedly influences the 3E services provided.

However, as an overall observation, Figure 4.3 seems to point to local fire departments beginning to assume more responsibility for 3E services outside of public education once they reach a threshold size of 50-99 personnel. I suspect at this threshold, fire departments reach the critical mass of personnel resources needed to provide fire prevention specialization, while other local government entities drop out of the sample pool. I should also note that similar to population, as departments increase in size, they add existing building inspections first, followed by new construction inspections, then plan review. I believe this demonstrates that local fire departments are prioritizing occupied structures over those still in the construction pipeline. First, occupied buildings present a greater risk than

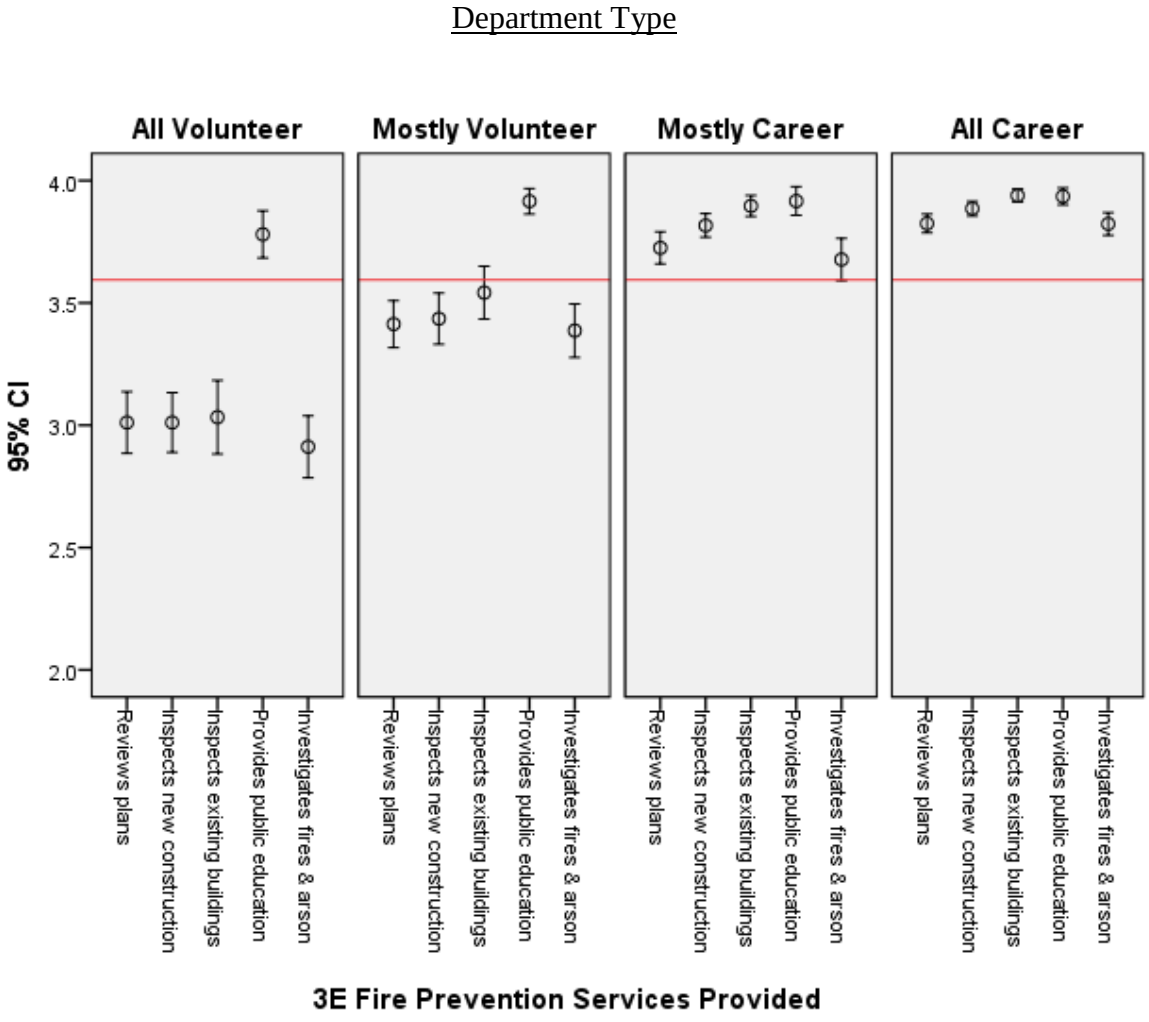
unoccupied buildings. Second, the fire department is the local agency with responsibility for ensuring safety after the certificate occupancy is issued.

In my final examination of individual 3E service provision, I look at the independent variable of fire department type. Figure 4.9 shows the four fire department types that I compare against the service provision score on the vertical axis. The figure clearly shows that in communities protected by all-volunteer fire departments and mostly-volunteer fire departments, 3E services are provided by entities other than the local fire department with the exception of public education. The individual service means for the other 3E services in all-volunteer fire departments fall around the 3.00 value, which corresponds to service being provided by other local government departments. Fire and arson investigation shows a little lower mean, most-likely indicating the entry of some state level actors. This would not be unusual in more rural areas where the state fire marshal or state police have investigative responsibility. Figure 4.9 also shows that the confidence interval for all-volunteer departments is much wider than any of the other department types signifying more data variability and uncertainty of service provision.

In mostly-volunteer fire departments, the individual service means fall around the 3.40-3.50 range and confidence intervals are narrower. Positioning of the error bars also show a statistically significant difference in the confidence intervals between services provided by all-volunteer departments and mostly-volunteer departments. This suggests that mostly-volunteer fire departments are picking up some responsibility for 3E service. More than likely this is a result of adding paid staff, who can attend to limited fire prevention duties during times when not responding to or preparing for emergency incidents. In

essence, paid staff provide resource slack time that can be utilized for other non-emergent fire prevention activities.

**Figure 4.9: 3E Fire Prevention Services Provided by Fire Department Type**




Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. n = 1200. Confidence interval = 95%. The red line indicates the combined mean (3.59) of all services provided across the types of fire departments.

Service provision for the other 3E services follow the same general trend seen in the independent variables of population size and department size. Figure 4.9 shows that as departments move from all-volunteer towards all-career, 3E services are increasingly

consolidated under the local fire department. This trend is evident in the location of individual service means and the decreasing range of confidence interval error bars. Figure 4.9 indicates a second statistically significant break in the confidence intervals between mostly-volunteer and mostly-career departments. This break is not seen between mostly-career and all-career fire departments. This follows the argument from the preceding section on department size. There appears to be a critical mass of career personnel that lends itself to fire departments picking up majority responsibility for 3E services. There is less data variation concerning who provides a particular 3E service as fire departments reorient towards all-career, as well as whether the service is provided, be it the local fire department or other local government agency.

As with the other independent variables, department type appears to have little effect on the provision of public education. There is no evidence of a statistically significant difference across the four groups. There are several possible reasons for this. First, there is little regulation of public education services, though the NFPA publishes guidance on requirements (National Fire Protection Association 2015). Second, public education is ill-defined compared to the other 3E services and includes a spectrum of activities ranging from informal community events to systematic, structured curricula. Third, the NFPA, FEMA, and several insurance companies (*see* www.travelers.com) provide free public education materials that minimize resource investment.

**Implications for Dedicated Fire Prevention Units and Staffing**

Finally, in examining how fire prevention services are provided by various communities, I look at whether there is a dedicated fire prevention work unit (often referred to as the Office of the Fire Marshal or similar) and their levels of staffing. Young (2012)

observes that the larger a department and service demand, the greater need for service specialization. The extant literature establishes a positive correlation between population size and department size, which Figure 4.5 bears out in this study. Part of this is attributable to increased emergency service demand. However, population size also increases non-emergent service demand as well whether it is delivered by the fire department or other provider. Growing, increasingly diverse population bases within limited land areas dictate multifamily, commercial, and industrial structures of increasing size and complexity, along with increasingly complex social interactions (Adams et al. 2007). Meeting the associated demands placed on local governments requires unique specialized skill sets, rather than generalist skill sets. Thus, I expect that dedicated fire prevention units will show up in larger communities and departments.

Since I am predicting the likelihood of a dedicated fire prevention unit, logistic regression is an appropriate method of testing the relationship against other categorical variables (Pampel 2000, Johnson and Reynolds 2012). My dependent variable is based on FPC survey question 10, which asks if there is a dedicated fire prevention unit and allows for only two answers, yes or no. I ran a single predictive logistic regression model which is found in Table 4.4. The model regressed the control variables of community population, total staffing, and department type on the dependent variable of a dedicated fire prevention unit. These control variables were identified by the FPC survey working group, discussed in Chapter 3, as conditions most likely affecting 3E service delivery.

As Table 4.4 reveals, the full model, with all predictors included was statistically significant $\chi^2 = 319.68$ ($p<.001$, df = 3, n = 1200), indicating that the model is a reasonable fit and differentiates between departments that have versus those that do not have a dedicated

fire prevention unit. The whole model predicts roughly 33% (Nagelkerke R square) of the variance in the presence of a dedicated fire prevention unit. Further, the model correctly classified 77.2% of the cases with a sensitivity of 88.8%. Overall, the model has a positive predictive (true positives) value of 80.5% (Pallant 2016).

**Table 4.4: Logistic Regression of the Presence of a Dedicated Fire Prevention Unit**

| Control Variable | β | S.E. | p |
|---|---|---|---|
| Community Population | .43 | .07 | .00 |
| Total Staffing | .35 | .09 | .00 |
| Department Type | .43 | .07 | .00 |
| Constant | -2.48 | .23 | .00 |
| Observations | | 1200 | |
| -2 Log Likelihood | | 1153.15 | |
| Chi-square | | 319.64 | |
| Degrees of Freedom | | 3 | |
| *P*-value | | .005 | |
| Nagelkerke $R^2$ | | .33 | |

Note: Logistic regression results from a convenience sample of survey respondents answering all five 3E service questions. n = 1200. The presence of a dedicated fire prevention unit is a dichotomous dependent variable. Yes = 1, No = 0. The variables tested are ordinal variables. Community population: 1 = <10K, 2 = 10K-25K, 3 = 25K-50K, 4 = 50K-100K, 5 = 100K-250K, 6 = 250K+. Total Staffing: 1 = <24, 2 = 25-49, 3 = 50-99, 4 = 100-250, 5 = 250+. Department Type: 1 = All Volunteer, 2 = Mostly Volunteer, 3 = Mostly Career, 4 = All Career.

Looking to the individual control variables, Table 4.4 indicates that all three are statistically significant ($p<.001$). Based on the coefficients (β), however, total staffing has the least effect on the presence of a dedicated fire prevention unit (.35), contrary to expectations. Community population and department type appear to have equal influence (.43), though the Wald statistic (37.05) shows the greatest influence for fire department type. While not shown in Table 4.4, the odds ratios for the three independent variables were positive with values of 1.53 (community size and department type) or 1.42 (department size).

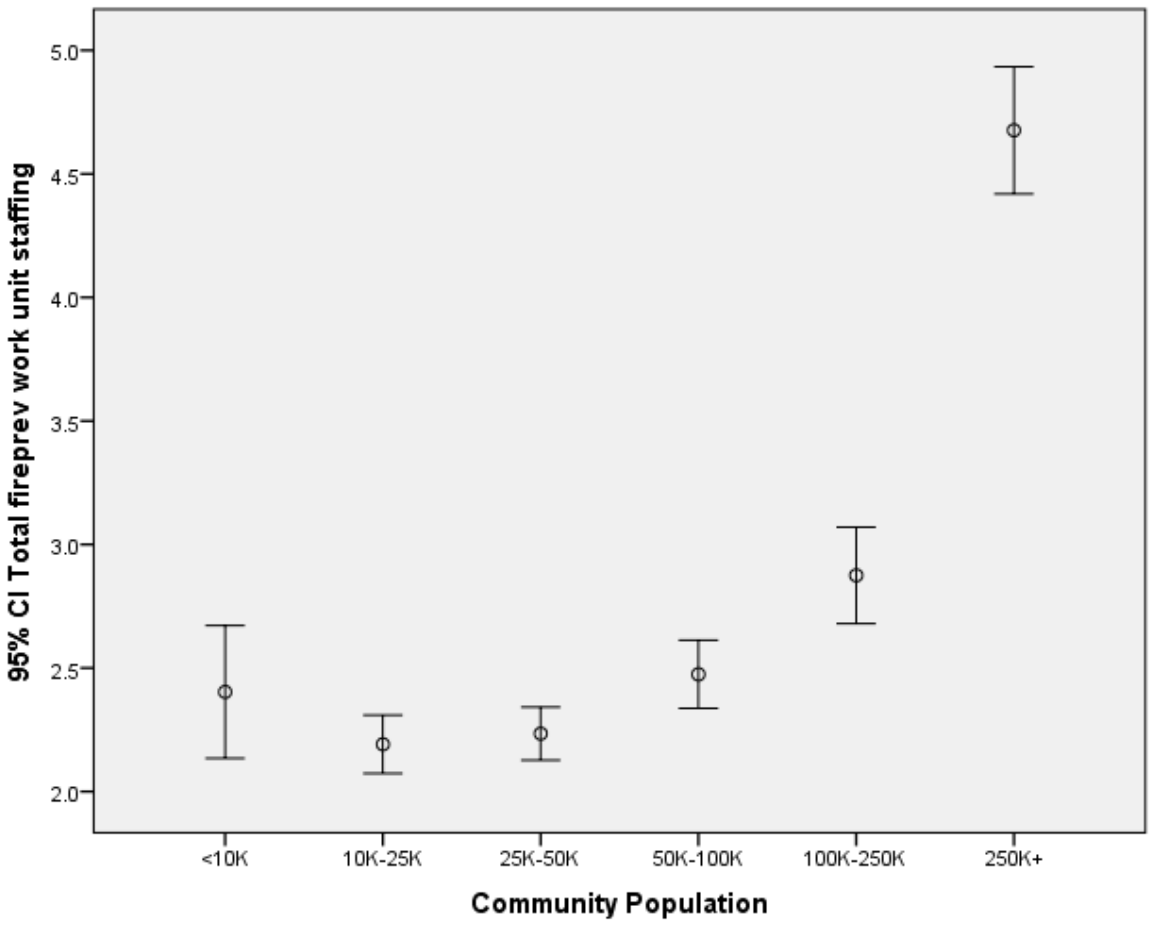
Taken individually and together, these values suggest that as departments move from all-volunteer to all-career, as the size of community protected increases, and as they increase total staffing, the likelihood of having a dedicated prevention unit increases as well. My inclination is to say that the presence of a dedicated fire prevention unit is tied to the transition points discussed earlier, though additional research would be required.

Having established the likelihood of a dedicated fire prevention unit being positively associated with community and department size, as well as fire department type, I now look at how the independent variables of community size, department size, and department type influence the staffing of these units. FPC Survey respondents that did not answer this question were listwise deleted leaving a slightly smaller study sample for this analysis (n = 823). I rely on error bars for examining dedicated unit size, which provide an estimate of mean and data variation. Mean values are not resistant to outliers, so the range of the error bars is important. Categories with fewer observations are more susceptible to outlier influence. In the last three figures discussed in this chapter, the dependent variable scale appears on the vertical axis. The scale for fire prevention work unit staffing levels is 2.0 = 1-5 persons assigned, 3.0 = 6-10 persons assigned, 4.0 = 11-20 persons assigned, 5.0 = 21-30 persons assigned, 6.0 = 31-50 persons assigned, and 7 = >50 persons assigned. The horizontal axis shows the categories for the independent variables.

Looking at Figure 4.10 and Figure 4.11 finds a clear J-shape distribution of the number of personnel assigned. As expected, there is a spike in dedicated unit size related to the 250+ thousand population category and 250+ total department staffing. I attribute this spike to the collapsing of the top three categorical answers to FPC survey question 7, which captured respondents protecting up to and over one million population, and top four

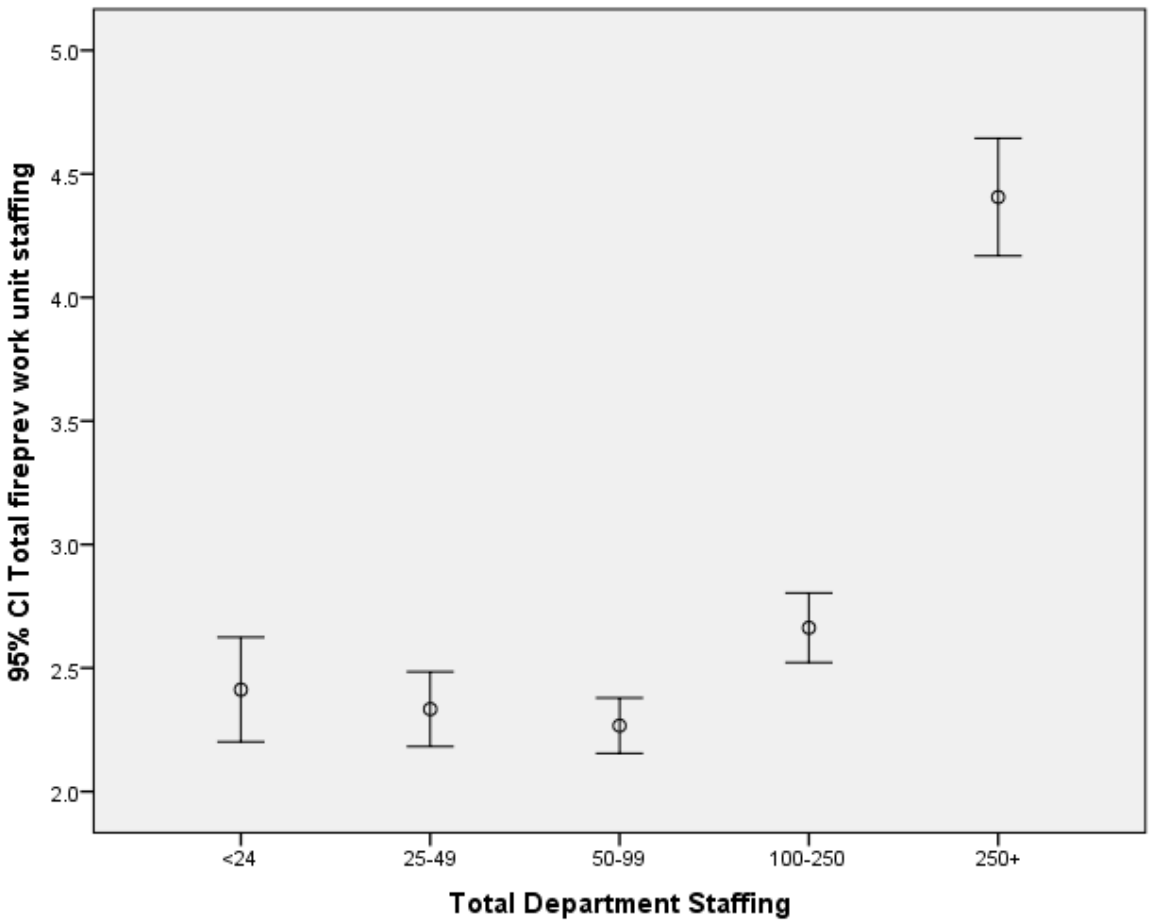
categories of question 8, which captured respondents in departments up to and exceeding 2000 employees. What was not expected was the indication of staffing levels of dedicated units the smallest communities and departments. For both, the reported mean values were noticeably higher than the lowest reported mean value. For the smallest communities and departments, this likely indicates the presence of dedicated fire prevention units within non-fire department-based providers, such as a fire marshal's office located within a building department.

**Figure 4.10: Total FP Work Unit Staffing by Community Population Served**




Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. A score of 1 = no persons assigned, 2 = 1-5 persons assigned, 3 = 6-10 persons assigned, 4 = 11-20 persons assigned, 5 = 21-30 persons assigned, 6 = 31-50 persons assigned, and 7 = >50 persons assigned. n = 823. Confidence interval = 95%.

**Figure 4.11: Total FP Work Unit Staffing by Total Department Staffing**




Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. A score of 1 = no persons assigned, 2 = 1-5 persons assigned, 3 = 6-10 persons assigned, 4 = 11-20 persons assigned, 5 = 21-30 persons assigned, 6 = 31-50 persons assigned, and 7 = >50 persons assigned. n = 823. Confidence interval = 95%.

Figure 4.10 presents means and variation of staffing data for dedicated fire prevention units by community size. The point estimate means for categories of <10-thousand ($\bar{x}$ = 2.40, n = 67), 10-25 thousand ($\bar{x}$ = 2.20, n = 136), 25-50 thousand ($\bar{x}$ = 2.23, n = 179), and 50-100 thousand ($\bar{x}$ = 2.3, n = 177) population ranges indicate that dedicated units are likely staffed with 1-5 personnel. Error bar ranges are much narrower for the 10-25 and 25-50 thousand populations ranges indicating tighter data, while the error bar for <10 thousand population

shows considerably more variation. For these four population categories, this implies that some dedicated units for these population levels are staffed with 5 to 10 personnel. However, there is no statistical difference noted between these four population categories, so clearly identifying a change is not possible.

Communities in the 100-250 thousand population range ($\bar{x}$ = 2.9, n = 128) are most likely staffed between 6-10 personnel, but again falling into two survey categories. Given that the mean for the 100-250 thousand population range is above the mid-point between the two staffing values with the error bar spread completely above the midpoint, staffing for these units is likely skewed towards the 6-10 personnel range, though a small number may be staffed with 1-5 personnel. The next category is 1.8 points higher on the scale indicating a considerable change in local government investment in fire prevention staffing. For communities in the 250+ population category, the mean value ($\bar{x}$ = 4.7, n = 136) implies that the average staffing of a dedicated fire prevention unit within this category falls somewhere between 11 and 30 personnel covering two staffing categories from the FPC Survey (*see* Appendix A). While the spread of the error bar shows wide variation in the data, the mean value still falls well within these two categories and shows a bias towards the upper staffing level of 21-30 personnel. The positioning of the error bars in the top two population categories indicates statistically significant differences in their staffing levels, as well as from the 50-100 thousand population category. I surmise this reflects the expansion of 3E services within larger communities under the fire department and provides limited support for community size effecting the size of dedicated fire prevention units.

Figure 4.11 graphs the same general trend of dedicated prevention unit staffing by total department staffing. In the total department staffing categories of <24 personnel ($\bar{x}$ =

2.4, n = 80), 25-49 personnel ($\bar{x}$ = 2.3, n = 165), and 50-99 personnel ($\bar{x}$ = 2.3, n = 240), the means fall below the dedicated staffing midpoint. The range of the error bars for the latter two categories also fall completely below the midpoint, while the error bar for the <24 category extends past the midpoint. This suggests that departments of these sizes with dedicated fire prevention units mostly staff them with between 1 and 5 personnel though some may have larger personnel complements of 6-10 personnel. It is probable that the some of the smaller departments reporting the higher fire prevention staffing levels are located within other local government entities rather than the fire department.

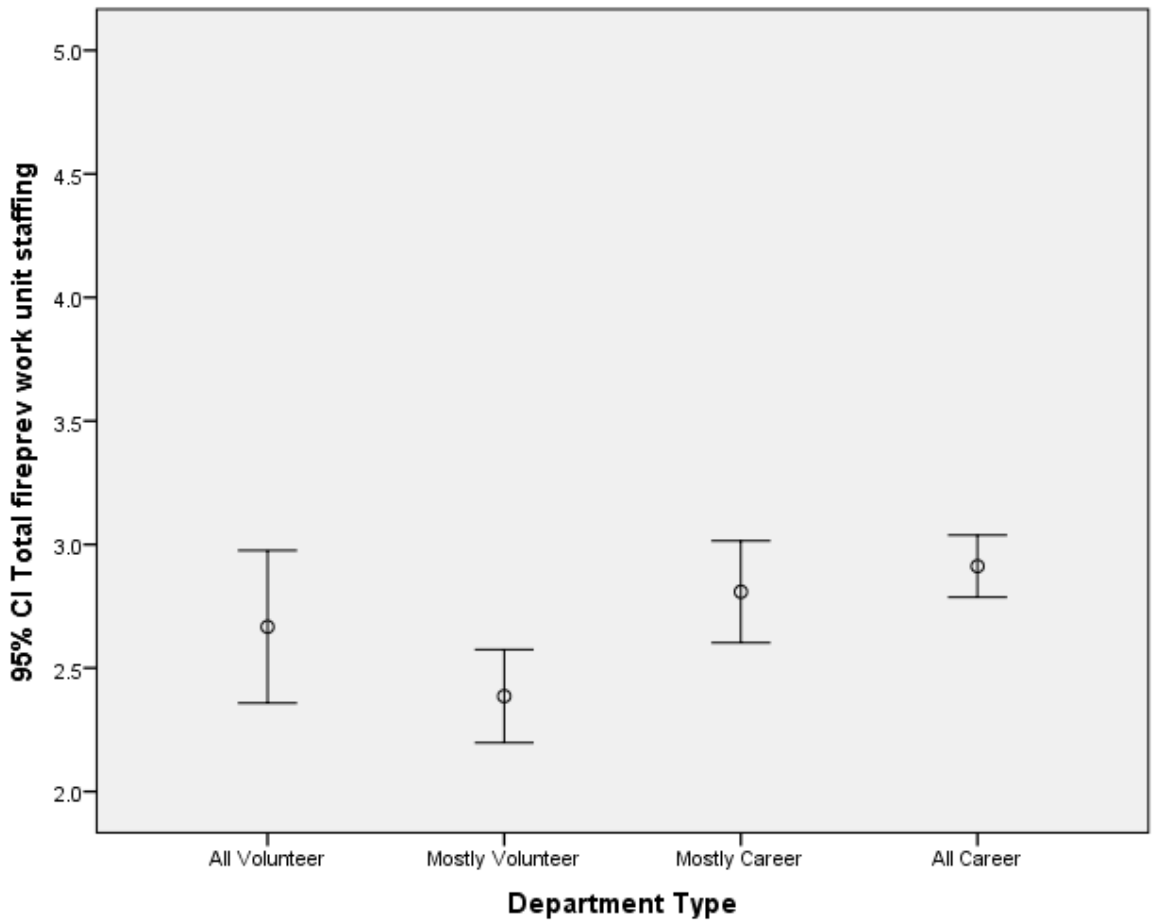
For the population group 100-250 thousand ($\bar{x}$ = 2.7, n = 178), departments with dedicated fire prevention units are likely staffed with between 1 and 10 personnel. The mean value and narrower range of the error bar express a bias towards the 6-10 personnel category. While there is only a 0.4-point difference in the mean value from the 50-99 staffing category, the range of the error bars indicates a statistically significant difference between the two population groups. This remains true for the next larger population group as well.

There is a significant jump of 1.8 points in mean value for departments above 250 total staffing ($\bar{x}$ = 4.4, n = 160) over the preceding category of 100-250 personnel. This implies that staffing for dedicated units in departments above 250 personnel probably falls between 11 and 30 personnel, though most likely between 11 and 20 personnel since the mean is below the midpoint of the two staffing categories. The wider range of the error bar indicates actual staffing may be larger or smaller. Overall, the evidence is limited supporting total department staffing influencing the number of personnel assigned to a dedicated fire prevention unit. Nevertheless, it is pronounced in departments above 100 personnel, which is indicative of local fire departments rather than other local government agencies.

Another way of looking at the J-shape of the population and department size figures (i.e., Figure 4.10 and Figure 4.11) is that of a bimodal distribution. This likely has to do with how departments (respondents) view fire prevention assignments. The mode associated with larger population and department sizes rises much higher and most likely represents "true" dedicated fire prevention units – those personnel assigned a specific 3E service, such as plan review. It also makes sense that these dedicated units are associated large departments protecting large communities. As previously noted, these are the most complex environments that fire departments operate in and include steep service demands. While probably not an overt calculation, there may be a comparative advantage by specializing 3E tasks in these environments.

On the other end of the scale, with smaller populations and departments, the smaller mode may also have to do with stand-alone units or departments with fire prevention responsibility. For example, Rockville (Maryland) is an incorporated city of approximately 60-thousand that lies in the center of Montgomery County. Rockville City has a small dedicated Fire Marshal's Office that provides plan review, new construction inspections, existing building inspections, and fire safety education. It lies within the Department of Community and Development Services. Emergency response is provided by the Montgomery County Fire and Rescue Service, which is a mostly-career county level department. As seen in Table 4.1, there are roughly 300 building and other local departments providing limited 3E services, mostly in plan review and new construction inspections. In such cases, it may make sense for the local fire department to shed responsibility to another political unit.

**Figure 4.12: Total FP Work Unit Staffing by Department Type**




Note: Results are from a convenience sample of local government survey respondents answering all five 3E service questions. A score of 1 = no persons assigned, 2 = 1-5 persons assigned, 3 = 6-10 persons assigned, 4 = 11-20 persons assigned, 5 = 21-30 persons assigned, 6 = 31-50 persons assigned, and 7 = >50 persons assigned. n = 823. Confidence interval = 95%.

Figure 4.12 visually displays the effect that department type has on the staffing of dedicated fire prevention units. Unlike the effects of population and department size on dedicated fire prevention unit staffing, department type does not appear to have the same level of influence. There are no drastic changes in mean values. All-volunteer departments ($\bar{x}$ = 2.7, n = 66) exhibit the greatest variation in data, but those that have dedicated fire prevention units probably staff them with between 1 and 10 personnel. Since the mean is

above the midpoint between staffing size categories, I expect that the study sample skews towards the 6-10 personnel category. Mostly-volunteer departments ($\bar{x}$ = 2.4, n = 114) show the lowest mean of department types. The error bar indicates tighter data variance. A mean below the midpoint and less data variance suggests that dedicated fire prevention unit staffing most likely lies between 1 and 5 personnel. The limited career personnel in these departments are likely charged with fire prevention duties requiring fewer staff than all volunteer departments.

There is only a 0.1-point difference between mostly-career ($\bar{x}$ = 2.8, n = 188) and all-career ($\bar{x}$ = 2.9, n = 455) departments. The range of error bar for mostly-career departments is wider than that for all-career department. Data implies that the average staffing of dedicated fire prevention units is probably between 6 and 10 personnel, though some may be staffed at higher or lower levels. The number of observations in each group is likely to suppress the effect of outliers, particularly for the all-career category. Data has shown there is a strong relationship between population size and department size. There is a less strong relationship between department size and department type showing that larger communities will lean toward career-oriented departments.

**Chapter Conclusions**

In this chapter, I examined the first research question concerning how 3E fire prevention services are provided across different communities. I began with developing a common evaluation scale for measuring delivery patterns of 3E fire prevention services. I then looked at how this common scale is affected by the independent variables of community size, provider department size, and the type of fire department serving the community. I used

a convenience sample survey to conduct my analysis, which is fully described in Chapter 3. Throughout this chapter the unit of analysis has been at the organization level.

I based the common evaluation scale on who delivers the particular fire prevention service of plan review, new construction inspections, existing building inspections, public education, or fire-arson investigations. The scale rankings are 1 = no service provided, 2 = service is contracted out, 3 = service is provided by another local department, and 4 = service is provided by the local fire department. Scores for each observation are summed and then divided by 5 to reach a numeric value. This is the 3E Index. The lower the score, the fewer services are provided and more entities involved. Higher scores indicate more services and greater consolidation under the fire department control. Individual observation index scores ranged from 1.20 to 4.00 demonstrating wide variation in approaches among communities.

Table 4.3 provides a succinct explication of how the average community of different sizes in the study sample provide fire prevention services via the 3E Index. Looking at the mean 3E Index score of combined services for each size of community, an unambiguous trend of increasing number of services and consolidation under the fire department is evident as community size increases.

The trend of increasing fire department concentrations under the fire department is repeated for each individual 3E service with the exception of public education. Here, there is some fluctuation in the mean scores between community sizes, but they are markedly consistent. If provided, public education is the purview of the local fire department. Perhaps more importantly is that as fire departments assume additional responsibilities, Figures 4.7, 4.8, and 4.9 show that existing building inspections are incorporated first. This demonstrates

a risk-management approach given that the highest risks are associated with occupied buildings.

Looking at the service means in the last column of Table 4.3 finds that fire-arson investigation is most likely to be provided by another government department, followed by plan review and new construction inspections. The average community receives all five 3E services. The difference lies in who provides the service.

Nuances in 3E service provision can be seen in Figure 4.2, Figure 4.3, and Figure 4.4. These figures indicate that despite what the average community receives in the way of 3E services, many communities do not receive most 3E services from local government, particularly those of less than 10,000 population, served by small local governments, or predominantly volunteer fire departments. Under the population category, the transition point appears to be between 25-50 thousand and 50-100 thousand population, while the transition for department size seems to be between the 25-49 total staffing and 50-99 total staffing levels. The transition in service provision for fire department type occurs between mostly-volunteer and mostly-career. Interestingly, these three transitions appear to overlap. When communities reach 50-100-thousand population, they will likely have a fire department between 50 and 99 personnel, and be protected by a mostly- or all-career fire department. To me, this represents a significant tipping point. These observations support the premise that community size, department size, and department type influence the scope of 3E service provision.

The logistic regression seen in Table 4.4 shows a positive influence ($p<.001$) of all three of the independent variables in predicting a dedicated fire prevention unit. Interestingly, though, department size is not as strong a predictor as department type. This is

most likely due to large response-focused all-volunteer departments in the study sample (>100 members, n = 19). Overall, 62.1% (n = 113) of all-volunteer departments reported not having a dedicated unit. When present, population served and department size strongly influence the staffing levels of such dedicated fire prevention units., with the median and mode being 1-5 personnel. Department type appears to have minimal influence on the staffing of these units. Department size has a clear influence.

Discussion

Drawing on Rubin (2010), the locus of budget control substitutes for the measure of program importance to politicians, the community, and department leadership. When program control is removed from the service it effects, importance of that service likewise diminishes in relation to other organization priorities. Lower scores then, not only indicate fewer 3E fire prevention services, they indicate communities and departments locked into a suboptimal pattern of relying on emergency response to manage the collective fire problem. Political will is lacking to force free riders into behaviors that relocate responsibility to individual system users.

This situation is tolerable so long as the fire department has slack in its capacity to respond to calls for service. Such tolerance has a discernable change point. As I noted in my earlier discussion, there appear to be transitions associated with data patterns concerning population served, department size, and department type. These can be seen in the provision scores assigned to each individual service and the combined 3E Index score. I believe these transitions represent when fire departments go from being a public good to a common pool good. It is at these transition points that the 3E activities, other than public education, take on increasing importance. Public education is voluntary. People are free to choose whether

or not to act on the knowledge. However, when fire department service demand saturates available resources, the more coercive 3E services become more vital to preventing *Hardin's Tragedy*.

This problem is particularly acute in smaller communities served by small and/or volunteer-oriented departments, but certainly not limited to these communities as indicated by the number of outliers associated with larger communities in Figure 4.2, 4.3, and 4.4. Fire loss patterns in the United States are much higher per capita in smaller communities than in larger jurisdictions, despite the attention larger jurisdictions receive (Tri-Data Corporation 1997, Allareddy et al. 2007, National Fire Data Center 2016). However, the sheer weight of numbers in larger communities forces difficult service decisions.

Smaller communities and larger resource strapped communities, such as those losing core industries, lack the tax base to implement comprehensive preventive 3E services. Fire departments in these communities may lack authority to impose requirements or sanctions on persons who attempt to free ride. Further, they may find themselves in politically untenable positions when they do try to enforce requirements. Enforcement inevitably leads to charges of the fire department eroding the tax base by closing businesses. Instead, this effort is left to other local government departments who may or may not place the same level of importance on fire prevention or lack understanding of the fire department's service demand saturation. One means around this dilemma is to staff a standalone fire marshal's (or other) office with specific authority and responsibility to provide the fire prevention function.

There are also cultural issues of self-reliance and perceived government interference that raise barriers to most of the 3E services (Mattson 1994). Enforcement of fire prevention provisions, whether through plan review or inspection, generally costs money. Business and

homeowners are reluctant to spend scarce resources on something they do not see as necessary or depriving them of some other form of economic benefit. Many will actively seek to avoid compliance. This leaves public education as the most acceptable means of influencing fire safe behavior. It does not require community members to give up control of possessions (money and property) and leaves intact their freedom of choice.

Finally, existing response practices are reinforced due to the relatively low level of fire suppression demand, which are highly visible public events. Service demand saturation generally occurs from the non-fire events that make up the bulk of response in larger communities. Smaller communities do not generate the level of service demand found in larger population centers. However, in all-volunteer or mostly-volunteer departments, an annual call volume of only a hundred events can tax staffing resources such that fire prevention becomes a luxury service that cannot be provided.

# CHAPTER V

## WHICH DEPARTMENTAL PROVISION SCHEMES WERE AFFECTED BY THE GREAT RECESSION CUTBACK?

Chapter 4 addressed my first research question and examined how 3E fire prevention services are provided across different communities in my convenience sample. It established a 3E Index that incorporates various approaches based on who delivered the particular fire prevention service, if delivered at all, and whether provision was concentrated under the fire department or covered through other providers. Higher 3E Index scores indicate more services are provided by the local fire department. Lower scores indicate fewer services are provided and those provided are dispersed among different entities. The chapter then examined how 3E service delivery is affected by community size, department size, and fire department type, and whether the presence of a dedicated fire prevention unit has any influence on delivery.

This chapter addresses the study's second query: *Which departmental provision schemes were affected by the Great Recession Cutback?* These schemes are indicated by the 3E Index score which provides one parameter of interest along with the individual 3E service types. The scope of this question addresses whether community and department

size, fire department type, and existing 3E service approach lead to budget cuts of 3E fire prevention services.

FPC Survey question 12, *"Has your organization made cuts to fire prevention services in the last two years?"* operationalizes this second research question by acting as my key dichotomous dependent variable. The survey work group chose the two-year window for cuts based on two factors. First, not all local governments operate on the same budget year cycle. Budget cycles may coincide with the calendar year, use a July to June budget year, or align with the federal government budget year (Rubin 2010). Second, public budgeting experiences a lag from economic downturns, particularly those that depend on property taxes. These are typically collected at the end of calendar years, so that shortfalls may not be felt for several months or longer (Scorsone and Plerhoples 2010). The two-year window allowed for capture of the different budget variations and differing reactionary time lags in the single survey. Survey respondents in the study sample that did not answer question 12 were listwise deleted from this analysis. A frequencies count conducted in SPSS returned the sample size for this question's analysis (n=827), with 50.2% (n=415) indicating that cuts were made and 49.8% (n=412) indicating that cuts were not made.

Chapter 2 established the importance of fire prevention as a tool for addressing fire department capacity saturation. Capacity saturation finds its roots in public free-riding behaviors and is ingrained in suboptimal organizational reactions (Kelman 1981). Saturation takes the local fire department from a type of public good to a common pool good (Ostrom 1990), meaning that at some point the fire department will lack the resources necessary to respond to all calls for assistance in time to affect positive outcomes (Randall 1983). In that situation, available resources will already be committed to other service demands or poorly

positioned and as a result response times will be stretched. Research has clearly shown that positive incident outcomes are tied to response times (Challands 2010).

Given that half of the surveyed departments are making cuts to fire prevention, the resulting question centers upon who is making cuts. Smaller communities, smaller departments, and predominantly volunteer departments probably have some amount of slack in their service capacity, so that they will not slide into a common pool resource. Nonetheless, these bodies also face smaller resource pools to support their services. Cuts to 3E services may be more easily accepted and a preferred option to losing response capacity in those settings. The suboptimal reliance on emergency response to manage the community fire problem likely continues as the policy of choice.

Larger communities, larger departments, and predominantly career departments with high service demand may already be beyond the tipping point toward being a common pool good. For these entities, cutting back 3E services may further entrench already suboptimal strategies. As service demand increases or emergency events become more serious and resource intensive, opportunities to shift responsibility for preventing incidents are diminished as resources are pulled from prevention. The underlying effects of these situations typically are evident as stressed response capacity affects the public and politicians are quickly brought into loop. This, in turn, may lead to reactionary decisions to spread response forces even thinner to meet service demands. National fire loss statistics show that when insufficient resources support response activities, property and human losses increase. In addition, responder health and safety are jeopardized (Lawrence 2001, Challands 2010).

**Distribution of Fire Prevention Cuts**

To answer my second research question, I begin by recoding the dependent variable from FPC question 12 according to convention (i.e., no = 0, yes = 1) and retitle the new variable *budget outlook*. As with the first research question found in Chapter 4, the survey working group believed that community size, department size, and department type would influence budget cuts to fire prevention. Each of these variables have different conditions thought to effect resource availability and service demand. Accordingly, I use these independent categorical variables and recode them as necessary. My first examination compares these independent variables against the dichotomous dependent variable of budget outlook. Since both are categorical/ordinal variables, cross tabulation is an appropriate method for analysis (Johnson and Reynolds 2012). Convention dictates that the dependent variable be placed on the Y axis and the independent variable is placed on the X axis.

Keeping with Johnson and Reynolds (2012) admonition to avoid using a single analytic test method, I report two test statistics. Chi-square tests the chance that two categorical data sets are related by comparing observed results against expected results if the data sets were independent. Gamma tests both the strength of a relationship between ordinal variables and its direction by measuring the difference in probability that a randomly drawn pair of observations is concordant as opposed to being discordant. For each, I also report the probability of chance occurrence following convention of $p<.05$.

Organization Level Factors and Budget Cuts

For the first cross tabulation, represented in Table 5.1, I examine budget outlook by the six categories of population under the independent variable population served. The systematic relationship in this table is quite clear - larger fire service jurisdictions are

associated with a greater likelihood of budget cuts to fire prevention. Population served and budget cuts to fire prevention are significantly related to each other (i.e., chi-square = 39.29; 5 df; $p<.001$ two-sided test), meaning that I can reject the null hypothesis. Data for the study sample (n=827) show a moderate, statistically significant positive connection (*gamma* = .28, $p<.001$) between community size and budget cuts (Laerd Statistics 2016). For communities with less than ten thousand population, approximately 30% made budget cuts to 3E services. By the time communities reach a population of 250-thousand plus, the level of budget cuts to 3E services rises to nearly 70%. This relationship probably is related to the overall number of 3E services provided, as well as the career-volunteer composition of the fire department. Chapter 4 found a positive relationship between the number of 3E services provided and community size. Smaller communities generally provide fewer 3E services and these are more likely spread out among other entities. Fewer services means fewer opportunities for cuts.

The sample data from Chapter 4 reveal that community size has a robust relationship with the type of fire department providing services. The smaller a community the more likely it is to depend on an all-or mostly volunteer fire department. Community size also is tied to the potential for a dedicated fire prevention unit. In the case of small career-oriented departments, the covered communities do not tend to be resource rich. Smaller communities often lack dedicated fire prevention units, meaning that the cutting of 3E services is a less obvious strategy for managing budget shortfalls.

Again, there is a slight transition point in the trend between the 25-50K and 50-100K population categories. This is consistent with the observations of Chapter 4 and conceivably it is a reflection of the underlying transition from a public good to common pool good

**Table 5.1: Budget Outlook by Community Population**

| | | Population Served | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | <10K | 10K-25K | 25K-50K | 50K-100K | 100K-250K | 250K+ | Total |
| Budget Outlook | No Cuts | 70.15% | 60.14% | 50.84% | 51.41% | 45.38% | 30.15% | 49.82% |
| | Budget Cuts | 29.85% | 39.86% | 49.16% | 48.59% | 54.62% | 69.85% | 50.18% |
| Total | | 100.00% (67) | 100.00% (138) | 100.00% (179) | 100.00% (177) | 100.00% (130) | 100.00% (136) | 100.00% (827) |

Notes: Crosstabulation results are from a convenience sample comprised of respondents to a survey on budget cuts to 3E fire prevention services. n = 1200. This particular table concerns the dichotomous dependent variable Budget outlook (no cuts / budget cuts) against the size of the population protected by the respondent fire department. Valid cases n = 827. Missing cases n = 373. Chi-Square = 39.29; df = 5; $p<.001$ (two-sided test). *gamma* = .28; $p<.001$.

environment. It may be at this point that emergency response demand begins to outpace slack capacity forcing departments to pull funds from fire prevention to maintain response capacity.

In Table 5.2, I inspect the relationship between the independent variable of departmental staffing versus budget outlook. The recoded independent variable offers five possible categories of department size. Consistent with population size relationship, a systematic trend can be found. As departments increase in personnel, the likelihood of budget cuts to fire prevention tends to increase. Otherwise, the data displays an overall connection between department size and budget cuts (i.e., chi-square = 26.99, 4 df, $p<.001$ two-sided test) rejecting the null hypothesis. Data indicates a moderate, statistically significant positive connection between department size and budget cuts (*gamma* = .22, $p<.001$).

The conspicuous exception is with departments of 24 or fewer personnel. In this particular category, the cuts / no cuts data shows an even 50% split. While not shown in Table 5.2, data shows that the distribution of cuts/no cuts across department types at this size is fairly even. The number of departments reporting no cuts (n = 40) ranges from 9 to 11 by type and those reporting cuts (n = 40) ranges from 8 to 12 by type. Further, data also shows consistent distribution of cuts/no cuts between fire department providers (cuts n = 23, no cuts n = 24) and non-fire department providers (cuts n = 17, no cuts n = 16). This leads me to believe that there is another factor at work influencing the cut/no cut decision with providers at this size. One possibility is the presence of volunteer providers who, by definition, consume fewer resources in service delivery. Budget cuts would do little to deter service provision. Another possibility is the geographic distribution of these providers. The Great

**Table 5.2: Budget Outlook by Total Department Staffing**

| | | Department Staffing | | | | | |
|---|---|---|---|---|---|---|---|
| | | <24 | 25-49 | 50-99 | 100-250 | 250+ | Total |
| Budget Outlook | No Cuts | 50.00% | 61.82% | 53.91% | 46.93% | 34.38% | 49.82% |
| | Budget Cuts | 50.00% | 38.18% | 46.09% | 53.07% | 65.63% | 50.18% |
| Total | | 100.00% (80) | 100.00% (165) | 100.00% (243) | 100.00% (179) | 100.00% (160) | 100.00% (827) |

Note: Crosstabulation results are from a convenience sample comprised of respondents to a survey on budget cuts to 3E fire prevention services. n = 1200. This particular table concerns the dichotomous dependent variable Budget outlook (no cuts / budget cuts) against the total staffing of the respondent fire department. Valid cases n = 827. Missing cases n = 373. Chi-Square = 26.99; df = 4; p<.001 (two-sided test). *gamma* = .22; *p*<.001.

Recession was extremely uneven in its effect across rural, suburban, and urban environments (Bennett, Yuen, and Blanco-Silva 2018). Small departments in rural settings faced more budget difficulty than small departments situated in a more urbanized setting.

While the smallest departments in the study sample appear to have an even chance of cutting fire prevention programs, data shows departments in the range of 25-49 personnel have only a 38.18% chance of cutting 3E services. From this low point, the likelihood of cuts to 3E series rises to 65.63% for departments above 250 personnel. Unlike population size, however, there is no dip in the trend as department size increases. Again, these trends parallel the observations of Chapter 4.

The 3E Index indicates the smallest fire departments offer the fewest 3E services for their communities. Many of the 3E services in the community are likely provided by other government departments or outside agencies. If the local fire department only offers one or two 3E services, then that severely limits available strategies during economic downturns. Opportunities to employ resisting or smoothing actions may not exist. Keeping with the literature that non-mission critical programs are sacrificed first (Jick and Murray 1982, Plant and White 1982, Berne and Stiefel 1993), it makes sense that departments at this size would make cuts to budget demands that affect emergency response capacity. On the other end of the scale, the largest departments have much larger budgets resource pools and capacity. It is easily conceivable that they could make cuts to emergency response, as well as fire prevention services without severely jeopardizing the overall delivery of either service.

The results of last cross tabulation for this chapter are shown in Table 5.3. This table compares budget outlook with the four categories of fire department typology. The budget cut trend in this table is the clearest. Statistics demonstrate that department type and budget

**Table 5.3: Budget Outlook by Fire Department Type**

| | | Fire Department Type | | | | |
|---|---|---|---|---|---|---|
| | | All Volunteer | Mostly Volunteer | Mostly Career | All Career | Total |
| Budget Outlook | No Cuts | 71.64% | 60.87% | 47.87% | 44.64% | 49.82% |
| | Budget Cuts | 28.36% | 39.13% | 52.13% | 55.36% | 50.18% |
| Total | | 100.00% (67) | 100.00% (115) | 100.00% (188) | 100.00% (457) | 100.00% (827) |

Note: Crosstabulation results are from a convenience sample comprised of respondents to a survey on budget cuts to 3E fire prevention services. n = 1200. This particular table concerns the dichotomous dependent variable Budget outlook (no cuts / budget cuts) against the fire department type. Valid cases n = 827. Missing cases n = 373. Chi-Square = 23.57; df = 3; p<.001 (2-sided test). *gamma* = .25; *p*<.001.

cuts to fire prevention are systematically related (i.e., chi-square = 23.57; 3 df; $p<.001$ two-sided test). This result allows me to reject the null hypothesis of non-association. Table 5.3 displays a moderate, statistically significant positive connection between fire department type and budget cuts (*gamma* = .25, $p<.001$).

As departments transition from all-volunteer to all-career, the likelihood of budget cuts to fire prevention services increases. It is also very clear that the addition of career staff makes a marked difference in the frequency of budget cuts. Between all-volunteer and mostly-volunteer, there is an 11-point change in percentage of cases reporting budget cuts. Between mostly-volunteer and mostly-career, there is another 13-point change in percentage. However, between mostly-career and all-career, this change drops to 3 percentage points. This seems to indicate that cuts made to fire prevention are mostly associated with personnel in the mostly-volunteer and mostly-career departments.

Simply put, volunteer departments might have no real cuts (e.g., personnel or other forms) to make. Except in cases where personnel are hired from department funds as casual labor or receive a stipend for certain services, the 3E services may be covered like all other services. Because minimal resources are allocated, there may be nothing to really cut. Along these lines, Chapter 4 found that all-volunteer departments were least likely to provide any of the 3E services except the category for public education. Public education is the 3E service that is least resource intensive, so that is intuitive. As departments move into mostly-volunteer structures, the 3E Index confirms that additional 3E services are added. The career staff in these settings would be most likely to cover these services, and of course, they would be vulnerable to budget cuts. Perlman and Benton (2012) noted that local governments looked to personnel cuts as their first strategy when paring back during the Great Recession.

Along these lines, it seems that as more career personnel are added to the department roster, the more 3E services are added and the more likely cuts to fire prevention become.

Distribution of Fire Prevention Cuts by Individual 3E Service

In the preceding section, I examined how the independent variables of community size, department size, and department type interacted with the dichotomous dependent variable of budget cuts. In this section I explore budget cuts to individual 3E services. For this and the remaining analysis in this research paper I focus on departmental staffing and fire department type. I will minimize my attention to community population because of its high correlation with department size and because the departmental variable tends to perform better in modeling results.[6] When constructing my analysis, I use 95% confidence interval (CI) error bars to determine how variations in department size and type affect the likelihood of budget cuts to the individual fire prevention services. My dependent variable is the 3E Index score, which categorizes who provides a particular service within a jurisdiction. As discussed in Chapter 3, a score of 1 means the service is not provided; 2, the service is contracted out; 3, the service is provided by a local government entity other than the local fire department; and 4, the service is provided by the local fire department.

Error bars provide two basic pieces of information. One, they are a means intended to help "assess the significance of the difference between two values" (Krzywinski and Altman 2013, 921). Two, they are a visible representation of a point estimate's precision (Cumming and Finch 2005). The bar extending from either side of the point estimate shows

[6] The preceding discussions show a clear positive correlation between population and staffing. This connection is well documented in the extant literature (Walker 1979, Brueckner 1981, Ladd 1992, Jennings 1999, Young 2012, Jennings 2013). I drop analysis of population since many of the service-oriented political and managerial decisions regarding budget cuts occur at the departmental level and not at the community population level. Analysis of both population size and department size would be duplicative and not add any important observations to the discussion.

the margin of error for the estimate or data variability. Three types are in common use: standard deviation, standard error of the mean, and confidence interval (CI). Of the three types, Krzywinski and Altman (2013) note that CI provide a more intuitive interpretation of measurement reliability. Further, of the three, CI error bars do not have a fixed value. Researchers can change the interval value according to the accuracy needed, though 95% CI is most common and corresponds to $p < .05$ null hypothesis significance testing (NHST) threshold.

Cumming and Finch (2005) offer guidance for interpreting error bars for independent samples. First, begin with identifying the dependent variable and explicate the measurement scale. Identify the effect of interest and how the mean and CI lead to any conclusions from the data. Focus first on the means and any discernable patterns. Explain how these fit against research hypotheses and if the effects significant. The CI identifies the range of probable values for the true population mean. Values outside the CI are unlikely. Any value outside the CI rejects the null hypothesis with $p < .05$ (two-tailed). If the CI is narrow around the point estimate for the mean, this reasonably represents the true mean of the population. Explicitly,

> "For a comparison of two independent means, $p \leq .05$ when the overlap of the 95% CI is no more than about half the average margin of error, that is when proportion overlap is about .50 or less. In addition, $p \leq .01$ when the two CIs do not overlap, that is, when proportion overlap is about 0 or there is a positive gap. These relationships are sufficiently accurate when both sample sizes are at least 10, and the margins of error do not differ by more than a factor of 2." (Cumming and Finch 2005, 176).

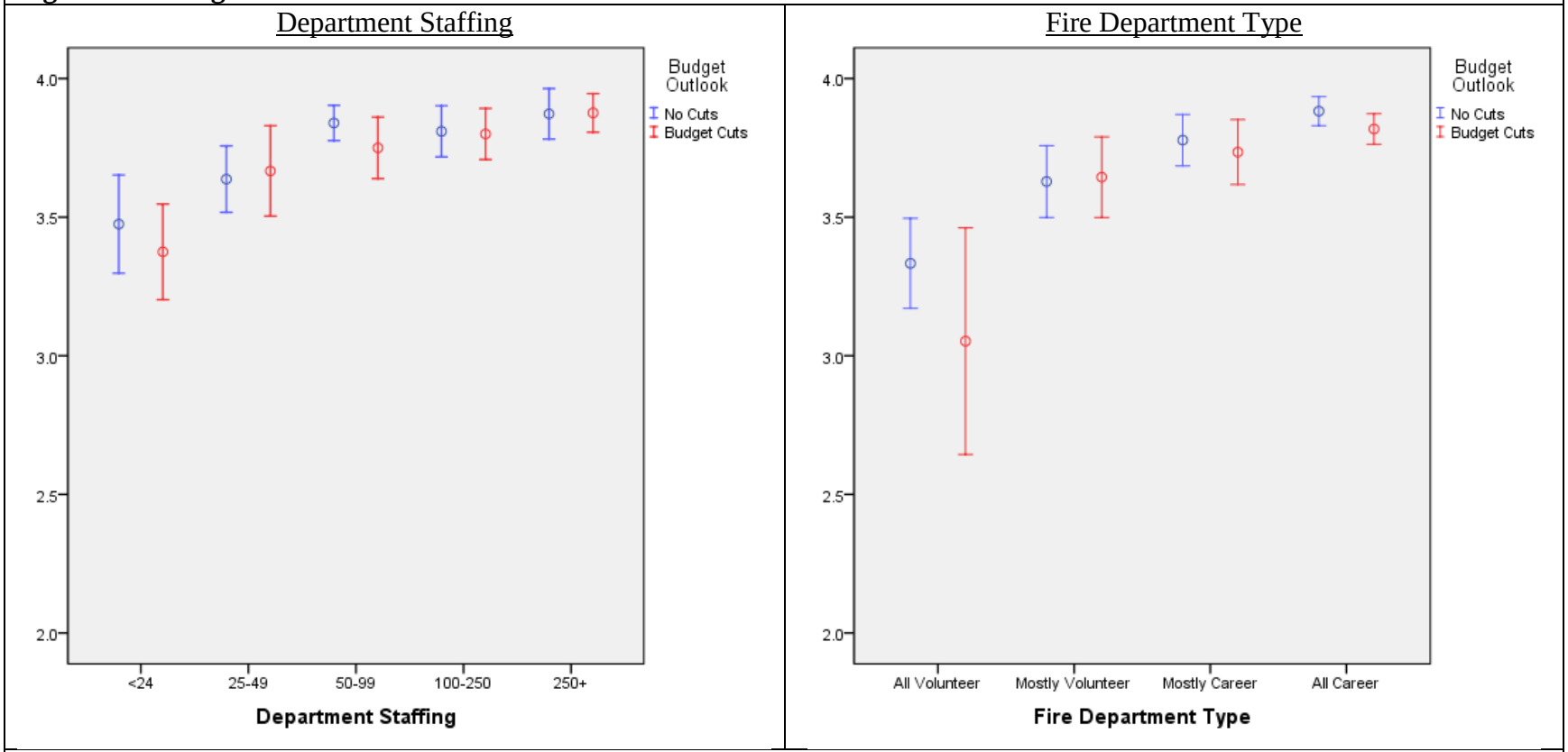
Following Cumming and Finch (2005) for my analysis, I look first at the predicted means. In Figure 5.1, one observation apparent across all department sizes is that there is no statistically significant difference ($p > .05$) between departments that made cuts and those that

did not make cuts. This holds regardless of who provides the plan review service as indicated by the index score. This indicates that the service scheme is not driving cuts to plan review services. Figure 5.1 also reveals that as departments get larger, they approach the index value of 4, meaning there is more uniformity among service providers and greater concentration plan review under the local fire department. At the lower end of department size, Figure 5.1 show some small variation in mean scores between cuts and no cuts. I take this to indicate that the introduction of other plan review service providers increases the chance of budget cuts.

When looking at fire department type, Figure 5.1 again shows that budget cuts are associated with the introduction of alternate plan review service providers into delivery schemes. This association is greatest with all-volunteer departments, though also seen in mostly- and all-career departments. The exception is mostly-volunteer where there is no apparent difference. The location of the predicted mean and width of the error bars show a clear reliance on other entities inside and outside of local government to provide plan review when the local fire department is all volunteer. The width of the budget cuts error bar for this category is the largest and appears to be twice the width of the no cuts error bar revealing a great deal more variability in the data. This data variability leads me to surmise that the other plan review providers, mostly from local government or contracted to local government were subject to budget cuts. This is not surprising. New development and new construction are tied tightly to the economy. When economies shrink, these activities slow or stop (Miller and DiRocco Jr. 2012).

For non-fire department agencies who are focused on new development and construction, such as building departments, economic downturns force a pullback. Many are

**Figure 5.1: Budget Cut Environment for Plan Review Services**



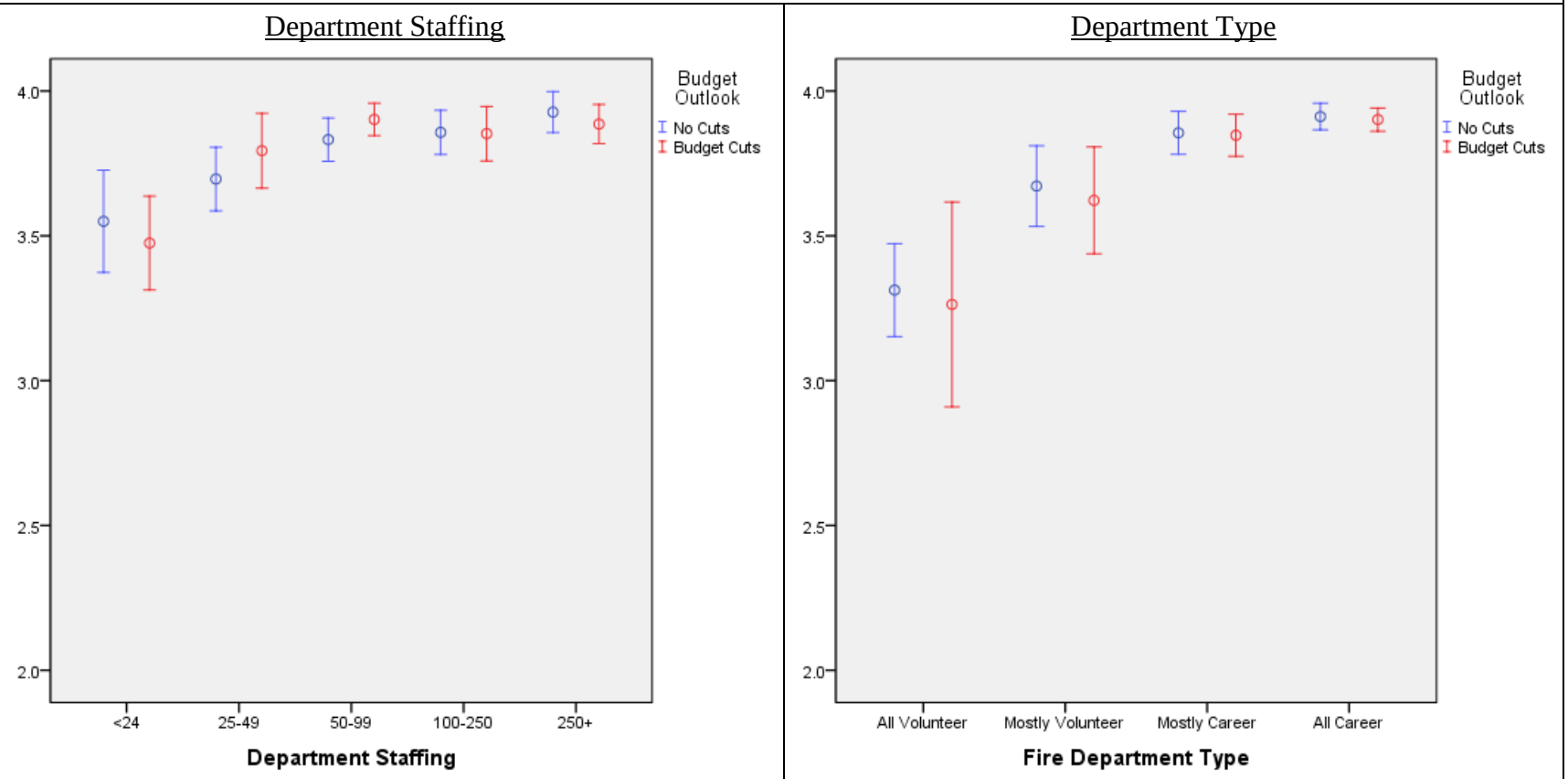

Note: Results are from a convenience sample comprised of respondents to a survey on budget cuts to 3E fire prevention services. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. The study sample for this question (n = 827) is derived from the original study sample (n = 1200) through survey question 12, which serves as the dependent variable. Confidence interval = 95%. Mean values are unweighted and calculated from the entire convenience sample.

self-supporting enterprise funds that depend on the fees generated from the services provided, usually plan review and new construction inspections. In smaller departments where a few people provide all the available 3E services, as shown in Chapter 4, and pre-recession housing growth was lackluster, the effect of the downturn may not be as pronounced on plan review services.

In communities experiencing rapid growth in the housing market prior to the Great Recession, adding plan review capacity through civilian employees would have been relatively easy. In larger career-oriented departments, usually associated with larger, established communities, it is also more likely that dedicated civilian staff provide plan review. In either case, reduction strategies would target cuts to reduce or reassign unnecessary personnel. The strategy employed to reduce costs would affect whether it showed as a cut or no cut. The major difference is that in larger communities and larger departments, reductions can be accomplished through normal attrition associated with a larger workforce. Work associated with unreplaced personnel can be shuffled off to other employees. If the positions are kept on the books, but simply not filled, the cost savings may not be reported as a cut. If the positions are eliminated, then the cost savings shows up as a cut. In small communities, with smaller workforces, the opportunity to use normal attrition for cost savings is just not available. When the housing market crashed, revenue stopped and cutbacks became imminent since these organizations lack the capacity to shuffle work load.

Closely tied to plan review, new construction inspections are the next step towards occupancy of new buildings. Figure 5.2 provides graphic evidence of this relationship. For both fire department size and type, the new construction inspection trends are markedly similar to plan review. As department size increases and lean towards all career, new

**Figure 5.2: Budget Cut Environment for New Construction Inspections**




Note: Results are from a convenience sample comprised of respondents to a survey on budget cuts to 3E fire prevention services. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. n = 1200. Confidence interval = 95%. Mean values are unweighted and calculated from the entire convenience sample.

construction inspection becomes a responsibility of the local fire department. Data certainty regarding budget cuts to new construction inspection also improves. In addition, the width of the error bars indicates more variety in who is providing new construction inspection.

Two of the department size categories are worth noting. Departments in the 25-49 and 50-99 categories indicate that higher 3E index ratings for new construction inspections are associated with budget cuts. They comprise 49.3% (n=408) of the study sample for this second research question. This points to the possibility of some unique conditions emerging in departments that of these sizes. As previously mentioned in chapter 4, there appears to be a transition when fire department service passes from public good to common pool good. Particular 3E service cuts may be where the additional stressors on service demand are felt. Fire departments may also begin to specialize prevention services and civilianize these employees. High service demand tends to force departments to make critical decisions on where to place available resources. Path dependency theory predicts that this will be in maintaining emergency response capacity.

A possible compounding factor is that communities protected by these departments, particularly those in the Sun Belt, were experiencing significant growth at the same time they were losing revenue (Greenblatt 2014, Maciag 2015, 2017). Since many of these size departments already relied on alternate delivery strategies, the recession would have forced cuts to services not directly supporting the population growth. New development takes years from plan inception to occupancy. New construction inspections were probably cut with the anticipation that they would be restored when development caught up with growth.

However, compared to plan review, there appears to be greater involvement of local government providers at smaller department levels judging from the location of the predicted

means against the 3E service index. This possibly indicates a desire to maintain some quality control aspect over new construction or that personnel providing new construction inspections, also provide other services. Plan review is considerably easier to contract out or consolidate since it is essentially piece-work and is less subject to externalities, such as travel time and job site conditions.

Fire department type in Figure 5.2 shows greatest variability in delivery schemes for all-volunteer departments. The 3E scale indicates that more non-fire-based entities are involved when communities are protected by such departments. Discussion of Figure 5.1 pointed out that non-fire department-based service providers may be at greater risk to economic down-turns than fire department-based providers. This risk would also apply to fire departments that have specialized their fire prevention services (i.e., dedicated plan reviewers). Fire departments that have non-specialized fire prevention services may be able to redirect resources without having to cut services.

Unlike plan review and new construction inspections, existing building inspections are concerned with the safety of occupied buildings. Failures to maintain the fire safety features of these buildings place many more people at risk. Figure 5.3 addresses the relative certainty of budget cuts to the 3E service of existing building inspections. Figure 5.3 shows the consistent trend of decreasing variation in providers as departments increase in size. Another trend is also visible in the Department Staffing panel. With the exception of departments with less than 24 employees, the mean values for *budget cuts* is greater than the *no cuts* mean values among the four categories of fire department size greater than 25 personnel. This indicates greater consolidation of existing building inspections under the fire department as these departments increase in size leads to increases in budget cuts for this

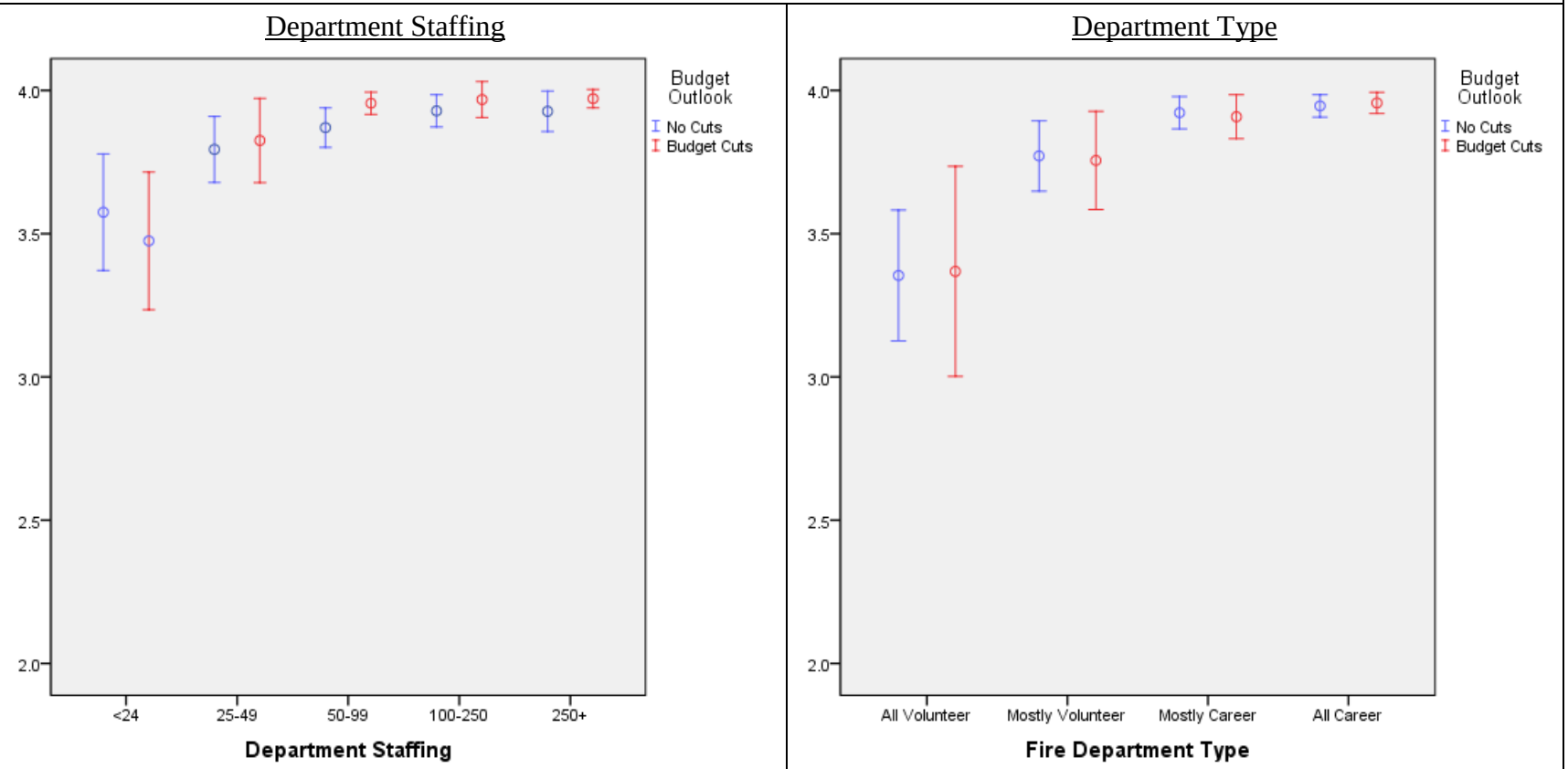
service. Larger departments are more often associated with well-established center cities or mature suburban communities with high service demand. In such cases, consolidation of service under the local fire department would likely increase the potential for budget cuts, while the introduction of alternate service provides would decrease the potential for cuts.

Looking back to chapter 4, these communities appear to have consolidated most of the 3E services under the local fire department. These communities are also more likely to implement cutbacks early in response to fiscal stress (Lobao and Adua 2011). Alternatively, smaller, faster growing communities look to other means, such as cooperative intergovernmental service delivery and alternate revenue sources to manage such stress (Kim and Warner 2016). This differentiation would be reflected in the choice to cut or not cut services.

When department type is examined, the uncertainty associated with budget cuts decreases as fire departments transition from all-volunteer to all-career. That said, the mean rate for *budget cuts* versus *no cuts* is noticeably even across all department types. Looking at both panels in Figure 5.3, error bar overlap in department staffing and department type shows no statistically significant likelihood ($p>.05$) of existing building inspections *budget cuts* compared to *no cuts*.

Figure 5.3 also exhibits greater centralization of existing building inspections under the fire department as departments get larger or increase career staffing. This is particularly evident in the three largest staffing categories and career-oriented department type categories. In these, the index values are close to 4.0. As the predicted means approach 4.0 in the staffing panel of Figure 5.3 existing building inspections have a greater association with budget cuts. When external providers are engaged in this service, indicated by lower index

**Figure 5.3: Budget Cut Environment for Existing Building Inspections**




Note: Results are from a convenience sample comprised of respondents to a survey on budget cuts to 3E fire prevention services. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. n = 1200. Confidence interval = 95%. Mean values are unweighted and calculated from the entire convenience sample.

scores, there is greater association with cuts for the smallest departments and all-volunteer departments. Remember that fire department size is strongly linked to community size and service demand. So, for smaller departments in growing communities it becomes easy to justify curtailing or consolidating existing building inspections under the building or similar department, while the fire department focuses on keeping pace with demand. These actions would all show up as a cut to this 3E service, while still providing the service. In established larger and career-oriented departments there is likely greater capacity and adaptability in how service is delivered without severely limiting service delivery. Instead, it becomes an exercise in changing program objectives within politically acceptable limits, such inspect all commercial buildings according to imposed risk in lieu of inspect all commercial buildings once every two years. There is a clear difference in the level of resources required for each option.

Regardless of department size or type the prevailing argument against existing building inspections is that those buildings subject to inspection are safe (Jennings 2013). First, with few exceptions, the existing building stock has already been subject to plan review and new construction inspections. Second, building owners frequently see existing building inspections as superfluous and infringing on property rights. Third, bringing existing buildings into compliance can be very expensive. Fourth, commercial structures do not burn with such frequency that it raises prolonged community attention.

The next figure addresses Public education, the most pervasive of the 3E fire prevention services provided by fire departments. It has been called the cornerstone of fire prevention (NCFPC 1973) and a critical factor in gaining code compliance (May and Wood 2003). Figure 5.4 indicates how public education fares during the cutback environment. The

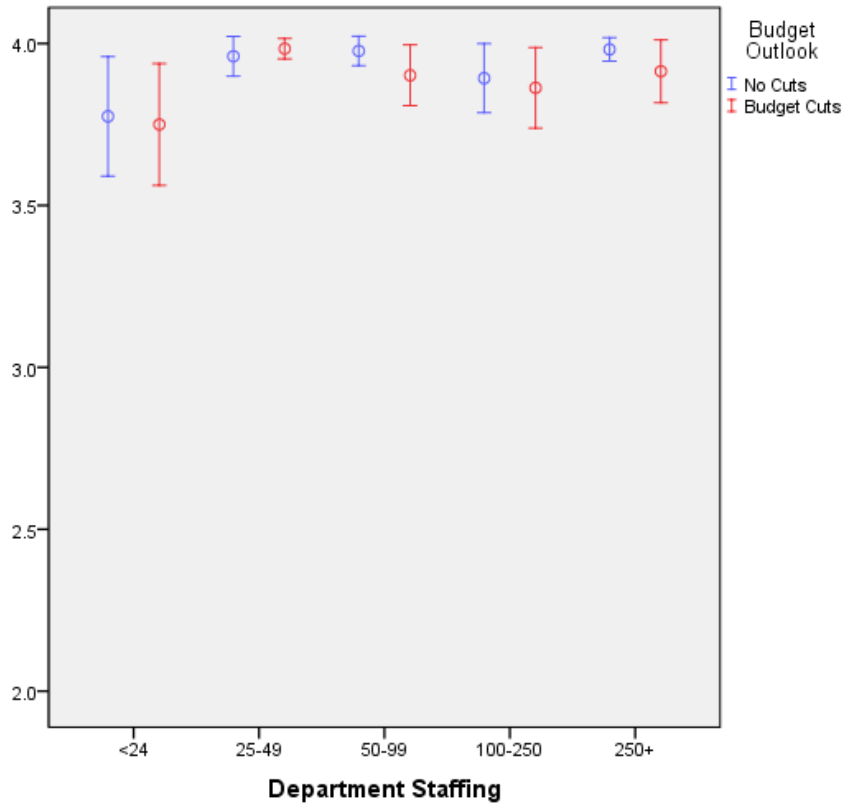
panel on department staffing shows public education is the almost exclusive province of the local fire department, though other schemes are evident from the index score across most department sizes and types. Data shows that in only 34 communities is public education provided by another local agency. In 27 communities, it is simply not provided. The noticeable stand out is the smallest department category and all-volunteer departments, which show much greater variation. Here, other providers enter the arena or the service is completely cut. This tells me that when a local fire department cuts public education, it is not picked up by another local entity.

One example for the provider mix is a municipality that has a standalone fire marshal's office that provides 3E services, while response is handled by the local fire department. This is not an unusual occurrence with college campuses and small municipalities embedded in larger county systems, such as Gaithersburg, MD and Altamonte Springs, FL. A similar pattern is visible in the department type pattern, with evidence of external or no providers with all department types, but concentrated in the all-volunteer category for the same reasons.

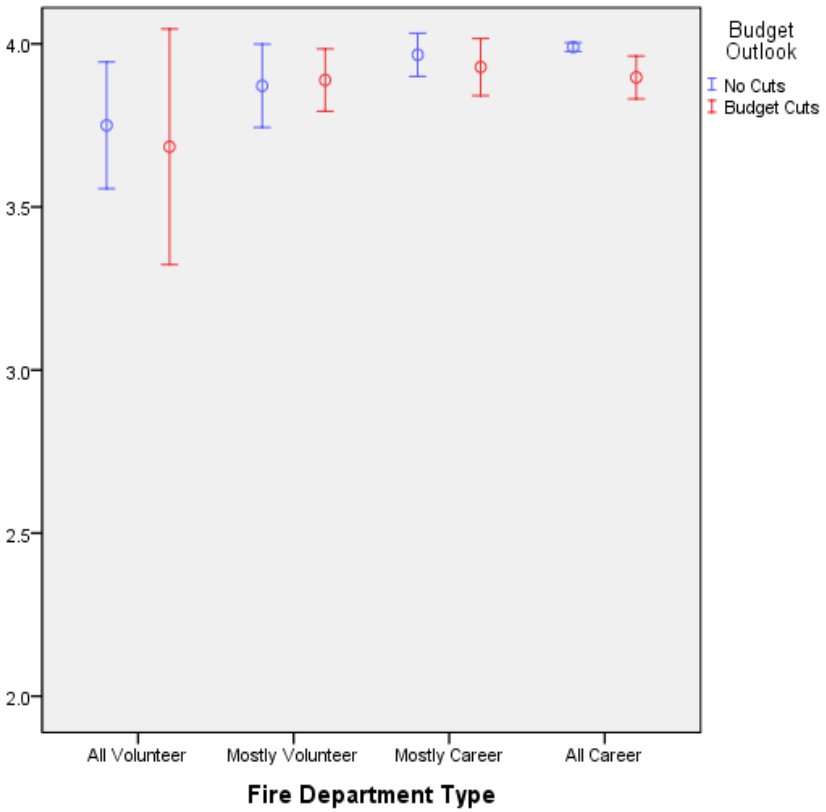
The means for both department staffing and department type exhibit a bit of a sine-wave shape, which is difficult to interpret and not reflective of the previously discussed 3E services. One possible explanation concerns which entity is providing the service. When the mean value is closer to four, there is less variation in providers. Respondent level data indicates that roughly 5% (n = 61) of fire departments, regardless of size or type, do not provide public education services. In half of these (n = 34), another entity provides the service. These other providers may be spread out among the various categories for each panel, but are most likely concentrated in the smallest or all-volunteer departments.

**Figure 5.4: Budget Cut Environment for Public Education**

Department Staffing




Department Type




Note: Results are from a convenience sample comprised of respondents to a survey on budget cuts to 3E fire prevention services. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. n = 1200. Confidence interval = 95%. Mean values are unweighted and calculated from the entire convenience sample.

Looking at cuts versus no cuts, I take the proximity of the means in each category to indicate that when local fire departments provide this service, they may be engaging in resistance strategies. I pose several possible intertwined reasons for public education cuts in larger career-oriented departments. First, large departments are in well-established communities and probably taxed by emergency service demand. Cutting emergency response forces in such circumstances requires deep shortfalls and lack of other options. Second, in these larger departments, civilian public educators are frequently hired to provide this service. Uniformed firefighters typically take months and considerable expense from time of hire to providing service. Civilian employees can usually begin delivering a service within a week or so. From an institutional standpoint, this makes them much easier to replace. Further, uniformed firefighters can perform much of the public education service, but civilian public educators cannot perform any emergency response duties. Thus, public education tasks are more easily shifted to emergency response forces. Finally, many of these larger, established departments are unionized, which provides some level of protection against reductions for uniformed personnel, but not for civilian educators. These providers become the least difficult choice to cut and transfer responsibility.

Judging from the location of the predicted means, budget cuts to public education occur slightly less often than no cuts for department staffing and department type, with one exception in each panel. Under department staffing, in the staffing category of 25-49 personnel, public education seems to be cut slightly more often than not. Further, width of the error bars for budget cuts indicates little variability in the data. When compared to the other four 3E services, the value of the mean and width of the error bar indicates that public education is targeted when budget cuts are necessary. Most likely, this is due to the limited

3E services provided by local fire departments in this category as indicated by comparing the Figures 5.1 to 5.5 against each other. Thus, when cuts are necessary, there is no other choice but to cut from public education. There is little opportunity for across-the-board cutting from multiple 3E services.

In the department type panel, all-career departments seem more likely to avoid cuts to public education. The predicted mean value is close to four and bound tightly by the error bar. The predicted mean for budget cuts is noticeably lower and there is no overlap with the error bars with no cuts indicating there is no likelihood that the predicted means could have the same value ($p<.05$). This tells me that in all-career departments, particularly in well-established communities in which interagency bonds have been developed, there is a greater emphasis on retaining internal public education services when compared with the other 3E services provided. Cooperative programs, such as Risk Watch[7], which depend on alternate providers, are easy targets for cuts by other agencies, which may not share the same priorities as the fire department.

The greatest uncertainty is associated with all-volunteer departments which is probably due to the involvement of other service providers. That said, the width of the budget cuts error bar indicates that regardless of who provides the services, budget cuts to public education were not limited to any one provider. The changes in mean location and error bar widths across the different department types is probably indicative of how the 3E public education service is perceived and delivered. Activities considered to be public education run the gamut from fire station visits by local school classes to evidence-based

[7] Risk Watch is an NFPA developed program targeted at grade school children that teaches fire and injury prevention. The program is designed to be delivered through local school systems in cooperation with local fire and other public safety organizations.

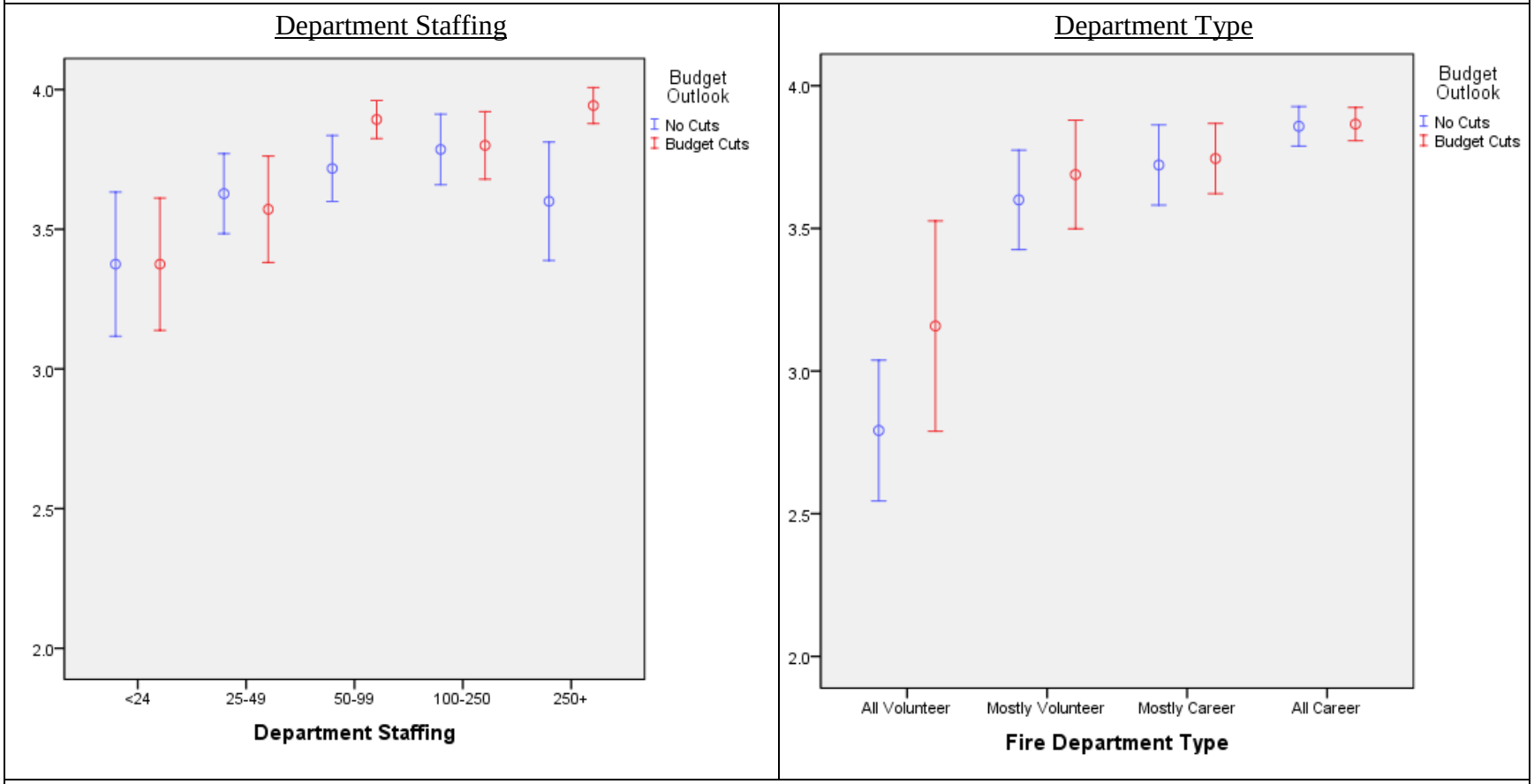
programs, such as Remembering When[8]. All-volunteer and mostly-volunteer departments are probably focused on the less resource intensive public education activities rather than those programs that deliver a measurable product. This would hold true in the fire departments focused on growth and were protecting expanding communities prior to the Great Recession. From a budget cuts perspective and certainly not in every case, this means that comprehensive programs get cut in mostly- and all-career departments, while scattershot activities are curtailed at the all-volunteer level.

The last 3E service reviewed is fire-arson investigation, found in Figure 5.5. This service occupies a unique and important role in fire prevention. Public attention focuses on the arson investigation side, since it involves solving a crime. However, it is general fire investigation that carries the most benefit to overall fire prevention efforts. Fire investigation focuses on determining origin and cause (O&C), which must occur before a finding of arson can be made and further investigation begins. Arson is intentional and only a small slice of the total fires that occur. In its fullest extent, fire investigation also looks at human behavior, and structural and fire protections systems behavior. It is the all-important feedback loop to plan review, code enforcement, and public education. Fire investigation identifies what worked, what did not work and why, how did human behavior contribute to the losses, and what are the emerging fire problems. As important as it is to the fire department mission, it is also the 3E service most-likely provided by another local department or external provider.

Looking at both panels in Figure 5.5, the involvement of external service providers is evident in all categories of department staffing and department type, though with changing

[8] Remembering When is a comprehensive 16-point fire and fall prevention program developed by NFPA and targeted at older adults that can be delivered in a variety of formats.

**Figure 5.5: Budget Cut Environment for Fire-Arson Investigation**




Note: Results are from a convenience sample comprised of respondents to a survey on budget cuts to 3E fire prevention services. A score of 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, and 4 = service is provided by local fire department. n = 1200. Confidence interval = 95%. Mean values are unweighted and calculated from the entire convenience sample.

emphasis across those spectrums. One significant observation in the staffing panel is that for categories 50-99 and 250+, local fire department provided fire-arson investigation is more likely cut. When external providers deliver the service the likelihood of cuts decreases substantially. Considering the associated error bars in these two categories, those surrounding the predicted mean for cuts are tight, indicating that there is little variation in the data. Whereas, the error bars for no cuts are considerably wider indicating much greater variation in delivery practices. Further, no or minimal overlap of the paired error bars in these two categories indicates minimal chance that they have the same value ($p<.005$). In other words, for fire departments in these two categories, department size influences the decision to cut services and does not support the null hypothesis. For the other three categories under staffing there is not seem to as great a differentiation between means of cut and no cuts, though there is a small fluctuation in the means for the 25-49 category. This possibly indicates that alternate delivery schemes get cut more often. However, the overlap of the error bars for each these three categories is such that differentiation of values is not possible.

One potential reason for this observed difference in the 50-99 and 250+ categories is that for the crime of arson, there is always the fallback of turning the service over to the police. Fire departments traditionally perform origin and cause (O&C) investigations, but not necessarily arson investigation. Fire O&C investigation emerge as an important function fairly early in fire department growth. Arson investigation does not. Both require specialized knowledge and training. However, with arson there is the addition of legal concerns. In smaller and volunteer-oriented departments, the burden of training and equipping fire investigators is much higher. Consequently, we see a much greater

involvement of local and state law enforcement agencies with these levels. As departments get larger and increase their career complement, it is more likely that the responsibility for fire and arson investigation is consolidated under the fire department, which can be seen in the department type panel in Figure 5.5.

Under the department type panel in Figure 5.5, the most noticeable trend is the increase in index score as departments move from all-volunteer to all-career. Coupled with the decreasing width of the error bars, this indicates that responsibility for fire-arson investigation is increasingly concentrated under the fire department. While obvious with all-volunteer and mostly-volunteer departments, scrutiny of the four paired means finds that fire-arson investigation has a slightly greater chance of being cut than not, though the error bars indicate no statistically significant difference. Overall, for the fire departments with any career personnel, I cannot reject the null hypothesis. However, for all-volunteer fire departments, I can make the argument that department type likely influenced the service cut decision ($p<.1$).

As with the other 3E services, there is increased provision by other sources when the local fire department is all-volunteer. However, when compared against the other 3E services (Figures 5.1 through 5.4), fire-arson investigation reverses the likelihood of budget cuts versus no cuts. The mean for budget cuts is significantly higher on the scale than no cuts. This demonstrates that fire-arson investigation is cut at the local provision level, regardless of who is providing the service. When contracted out, fire-arson investigation has a better chance of not being cut. This relationship continues through the other department types, though gradually decreasing in disparity until there are almost equal chances with all-career departments.

Prior to the Great Recession, suburban communities were experiencing substantial growth in residential markets as new homebuyers migrated out of center cities. This would have increased overall fire service demand in these communities. Such suburban fire departments were likely focused on expanding their emergency response capacity even at the expense of other services. It also follows that after the onset of the Great Recession, overall fire department demand in these communities further increased as the downturn increased the level of poverty in these communities (Jennings 1999, Wiltz 2014). Many fire departments and fire marshal's offices further expected that the run of foreclosures would result in increased arson and suspicious fires and took steps to prepare, such as cross-training. However, the much-anticipated rise in fire and arson rates did not materialize. Business continued as usual in this case. If cuts were made, there was no net loss of community level services, only a transfer of responsibility for arson fires due to legal requirements, though the fire department reports this as a budget cut.

Regression Analysis of Independent Variables on Budget Outlook

To further develop my analysis for the second research question, I also include logistic regression which simultaneously controls for effects related to my independent variables. Logistic regression is a proper method for exploring potential relationships between dichotomous dependent and numerous independent variables (Aldrich and Nelson 1984, Pampel 2000, Johnson and Reynolds 2012). I run two models regressing the control variables of *Total Staffing*, and *Department Type* against the dichotomous dependent variable, *Budget Outlook*. The first model also includes the control variable of *3E Index*, which is the average score of the five combined 3E services. The second model includes the

separate five categories of 3E services as control variables in lieu of the singular 3E Index. These models are found in Table 5.4.

**Table 5.4: Logistic Regression of Department Budget Cuts**

| | | Index | | | Individual Services | |
|---|---|---|---|---|---|---|
| Control Variable | β | (s.e.) | p | β | (s.e.) | p |
| Total Staffing | .17 | .06 | .01 | .18 | .06 | .01 |
| Department Type | .30 | .09 | .00 | .28 | .09 | .00 |
| 3E Index | -.26 | .25 | .28 | | | |
| Plan Review | | | | -.39 | .19 | .04 |
| Inspection – New | | | | .10 | .25 | .68 |
| Inspection - Existing | | | | .07 | .22 | .75 |
| Public Education | | | | -.32 | .18 | .08 |
| Fire-Arson Investigation | | | | .19 | .12 | .12 |
| Constant | -.54 | .84 | .52 | -.09 | .95 | .92 |
| Observations | | 827 | | | 827 | |
| -2 Log Likelihood | | 1115.86 | | | 1106.44 | |
| Chi-square | | 30.59 | | | 40.02 | |
| Degrees of Freedom | | 3 | | | 7 | |
| *P*-value | | .00 | | | .00 | |
| Nagelkerke $R^2$ | | .05 | | | .06 | |

Note: Logistic regression results from a convenience sample of survey respondents answering all five 3E service questions. Budget outlook is a dichotomous variable drawn from FPC Survey question 12 (i.e., Has your organization made cuts to fire prevention services in the last two years?) with values 0 = no cuts, 1 = budget cuts. The control variables tested are ordinal variables. Total Staffing: 1 = <24, 2 = 25-49, 3 = 50-99, 4 = 100-250, 5 = 250+. Department Type: 1 = All Volunteer, 2 = Mostly Volunteer, 3 = Mostly Career, 4 = All Career. 3E Index is the aggregate score: 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, 4 = service is provided by local fire department. Plan Review, New Construction Inspection, Existing Building Inspection, Public Education, Fire-Arson Investigation are the individual 3E services: 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, 4 = service is provided by local fire department.

Table 5.4 shows that the first model, incorporating the three independent variables, was statistically significant with $\chi^2 = 30.59$ ($p<.001$, df = 3, n = 827) and a reasonable fit. The full model distinguishes between those departments likely to make budget cuts to fire prevention services versus those that do not make cuts, though the Nagelkerke R square value (.05) exhibits a relatively small value, which is often found with survey research data

such as these. The full model correctly classified 52.2% of the true positives and 66.0% of true negatives. It has a positive predictive value of 59.9% and a corresponding negative predictive value of 60.4% (Pallant 2016).

Considering the control values next, Table 5.4 shows that *Department Type* has the most statistically significant influence ($p<.001$), followed by *Total Staffing* ($p<.01$). The coefficient for *Department Type* ($\beta = .30$) is positive and shows that changes in its value generates a reasonably robust change in the probability of budget cuts as one moves from volunteer departments to all career departments. In other words, the more career-oriented a department is, the more likely 3E services will face budget cuts. Changes in *Total Staffing* ($\beta = .17$) also produce independent changes in the probability of budget cuts. More staffing increases the likelihood of fire prevention budget cuts. On the other hand, the combined *3E Index* ($p<.30$, $\beta = -.26$) is not significant at traditional probability levels, but it does show some residual strength with respect to direction. The negative parameter would suggest that the greater provision of 3E services is a related to a smaller probability of budget cuts, although it is not significant. Below I control for the separate 3E services and find that some types are significantly related to budget cuts, while others are not.

The Wald statistic also indicated the same hierarchy of influence on the likelihood of budget cuts with values of 12.48 (*Department Type*) and 7.90 (*Total Staffing*). The odds ratio for the two control variables are 1.35 (*Department Type*) and 1.19 (*Total Staffing*). Thus, as department type changes from all-volunteer to all-career, study sample respondents were roughly one-third more likely to report budget cuts. Similarly, each increase in staffing category size is associated with a 20% greater likelihood of reporting budget cuts. The 3E Index is not significant at traditional levels, so it is not considered.

The first model in Table 5.4 tells me that *Department Type* exerts the most influence on the likelihood of budget cuts, followed by *Total Staffing*. However, *3E Index* or how many services are provided and who provides them could act as a counter-influence. In short, the more career personnel in the department, the greater probability of fire prevention budget cuts, but providing more fire prevention services *might* have some ameliorative influence. To further investigate that effect, I separately control for the different 3E categories in the next model configuration in Figure 5.4.

The first thing noticeable in the second model is the consistency of the coefficients and significance of *Department Type* and *Total Staffing*. Significance does not change, while influence of *Department Type* drops by .02 points and the influence of *Total Staffing* increases by .01 point. This second model correctly classified 52.9% of true positives, with a sensitivity of 64.3%. It has a positive predictive value of 57.9% and a negative predictive value of 59.6%.

Looking at the individual 3E services, the second model shows that *Plan Review* ($p<.05$) and *Public Education* ($p<.05$ single tail test) are statistically significant. Both of these variables have fairly large negative coefficients, $\beta = -.39$ and $\beta = -.32$ respectively, meaning that higher scores are associated with decreases in the likelihood of budget cuts to the service. The p-value for *Fire-Arson Investigation* shows some marginal strength ($p<.10$ single tail test), so there may be a slight positive influence related to budget cuts. The p-values for *New Construction Inspection* ($p\leq.68$) and *Existing Building Inspections* ($p\leq.75$) are not meaningful with respect to likelihood of budget cuts. Wald statistics confirm that of the five 3E services, *Plan Review* (4.19) has the greatest influence on the possibility of budget cuts, followed by *Public Education* (3.08), and *Fire-Arson Investigation* (2.37).

Looking to the odds ratios given, for every unit increase in the *Plan Review*, the likelihood of respondents reporting budget cuts is .68 time less likely. For *Public Education*, the likelihood of reported budget cuts is .72 time less likely. Judging from the two models, I can conclude that *Department Type* and *Total Staffing* contribute to the likelihood of budget cuts, while higher 3E Index scores decrease the likelihood of budget cuts. Specifically, *Plan Review* and *Public Education* exert influence against budget cuts. Inspections appear to have no influence either way, while *Fire-Arson Investigation* exerts minimal budget cut pressure.

**Chapter Conclusions**

I explored this second research question concerning which 3E fire prevention provision schemes were affected by the Great Recession. At this moment, many local governments have yet to fully recover and history foretells another downturn is forthcoming. My examination began at the organizational level. I looked at the effect of community population, department size, and fire department type on the probability of fire prevention service budget cuts. In the following sections, I inspected program level data. I examined the probabilities of budget cuts for each 3E service according to department staffing and fire department type. Finally, I compared the 3E Index with the individual 3E services. I started with the same convenience sample discussed in Chapter 3. However, I used survey question 12 to operationalize my inquiry and refine my study sample. Respondents that did not answer question 12 were listwise deleted, leaving a smaller study sample (n = 827). Of this smaller study sample, 826 of the respondents indicated that the organization had a dedicated fire prevention unit, which is worth noting for later study.

I analyzed the organization level budget cut factors using cross-tabulation. I found clear evidence of trends showing that as communities and departments increase in size, the

percentage of departments making budget cuts also increases. Another striking observation is the sharp uptick in the percentage of departments making cuts in the largest category of each independent variables. This means that the largest departments in the largest communities made budget cuts to fire prevention. This is probably the result of the uneven impact of the Great Recession and following recovery. Charles (2019) observes that half the economic recovery since 2010 occurred in the nation's 20 largest metro areas. The author further noted that roughly half of net new business in the decade following the onset of the recession was limited to Washington, D.C. and New York City. The vast majority of urban areas were very much struggling to balance their budgets.

The observation that budget cuts are mainly focused on the largest populations and departments is followed by the same pattern in department types. Once departments are majority career, the percentage of departments reporting budget cuts to fire prevention increases dramatically. This pattern is also tied into the economics of the downturn. There is a relationship between population size and department type. Larger communities lean towards mostly- and all-career fire departments.

The common denominator for all three organizational level variables appears to be the ratio of career personnel to total department staffing as defined by department type. Obviously, the trend of all-volunteer to all-career reflects this. Data from this study sample also shows that as departments increase in size, they tend to migrate towards all-career, with population more than likely driving that shift. Personnel costs account for the largest proportion of expenditures and potential savings in local government – more paid personnel, more potential savings.

I next examined which 3E services were impacted by cuts. Looking across all five 3E services, I found that the greatest variability in provision schemes and lower index scores were associated with the departments in the <24 personnel and all-volunteer department categories. This indicates greater inclusion of delivery by other entities. While some of these departments may deliver all five 3E services, the majority do not. Examination of respondent level data finds that those respondents from these groups who deliver all five 3E services are most-likely non-response oriented, such as standalone fire marshal's offices.

Analysis results also indicated that plan review is more resistant to cuts when provided by local government, including the fire department. The most-likely explanation is that plan review is often associated with a revenue stream accepted by developers and builders as a cost of doing business. Where inspections are concerned, there appears to be greater chance of preserving new construction inspections when the local fire department is either all- or mostly-volunteer and the service is provided by other entities. This would follow from being part of a revenue stream. Whereas, for mostly-career and all-career departments, there is no differentiation. In all probability, these inspections are tax-supported, as is the case for existing building inspections. All things being equal, department size seems to be the driver of budget cuts in inspection services.

As expected, data shows that where public education is concerned, the local fire department is the most numerous provider. Regardless of department size or type, there appears to be a greater likelihood of no cuts being made. This service is not heavily dependent on resources, is easily transferred to emergency response units, is non-confrontational, and helps maintain the desired public image of the local fire department.

Public education frequently doubles as a public relations tool. Cuts to this service run counter to the best interests of the local fire department.

Results for fire-arson investigation do not show any systematic relationship with department staffing. Two categories (i.e., 50-99 and 250+) show a greater propensity toward cuts than not. For volunteer-oriented departments, budget cuts are more likely, while in career-oriented departments, the probability of budget cuts is about even. This indicates that volunteer-oriented departments, if they provide the service, have a fallback option for fire-arson investigation, such as the state fire marshal's office. Many, of these external agencies automatically involved if a crime is suspected. O&C investigations do not hold the same level of urgency and budget cuts are more easily made.

In the last part of my analysis for this second research question, I look at the likelihood of budget cuts as influenced by total staffing, department type, the 3E Index, and the individual 3E services. Two logit regression models found that department type ($p$ <.01) has the greatest effect on the probability of budget cuts, followed by staffing levels. Taken together, these show that as the proportion of career employees in the personnel complement increases, so too does the likelihood of budget cuts.

As important, the 3E Index model suggests that higher scores may decrease the probability of budget cuts (β =-.26, $p$ = .28). However, in the second model plan review (β = -.39, $p$ <.05, two-sided test) and public education (β = -.32, $p$ <.1, two-sided test) express an association with lowering chances of budget cuts. I believe this indicates that generally, the 3E Index is inversely related to the chance of budget cuts. However, data for the other services creates sufficient noise in the model to warrant discretion.

Discussion

Following the trend that seems most obvious from Tables 5.1, 5.2, and 5.3, that career personnel increases lead to greater possibility of budget cuts to 3E services. This means mostly- and all-career departments face budget cuts more frequently than mostly- and all-volunteer departments. Taking the trend another step leads to the eventual observation that the largest departments and communities are cutting fire prevention to balance budgets. More telling, the budget cut trendlines for community and department size accelerate with the largest categories of each. It appears that fire departments in the largest communities are most frequently hit by cuts. This should not be construed however, to mean that smaller community fire departments are faring better in fire prevention. A quick look at population data shows that communities in two categories 25K-50K and 50K-100K were also especially hard hit, but not as a proportion of total communities at that size.

Furthermore, data shows that smaller communities are more likely to outsource certain 3E services or simply not provide these services. Thus, when budget cuts hit 3E services, there are fewer to cut. The net effect of budget cuts is probably be more extreme than with larger communities.

Looking at individual services, plan review is easily provided by private engineering firms. Among survey respondents, 7% (n = 13) of plan review not provided by the local fire department was contracted out. Only, 2% (n = 5) reported contracting out new construction inspections. For both services, budget cuts were about 50%. The major concern here is losing control over the service and its quality (Mohr, Deller, and Halstead 2010). A conflict of interest situation is easily foreseeable and the local government lacks the expertise and capacity to exercise quality control.

On the other hand, fire-arson investigation is outsourced to other government entities by 17% (n = 142) of the survey respondents. This practice ensures both provision and general quality of the service. Most likely, who provides service is dictated by statute. However, data indicates that the only 41.5% (n = 59) of these made budget cuts versus a rate of 52% (n = 356) among fire department providers.

Existing building inspections and public education present special situations. Neither service is easily outsourced except to another local government entity and generally are not mandated by law. Data shows that existing building inspections are outsourced to another government entity by about 9.5% (n = 78) of survey respondents, while public education is outsourced by only 2.7% (n = 22) in the survey sample. For both services, the budget cut rates were roughly 38% and 58%, respectively. For public education, it is almost equally the case (n = 16) that the service is not provided.

A parallel observation that accompanies community and department size, and department type, is that the large departments more than likely provide all five 3E services. Chapter 4 clearly established the relationship between department size and the 3E Index. As departments increase in size, they also increase the number of 3E services provided. This trend is also evident as fire departments transition from all-volunteer to all-career. Taken to its end, the result is that the largest all-career fire departments protecting the largest communities likely provide all five 3E services and are more likely to make cuts to these services.

From a fire protection standpoint, this is problematic. Fire prevention is a key component of a community's fire protection. Fire risk is greatest in densely population communities, exactly where fire prevention cuts are being made. Scholars have shown

improved fire protection and economies of scale when both services are provided (Duncombe 1992, Duncombe and Yinger 1993, Donahue 2004a). Large communities that make cuts to fire prevention services may actually be increasing their cost of fire protection. The likely result is increased service demand, both in terms of volume and severity. This will increase the demand for more emergency response resources, leading to additional cuts to fire prevention and other areas. Communities become locked into a cycle of sub-optimal choices.

Having established that fire prevention budget cuts are more likely in larger, career-oriented departments, the next logical question is to look specifically at which services are being cut. One thing that becomes apparent when looking across all five 3E services from department staffing and department type perspectives. This is certain services have an increased likelihood of budget cuts depending on whether or not it is provided by the local fire department. Plan review seems more resistant to budget cuts than not regardless of which perspective taken. The only other service that appears to have systemic resistance to budget cuts is public education, though this is marginal in some categories. Otherwise the data is conflicting across categories.

Plan review is normally associated with a revenue stream regardless of who provides the service. Demand for plan review and new construction services slow down, but generally does not disappear during downturns. Instead, renovations and additions become their mainstay. Building and fire codes frequently call for a plan review for such smaller reconstruction projects, but may do away with the inspection requirements based on the square footage or alteration of existing building components. Local governments will likely avoid cutting back on plan review only to the extent it can meet service demand and retain

self-funding. In jurisdictions where plan review is tax-funded, new construction increases tax revenues and again, will be resistant to budget cuts.

Public education occupies a unique role in fire prevention. First, it is recognized as the cornerstone service. Public education has a synergistic effect on every other fire prevention service (May and Wood 2003). Second, public education is not coercive. Citizens and businesses participate at their own choice. Failure to participate carries no penalty other than an increased risk, which generally goes unrecognized (Clark, Smith, and Conroy 2015), and costs are distributed to the community rather than being borne by the individual (Brueckner 1981). Third, public education requires few dedicated resources, unlike the other 3E services. Finally, public education places the fire department in a positive light. Firefighters are viewed as subject matter experts by the community. In a nutshell, 3E services associated with revenue and the public perception of the fire department are resistant to budget cuts.

This presents a bit of a mixed bag from the view of fire protection. It is a truism among fire prevention practitioners that a building is never safer than the day the certificate of occupancy is approved. From that point forward it is subject to the wear and tear of human occupation. Fire protection systems and inherent fire safety features required during plan review begin to breakdown. The 3E service intended to counteract this gradual failure, existing building inspections, appears to be background noise in the data, so no conclusion can be drawn.

However, it can be said that inspections are a frequent source of complaint, but a critical aspect of maintaining building fire safety. At best, they are viewed as a necessary evil by building owners and occupants. This makes inspections an easy budget cutting target.

Public education on the other hand has been shown to be an effective tool to reducing fire risk at relatively low cost to a community (Schaenman et al. 1990, Ta et al. 2006). Fire safety can be delivered at much lower costs than other of the 3E services. It is easily delivered by emergency response units, making it difficult to cut. Public education outreach by uniformed firefighters has been shown to have higher acceptance and retention rates (Ta et al. 2006). Furthermore, the data shows that public education programs decrease the probability of budget cuts.

Overall, the data demonstrates that communities most likely delivering the most comprehensive fire prevention schemes as measured by the 3E Index will also be the most likely to face budget cuts. These communities tend to be more densely populated and present the greatest service demands, both emergency and non-emergency. They are also likely facing the greatest economic challenges, which were exacerbated by the Great Recession. As for the individual 3E services, programs associated with revenue streams or public image help reduce the chance of budget cuts, while those that are easily shifted to other agencies or result in political fall-out are more likely to see budget cuts. The particular strategies used to implement these cuts are examined in the next chapter.

# CHAPTER VI

## HOW DID DEPARTMENTS WITH DIFFERENT PROVISION SCHEMES STRATEGICALLY APPROACH CUTS TO 3E SERVICES?

Chapter 4 investigated the overarching question of how different jurisdictions provided 3E fire prevention services. It established an index for ranking the service delivery schemes based on how many of these services are provided and who provides each of the individual services. Chapter 5 then looked at how the various delivery schemes were affected by the economic downturn of the Great Recession. That chapter found that, in general, the likelihood of budget cuts followed the proportion of career personnel as measured by fire department type, with total department size following in influence. The introduction of outside service providers can significantly change the likelihood of budget cuts to individual 3E services in either direction. Providing plan review and public education are associated with marked decreases in the likelihood of budget cuts. On the other hand, providing fire-arson investigation increases the prospect of budget cuts. Having gained some insight into which programs departments will likely be affected by cuts, I examine the strategies employed to make those cuts.

This chapter addresses the third question of the study: *How did different provision schemes strategically approach cuts to 3E services?* The decision to cut budgets for individual local government departments is typically made at the political level and

reflects the high-level priorities in a community (Giroux, Mayper, and Daft 1986). Cutback decisions made as a result of economic recession must consider the parameters of size, duration, and urgency (Glassberg 1978, Baker 2011, Perlman and Benton 2012). Each of these factors affects the cutback options available to local government. Deeper and longer downturns require more significant cuts. The pace of the downturn dictates whether local government reaction is "incremental or quantum" (Glassberg 1978, 327).

Existing research indicates that local government will initially approach these cutbacks through across the board cuts. This approach to cuts helps maintain service capacity and shares the burden of cutting back across the various units or subunits of government. It also eases potential political costs by avoiding the prospect of alienating those constituencies invested in particular services (Reddick and Hassan 2003). If the downturn is sufficiently prolonged or severe, then local government will turn to targeted eliminations and major reductions (Scorsone and Plerhoples 2010). At this level of cutback, elected officials forego retaining capacity and deliberately prioritize among the services provided by government. Strategic decisions frequently turn on questions of which services must be provided versus which services constitute amenities. Legal dictates and direct implications on public health and safety often means that the fires service is prioritized ahead of other services (e.g., parks and recreation), but it too faces the threat of the knife.

The specific details of budget cuts are usually made at the department level within politically set performance and resource parameters (Giroux, Mayper, and Daft 1986). As with overall local government reaction, individual departments may also implement across the board or targeted cuts. Departmental belt-tightening involves strategic service decisions that weigh trade-offs within politically prescribed limits while maintaining internal and

external organizational integrity. The focus of the FPC survey, described in Chapter 3, and the premise of this study is the department level reaction to retrenchment. Thus, this research question is aimed at department level strategic choices, rather than at political level strategies for addressing a constrained resource environment.

Numerous scholars have identified a range of cutback strategies that are available to local governmental departments, which can be summarized to include: 1) prioritizing services, 2) shifting services to alternate providers, 3) decreasing service levels, 4) discontinuing services, and 5) building alternative service capacity (Glassberg 1978, Levine 1978, McTighe 1979, Jick and Murray 1982, Packard et al. 2007, Baker 2011, Perlman and Benton 2012). Furthermore, such strategies may be internalized, as in the case of layoffs, or externalized as in decreased service hours for staff (McGowan and Stevens 1983). The literature on these cutback strategies points to personnel cutbacks as the primary method of budget balancing during the Great Recession (Scorsone and Plerhoples 2010, Perlman and Benton 2012) and that premise is consistent with the previous literature (Caiden 1981, Levine, Rubin, and Wolohojian 1982, Bozeman 2010) on cutback strategies.

As discussed in chapter 3, the FPC survey captured cutback strategy information through a series of questions found in its second section. The survey work group identified three expected methods of cutting 3E services, including: cutting personnel, cutting the number (or level) of services provided, and cutting back on the resources needed for job performance. Of these three, I focus on personnel cuts, since service delivery is achieved through people and it includes some measure of the other two identified methods. In the next section, I examine whether cuts were across the board or targeted, whether strategic orientation was short-term or long-term, and whether cuts were internalized or externalized.

**Strategic Reactions to Budget Cuts**

My analysis of this third research question is grounded in established cutback practices (Glassberg 1978, Levine, Rubin, and Wolohojian 1982, Stipak and O'Toole 1993, Scorsone and Plerhoples 2010). I look into whether the fire departments and other 3E service providers adopted strategies in the same manner as those identified in the literature. The literature points to across the board decremental cuts as the first reaction of local government in the face of downturns with the expectation is that the downturn will be short-lived and recoverable. Targeted cuts come into play when the fiscal situation is dire or extended. Thus, the principal strategic question is whether across the board, or targeted cuts, were implemented. An analysis of whether cuts were across the board or targeted also provides some indication of the depth of the financial impact on local fire departments and other service providers.

Initial Strategic Reactions

I examine initial strategic reactions to budget cuts by exploring whether cuts were made across the board or targeted by comparing department level budget cuts to 3E service budget cuts. The survey work group expected that overall department level cuts would drive cuts to fire prevention services. However, recognizing the size disparity between emergency response forces, fire prevention units, and their respective budgets, the survey work group selected different scales in the survey question responses.

I operationalize this examination through FPC survey questions 14, 15 and 20. FPC survey question 20 (n = 263) asked: *Did any other work units in the department experience cuts?* Respondents indicated that cuts were shared across work units in 73% (n = 193) cases and were targeted only at fire prevention in 27% (n = 70) cases. This establishes that a

preponderance of departments approach cuts from the perspective of sharing the burden. However, this perspective lacks nuance. The other two questions provide more detail.

Question 15 (i.e., *What percent of the fire prevention work unit(s) budget was cut?*) lists six categories of cut levels ranging from <5% to 25%+ in five percent increments. These categories provide the dependent variable. They were recoded to round categories values to whole numbers for consistency, to collapse a category of extreme values, and subsequently retitled *Budget Allocation*. Question 14 (i.e., *What percent of the overall department was cut?*) provides the independent variable. The survey provided for six possible categorical answers ranging from <2.5% to >15%, in two and half percent increments except for the final five percent category.

The comparison of department level cuts and fire prevention unit cuts were made using cross-tabulation. Respondents that did not answer both questions were listwise deleted to provide the study sample (n = 366). As Johnson and Reynolds (2012) note, cross tabulation is an appropriate method for examining the relationship between categorical ordinal variables. I report both the chi-square and gamma test statistics. Chi-square tests the chance that two sets are related or independent. Gamma expresses the strength of any relationship and its direction. I also report the p-value indicating the probability that any relationship is a chance occurrence. Table 6.1 presents the comparison data. In this particular table, the dependent variable is shown on the X-axis and the independent variable is shown on the Y-axis. While not presented according to convention, visual analysis of the data is clearer.

I use the proportionality of cuts to provide some indication of whether cuts were made across the board or targeted. I expect that, in aggregate, cuts to 3E services that are

**Table 6.1: Department Budget Cuts Compared to 3E Service Budget Cuts**

| | | 3E Services Budget Cuts | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | <5% | 5-9% | 10-14% | 15-20% | 20-25% | 25%+ | Total |
| Overall Department Budget Cut | <2.5% | 36 | 8 | 5 | 3 | 1 | 2 | 55 |
| | 2.5-4.9% | 39 | 20 | 9 | 3 | 5 | 9 | 85 |
| | 5.0-7.4% | 16 | 18 | 14 | 3 | 9 | 4 | 64 |
| | 7.5-9.9% | 3 | 10 | 3 | 4 | 4 | 3 | 27 |
| | 10-15% | 5 | 18 | 29 | 5 | 13 | 6 | 76 |
| | >15% | 4 | 2 | 8 | 12 | 23 | 10 | 59 |
| | Total | 103 | 76 | 68 | 30 | 55 | 34 | 366 |

Note: Crosstabulation results from the convenience sample comprised of respondents to a survey on budget cuts to 3E fire prevention services. n = 1200. This particular table evaluates cuts made to 3E fire preventions services relative to overall department budget cuts. Valid cases n = 366. Missing cases n = 834. Pearson Chi-Square = 157.03, $p<.001$, two-sided test. df = 25. *gamma* = .49.

reasonably commensurate with overall department level cuts are indicative of across the board cuts. Whereas cuts to 3E services that are disproportionately larger or smaller than overall department level cuts are indicative of targeted cuts. However, fire prevention budgets are only a fraction (3% - 5%) of overall department budgets (NCFPC 1973, Schaenman 1993), so it would be difficult to make up a significant shortfall by limiting cuts to fire prevention.

Table 6.1 compares department level cuts with fire prevention unit cuts. A visible trend, bounded by sharp drops in value runs from the upper left to bottom right of the table. This tells me a majority of departments made reasonably commensurate across the board cuts. This is consistent with previously observed cutback behavior in local government. Test statistics indicate there is a relationship between department level budget cuts and 3E service budget cuts (chi-square = 157.03; 25 df; $p<.001$ two-sided test), so the null hypothesis is rejected. Data from the sample also indicates a strong, statistically significant positive connection (*gamma* = .49, $p<.001$) between department level cuts and 3E service cuts (Laerd Statistics 2016).

In addition, I find some clear evidence of disproportionality at both ends of the scale that mostly disfavor 3E services and are suggestive of targeted cuts. In the upper right corner, the table shows that multiple departments made dramatic cuts to 3E services compared to overall department cuts. Accepting that personnel costs typically take up 85%-90% of fire department budgets, budget cuts exceeding 20% of a budget allocation must involve loss of personnel and 3E service capacity. The closer a department moves to the upper right of the table the more targeted the budget cuts become with regard to fire prevention. At the diagonally opposite corner of Table 6.1 lie departments that seemed to

prioritize 3E services over other organizational units. As can be seen, however, relatively few departments appear to be making this preventative type of investment in 3E.

One possible reason is that these communities have already cut as much as possible from fire prevention short of abandoning the service, and are making cuts elsewhere. Declining central cities and suburbs, such as those found in the Rust Belt, lacked the resources to respond effectively to the downturn. Likewise, in those places experiencing rapid housing growth, employment and local government finances were based on the construction industry. Departments protecting either declining central city suburbs or those experiencing vigorous economic growth prior to the Great Recession were especially hard hit. Targeted cuts may reflect severely financially stressed departments.

Across the board cuts appear to be the more likely reaction to an economic downturn for those departments that made cuts. Emergency response and fire prevention share the stress of cutbacks. However, this does not mean that all five 3E fire prevention services were equally affected. Looking back to chapter 3, the 3E service index clearly shows that other agencies are involved in service delivery or the particular services may not be provided. Other service providers external to the fire department likely have different budget priorities. For example, building departments may emphasize retaining plan review over existing building inspections since this is a service that is frequently associated with significant revenue generation. Even within dedicated fire prevention units, different priorities may emphasize prevailing conditions within the community. A community experiencing growth will probably prioritize plan review and new construction inspections over existing building inspections. Conversely, an older and more stable community may emphasize existing

building inspections and public education to minimize risk of ignition. The next reasonable step is to evaluate how retrenchment strategies affected the individual 3E services.

Strategies Affecting Individual 3E Services

I examine the specific cutback strategies departments employed by assessing the likelihood of cuts to each 3E fire prevention service. In a study of local government managers, Stipak and O'Toole (1993), identified four basic reactions or strategies to fiscal stress: 1) reduce services, 2) raise revenues, 3) improve productivity, and 4) shift services. This section examines cuts to specific 3E services, which fall under the reduce service strategy. At the same time, I will build upon the last section's observation that across the board cuts seem to be the default strategy for departments, while looking for signs of prioritization. Question 20 established a broader approach to cuts, but does not lead to conclusions regarding prioritization among the 3E services. It is possible that all elements within a department experienced cuts, but that one particular service was targeted to bear the brunt of those cuts.

I operationalize this section of the research through FPC survey question 16 (i.e., *Which FP services were affected by budget cuts?*). Question 16 provided for five possible answers, four of which concerned specific service categories and the fifth listed "other". It allowed respondents to select all services that were affected. Each of the four possible service answers (fire investigations, code inspections, plan review, and public education) were recoded into separate dependent variables for this analysis[9]. "Other" (n = 29) was dropped from the analysis as most respondents used this option to clarify cuts captured in the

[9] Note than new construction inspections and existing building inspections are combined in this question. The survey work group felt that within any one department providing 3E services, the same individuals are probably providing both new and existing structure inspections.

specific service categories and did not add to the analysis. My study sample for this line of inquiry was developed by filtering the original sample set with question 16 respondents. This provided 813 observations and seven distinct independent variables.

In this section I examine the likelihood that any one of the 3E services is cut. I use logistic regression to test the relationship between two categorical variables (Aldrich and Nelson 1984, Pampel 2000, Johnson and Reynolds 2012). My dichotomous dependent variables are based on the recoded categories from FPC question 16 described above. The recoded variable permit only two conditions regarding budget cuts, yes = 1 when answered, or no = 0 if unanswered. I ran four models, one each for plan review, code inspections, public education, and fire-arson investigation. Each model regresses the control variables of total staffing, fire department type, and each of the five 3E services on the individual dependent variable indicated. These models are found in Table 6.2.

*Plan Review*

The first model, *Plan Review* is seen in Table 6.2. Of the individual control values tested in the model, two demonstrated statistical significance. Department type ($p$ <.1) and existing building inspections ($p$ <.05) are statistically significant. Coefficient values show that of the two, existing building inspections (β = 1.03) has a much greater influence than department type (β = .24) on the probability that plan review is cut. Two other control variables, total staffing ($p$ = .20) and public education ($p$ =.20) exhibited residual strength and are considered only for direction of influence. Total staffing's coefficient is positive (β = .11) indicating that this variable increases the likelihood of cuts, whereas public education's coefficient is negative (β = -.25) indicating that it decreases the likelihood of cuts to the

**Table 6.2: Logistic Regression of Budget Cuts to Individual 3E Prevention Services**

| | Plan Review | | | Code Inspections | | | Public Education | | | Fire-Arson Investigations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Variable | β | (s.e.) | p | β | (s.e.) | p | β | (s.e.) | p | β | (s.e.) | p |
| Total Staffing | .11 | .09 | .20 | .17 | .07 | .02 | .14 | .07 | .04 | .33 | .09 | .00 |
| Department Type | .24 | .13 | .06 | .35 | .11 | .00 | .14 | .09 | .12 | .12 | .13 | .35 |
| Plan Review | -.23 | .24 | .34 | -.43 | .20 | .04 | -.36 | .19 | .06 | -.27 | .25 | .29 |
| Inspection - New | .06 | .33 | .85 | .12 | .28 | .68 | .41 | .26 | .12 | .11 | .35 | .74 |
| Inspection - Existing | 1.03 | .51 | .04 | .67 | .34 | .05 | -.05 | .23 | .82 | .34 | .40 | .40 |
| Public Education | -.25 | .20 | .20 | -.30 | .19 | .11 | -.40 | .18 | .02 | -.05 | .23 | .83 |
| Fire-Arson Inv. | -.02 | .17 | .92 | .25 | .15 | .10 | .06 | .13 | .65 | -.05 | .17 | .76 |
| Constant | -5.13 | 1.91 | .01 | -3.83 | 1.33 | .00 | -.12 | .97 | .90 | -3.67 | 1.58 | .02 |
| Observations | | 813 | | | 813 | | | 813 | | | 813 | |
| -2 Log Likelihood | | 712.40 | | | 937.74 | | | 1044.27 | | | 657.80 | |
| Chi-square | | 21.82 | | | 52.28 | | | 20.83 | | | 22.72 | |
| Degrees of freedom | | 7 | | | 7 | | | 7 | | | 7 | |
| *P*-value | | .003 | | | .000 | | | .004 | | | .002 | |
| Nagelkerke $R^2$ | | .05 | | | .09 | | | .04 | | | .05 | |

Note: Logistic regression results from a convenience sample of survey respondents answering all five 3E service questions and indicated that cuts had been made to particular 3E services in FPC Survey question 16 (n = 813). Budget Cuts to Plan Review, Code Inspections, and Public Education are dichotomous dependent variables with values 0 = no cuts, 1 = budget cuts. The control variables tested are ordinal variables. Total Staffing: 1 = <24, 2 = 25-49, 3 = 50-99, 4 = 100-250, 5 = 250+. Department Type: 1 = All Volunteer, 2 = Mostly Volunteer, 3 = Mostly Career, 4 = All Career. 3E Services Provided (Plan Review, New Construction Inspection, Existing Building Inspection, Public Education, Fire-Arson Investigation): 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, 4 = service is provided by local fire department.

dependent variable *Plan Review*. While not shown in the table, Wald statistics and odds ratio values indicate a similar pattern of significance for these same variables.

The values in this first model suggest that if a fire department provides existing building inspections, it increases the likelihood of cuts to plan review. Further, as fire department type changes from all-volunteer to all-career the likelihood that plan review will face cuts increases. Drawing on the observations from the previous two chapters, this means that larger departments in populous communities are more likely to be making these cuts. For a community hard hit by the Great Recession and struggling financially, this will increase overall fire risk and service demand. Total department staffing exerts influence towards cuts, while public education tends to offset that influence in favor of decreasing the likelihood of cuts. In total, large all-career fire departments providing existing building inspections in their fire prevention service suite are more likely to experience plan review cuts.

The full model with all predictors included is statistically significant with $\chi^2 = 21.82$ ($p = .003$, df = 7, n = 813). Test statistics indicate the model as a whole is a reasonable fit and distinguishes between respondents that reported cuts to plan review and those that did not. The model correctly classifies 83% of cases. Running the model including the control variable produced no change in predicted values from the model run without control variables (Pallant 2016).

*Code Inspections*

In Table 6.2, the model *Code Inspections*, finds that with the exception of new construction inspections ($p = .68$), all the others were statistically significant at the various accepted levels ($p<.1$, $p<.01$, $p<.001$). In order of influence, department type ($p = .00$), total

staffing ($p$ = .02), plan review ($p$ = .04), existing building inspections ($p$ = .05), and fire-arson investigation ($p$ = .10) all contribute substantially to the predictive value of the model. Public education ($p$ = .11) is borderline. Coefficient values show that existing building inspections (β = .67) most-likely produces the greatest change in the likelihood of *Code Inspections* being cut, followed by the opposite influence of slightly less magnitude with plan review (β = -.43). Despite the seeming contradiction in these values, they actually make sense from a practical view. The dependent variable code inspections includes both new construction inspections and existing building inspections. New construction inspections are typically part of a fee-based plan review process and required as part the building permit. If part of the permit process, their influence would be to dampen cuts to inspections, but would show up as noise in the model. Existing building inspections, on the other hand are tax supported. They generate considerable political and donor-class interference, responsibility is easily transferred either inter- or intra-agency, and their risk impact is difficult to quantify within any given budget cycle. In a nutshell, existing building inspections are an easy target.

Other control variables producing change in the likelihood of cuts to *Code Inspections* include department type (β = .35), fire-arson investigation (β = .25), and total staffing (β = .17). Though statistically borderline, public education (β = -.30) probably contributes significantly to decreasing the likelihood of cuts. Wald and odds-ratio values for each of the control variables follow the same hierarchy of influence and do not add any interpretive value.

In this model, six of the seven control variables contribute influence to the likelihood of cuts to code inspections. The exception being new construction inspections. Departments providing plan review and public education services appear to decrease the likelihood of cuts

to code inspections. However, department demographics of type and total staffing, as well as providing existing building inspections and fire arson investigation increase the odds for budget cuts to code inspections. Looking at this model in total, the values presented seem to show that larger, all-career fire departments face greater odds of cuts to code inspections. Code inspections is most likely to experience cuts, but it will be focused on existing building inspections rather than new construction inspections. This has serious fire risk management implications. As mentioned earlier, no building survives human occupation intact. Normal wear and tear will degrade passive and active fire protection features. Existing building inspections are intended to counteract this influence. In dense population environments, fire protection systems failures put many more persons at risk in a given location. Most fire department staffing and response allocations are predicated on the single family structure (National Fire Protection Association 2009). Fires in large structures require significantly greater emergency response resources to manage. This quickly strips resources from larger geographic regions affecting the ability of a community's emergency resources to address other emergencies.

The full code inspections model also shows that with all predictors included, it was statistically significant, $\chi^2 = 52.28$ ($p = .000$, df = 7, n = 813). The full model is a good fit. It is capable of discerning between departments that made cuts to code inspections and those that did not. The full model correctly classified 70.7% of the cases, but demonstrated minimal improvement (.5%) over the model with none of the control variables included. The complete model has a positive predictive value (true positives) of 59%. Its negative predictive value is 71%.

*Public Education*

In the third model, *Public Education*, only three of the seven control variables are statistically significant. Total staffing ($p$ <.05), plan review ($p$ <.10), and public education ($p$ <.05) significantly contribute to the predictive value of the model. Department type ($p$ <.10, single tail test) and new construction inspection ($p$ <.10, single tail test) are borderline and contribute to the direction of the prediction. Of the three statistically significant control variables, coefficients show that public education (β = -.40) has the greatest influence, albeit negative. This seems to indicate that departments providing public education try to avoid losing the service. Public education has been shown to be a low-investment, high-impact fire safety approach (McConnell, Dwyer, and Leeming 1996a). Further, public education enhances the visibility and standing of the fire department. It is an excellent public relations tool in addition to its primary intent. In terms of magnitude, public education is closely followed by plan review (β = -.36), then total staffing (β = .14). Wald and odds ratio values trend similarly and do not add any predictive value in this model.

This model suggests that as department size increases and department type changes from all-volunteer to all-career the probability of cuts to public education increases. In other words, the larger a department, and the more it leans toward a career roster, will act to increase the likelihood of budget cuts to this service. However, for departments providing 3E services, the odds of cuts to public education decrease if they provide plan review. It may be that two things are happening in response to the downturn. First, departments are making cuts to public education, but they are limited in scope so as to maintain an intact program. Two, the responsibility for public education is being transferred to other organizational

elements. P-values are too large to make assumptions regarding the influence of existing building inspections and fire-arson investigation.

The whole public education model is shown to be statistically significant, $\chi^2 = 20.83$ ($p = .004$, df = 7, n = 813). The full model presents a reasonable fit with all the predictors included and distinguishes between those departments that made cuts to public education and those that did not. The full model correctly classifies 65% of cases. Running the model with all the control variables included produced a one-point improvement in predicting cuts/no cuts to public education, from 63.7% to 64.7%. The model exhibits a 63% positive predictive value and a 65% negative predictive value.

*Fire-Arson Investigation*

The final model in Table 6.2, *Fire-Arson Investigation*, correctly classifies 85.2% of the cases and has a commensurate negative predictive value. It does not demonstrate any positive predictive value. Predicted and observed values did not change between the model run without control variables included and the model run with all control variables included. When looking at the individual control variables in the model, only total staffing was statistically significant ($p <.001$). It's coefficient ($\beta = .33$) shows substantial positive change in likelihood of cuts to fire-arson investigation with change to the value of department size. *P*-values for the remainder of control variables provide nothing of analytic value. The full model, including all control variables was statistically significant $\chi^2 = 22.72$ ($p = .002$, df = 7, n = 813). The chi-square value indicates that the model as a whole, fits and is able to distinguish between departments that made cuts to fire-arson investigation and those that did not. In a nutshell, this model points to total staffing as the sole factor in determining the likelihood of cuts to fire-arson investigation. The larger the department, the greater the

chance of cuts. This tells me that fire-arson investigation is resistant to budget cuts, perhaps because of dual involvement with other agencies and legal requirements. However, given that the only influencing factor is total staffing, when cuts become necessary, they will come from personnel.

*Combined Perspective*

Examining each of the service-based model provides insight into how each service fares in relation to the others. It clarifies which variables in a particular service have the greatest influences on each of the other services provided throughout the four models. Developing the larger picture of cut probabilities among services builds on the primary observation from the previous section, that across the board cuts appear to be the dominant strategy within departments. However, as also noted, cuts may be across the 3E services provided, but particular services may get cut more than others. A global review provides some evidence of prioritization is evident when taking a look at Table 6.2.

The first noticeable pattern follows the total staffing control variable. It is the only variable that exhibits any strength across all four dependent variables, though for plan review it is in direction only. The influence is also in a positive direction. This tells me that total staffing will be a constant factor affecting the likelihood of budget cuts. 3E services in larger departments are more vulnerable to cuts than those in smaller departments. This may be a function of the budget constraints on the largest communities. High levels of emergency services demand may force difficult choices about cuts to ensure that response capacity is maintained, even if it means cutting back other critical functions.

Department type is influential in changing the probability of cuts across plan review, code inspections, and public education, but appears to have no influence on cuts to fire-arson

investigation. Again, the influence in the first three services leans toward increasing the likelihood of budget cuts. As department type changes from all-volunteer to all-career, the probability of cuts to these services increases. The lack of influence on fire-arson investigation is probably due to the high number of non-fire-based service providers (e.g. local and state police) that are beyond the influence of fire department type or, in many cases, is mandated by law and essentially is non-negotiable. All in all, the pattern tells me that for departments providing fire-arson investigation, only department size influences the likelihood of cuts.

With regard to other 3E service-based independent variables, coefficients for plan review and public education are negative across all four dependent categories. However, the independent variable plan review is statistically significant only against code inspections and public education. I take this to mean that when a department provides the plan review service, that provision exerts pressure decreasing the likelihood of cuts to non-investigative 3E services. As a general rule, fees associated with the provision of a government service must be applied to only that service or risk being labeled a tax. However, when one 3E service (or more) is fee supported, it takes budget pressure off of other non-supported 3E services. In essence, fees for one service reduces the competition for scarce resource dollars among the other services. Public education applies influence that decreases the likelihood of budget cuts across three of the dependent variables. This may have more to do with how tasks are allocated across available personnel rather than direct budget pressure on other services. If high-value tasks are distributed, they may influence the opportunity to identify specific costs associated with the provision of other services.

One nuance under the dependent variable code inspections must be mentioned. As indicated before, code inspections includes new construction inspections and existing building inspections. New construction inspections are typically part of the building permit process that includes plan review. They are paid for at time of plan submittal for review. Existing building inspections are stand-alone. If new construction inspections are essentially bundled with plan review, then is seems likely that they would not have a significant influence one way or the other on the likelihood of cuts to the other 3E services.

Looking first at the individual dependent variables from a blanket view, it is obvious that code inspections are most susceptible to influence in either direction from the control variables. However, the balance tilts in favor of increasing the likelihood of budget cuts. Public education also shares predictor variables that point in both directions and appears fairly neutral overall. Plan review responds to existing building inspections and public education. Cuts to fire-arson investigation do not appear to be influenced by any of the other service-based control variables. Looking at the demographic factors, Table 6.2 displays that total staffing has the most extensive roll influencing budget cuts to 3E services. This is followed by department type, with the exception of fire-arson investigation. In a nutshell, I read table 6.2 to say that as departments increase in size and change towards all-career, the likelihood of cuts to particular 3E service increases. And, when budget cuts cannot be avoided, code inspections will be cut first, followed by public education. Cuts to plan review and fire-arson investigation will come only as a last resort. With total staffing being most predictive of cuts, it seems reasonable that those cuts would focus on personnel. In the next section, I will develop further insight into how personnel cut strategies are implemented by local fire prevention managers.

Short-term Strategy - Personnel Cuts

As discussed earlier, the extant literature points to personnel cuts as the most common choice of local government managers to address shortfalls (Scorsone and Plerhoples 2010). Personnel cuts, when done through furloughs or layoffs can close shortfalls quickly since employee compensation makes up the bulk of local government expenditures. Attrition takes longer and is less difficult for organization and employees in that it allows for advance planning. Regardless, the various methods of cutting personnel cuts share long-term consequences for organizations. First is an increased workload for remaining employees, decreased overall productivity, and sinking morale (Berne and Stiefel 1993, Olson, Seymour, and Weaver 2004). Perhaps more importantly, personnel cuts frequently lead to the loss of the organization's most talented and resourceful employees (Cayer 1986). Employees are the brain-trust of an organization. They have the most-extensive knowledge of how service is actually delivered and received, as well as customer expectations (Lipsky 2008). Thus, when personnel are cut, the organization is less effective and efficient.

Based on experiences within the survey work group, three questions were included in the FPC regarding personnel cuts. I use question 17 *(Were personnel cut from the FP work unit(s)?*) as the basis for my query into personnel cuts and to identify my study sample (n = 812). This question also serves as a proxy test for short-term strategies. The binary choice of answers provides me with my dichotomous dependent variable, *Personnel Cuts*. Question 17 was recoded according to convention, so that No = 0 and Yes = 1. My study sample for this section includes all respondents who answer this question on the FPC survey. In particular, I am concerned with the probability of personnel cuts at the 3E program level and individual 3E services level. To conduct my investigation, I ran two logit models. The first

model, titled “3E Index”, regresses total staffing, department type, and 3E index against personnel cuts. The second model, titled “Individual Services”, also regresses total staffing and department type, but drops the 3E Index and substitutes the individual services that comprise the index. These two models can be found in Table 6.3, under the heading “Personnel Cuts”.

The first model in Table 6.3, 3E Index, shows that two of the three control variables, total staffing ($p$ <.001) and department type ($p$ <.001) are statistically significant. The third control variable, 3E Index, shows moderate strength ($p$ <.1, single tail test). Positive coefficients for the three variables indicate that department type (β = .50) has the greatest influence increasing the chance of budget cuts to personnel, followed by total staffing (β = .38). However, the Wald statistics for total staffing (30.09) and department type (23.19) show that total staffing is the more important of the two predictor variables (Pallant 2016). The variable 3E Index, on the other hand, has a negative coefficient (β = -.44) indicating a possible influence decreasing the chance of budget cuts to personnel. The odds ratios for the three variables indicate that department type (OR = 1.7) will also produce the largest movement in the chance of personnel cuts, followed by total staffing (OR = 1.5), and 3E Index (OR = .65).

The full model with all predictors included is statistically significant with $\chi^2 = 81.38$ ($p$ = .000, df = 3, n = 812). Test statistics demonstrate that the model as a whole is a reasonable fit. It differentiates between respondents who reported personnel cuts and those that did not. The model accurately categorizes 70% of observations, with a 61% positive predictive value and a 71% negative predictive value. Running the model with all predictors resulted in a 3% improvement over running the model without predictors.

**Table 6.3: Logistic Regression of Personnel Cuts and Compensatory Action**

| | Personnel Cuts | | | | | | Compensatory Action | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3E Index | | | Individual Services | | | 3E Index | | | Individual Services | | |
| Control Variable | β | (s.e.) | p | β | (s.e.) | p | β | (s.e.) | p | β | (s.e.) | p |
| Total Staffing | .38 | .07 | .00 | .38 | .07 | .00 | .01 | .06 | .92 | .01 | .06 | .94 |
| Department Type | .50 | .10 | .00 | .46 | .11 | .00 | -.03 | .08 | .69 | -.04 | .07 | .61 |
| 3E Index | -.44 | .29 | .13 | | | | .73 | .19 | .00 | | | |
| Plan Review | | | | -.48 | .21 | .02 | | | | .06 | .15 | .70 |
| Inspection - New | | | | -.12 | .28 | .66 | | | | -.16 | .18 | .36 |
| Inspection - Existing | | | | .56 | .31 | .07 | | | | .48 | .16 | .00 |
| Public Education | | | | -.58 | .21 | .01 | | | | .17 | .17 | .30 |
| Fire-Arson Inv. | | | | .24 | .15 | .11 | | | | .25 | .10 | .01 |
| Constant | -.197 | 1.00 | .05 | -2.00 | 1.23 | .10 | -3.38 | .62 | .00 | -3.66 | .78 | .00 |
| Observations | | 812 | | | 812 | | | 1148 | | | 1148 | |
| -2 Log Likelihood | | 954.16 | | | 935.74 | | | 935.74 | | | 1421.77 | |
| Chi-square | | 81.38 | | | 99.74 | | | 21.48 | | | 30.65 | |
| Degrees of freedom | | 3 | | | 7 | | | 3 | | | 7 | |
| *P*-value | | .000 | | | .000 | | | .000 | | | .000 | |
| Nagelkerke $R^2$ | | .13 | | | .16 | | | .03 | | | .04 | |

Notes: Logistic regression results from a convenience sample of survey respondents answering all five 3E service questions and indicated that personnel cuts had been made in FPC Survey question 17 (n = 812) in the first two models. Personnel Cuts to total 3E Index and Individual Services are dichotomous dependent variables with values 0 = no cuts, 1 = budget cuts. In the second two models, Compensatory Action, the dichotomous dependent variables are 3E Index and Individual Services with values of 0 = no compensatory action taken, 1 = compensatory action taken. The control variables tested are ordinal variables. Total Staffing: 1 = <24, 2 = 25-49, 3 = 50-99, 4 = 100-250, 5 = 250+. Department Type: 1 = All Volunteer, 2 = Mostly Volunteer, 3 = Mostly Career, 4 = All Career. 3E Services Provided (Plan Review, New Construction Inspection, Existing Building Inspection, Public Education, Fire-Arson Investigation): 1 = service is not provided, 2 = service is contracted out, 3 = service is provided by other local department, 4 = service is provided by local fire department.

This data suggests to me that as fire department type changes from all-volunteer to all-career and as departments increase in size, the likelihood of cuts to personnel in fire prevention increases. However, higher 3E index values exert influence decreasing that likelihood. More robust fire prevention programs are more resistant to personnel cuts. One way of looking at this is that in large, established departments in large communities, program responsibilities have been sorted out and are well-entrenched. Resource scarcity is shared among all departments. Efforts to realign service provision will likely be met with resistance, particularly if realignment does not fit neatly with perceived missions and it means more responsibility without commensurate funding. If more comprehensive fire prevention programs demonstrate some resistance to personnel cuts, then it seems reasonable to examine which services within a program are more vulnerable to cuts. I investigate this potential effect in the second model in Table 6.3 under the "Personnel Cuts" heading, in which I control for the individual 3E service categories.

In this second model of Table 6.3, Individual Services, two things are immediately apparent looking at the second model in Figure 6.3. First is that the values for significance ($p$ <.001) and the coefficients ($\beta = .38$) for total staffing did not change between the first and second models. For department type, significance ($p$ <.001) remained unchanged. However, the coefficient for department type ($\beta = .46$) lost .04 of value in this second model, indicating it produces a slightly smaller effect on the probability of personnel cuts when including the individual 3E services in the model. Here again, the Wald statistic for total staffing (28.08) and department type (18.09) indicate that total staffing is the more important predictor variable, even though it does not produce as great a reaction. Test statistics indicate that the full model is a good fit ($\chi^2 = 99.74$, $p$ <.001, df = 7, n = 812) and differentiates between cases reporting cuts to personnel and those reporting no cuts. On the whole, the model correctly classifies

approximately 71% of cases, which is a 4.5% improvement over the model run without explanatory variables. This model has a positive predictive value of 63% and a negative predictive value of 72%.

The second pattern that stands out in this second model is the opposing influences seen in the test statistics for the individual 3E services. Public education is statistically significant ($p$ <.01) and with a negative coefficient (β = -.58) exhibits significant influence decreasing the likelihood of personnel cuts. Plan review follows with statistical significance ($p$ <.05). It also has a negative coefficient (β = -.48) and displays significant influence decreasing the probability of personnel cuts. Existing building inspections, on the other hand, are statistically significant ($p$ <.10) and with a positive coefficient (β = .56) indicates it strongly influences increasing odds of personnel cuts. Fire-arson investigation is also statistically significant ($p$ <.10, single tail test). It also has a positive coefficient (β = .24) showing moderate influence increasing the odds of personnel cuts. Statistics for new construction inspections provide no useful information.

Of the individual 3E services, Wald statistics show that public education (7.62) is the most important of these five variables influencing personnel cuts, followed by plan review (5.43). Importantly, both of these variables decrease the likelihood of personnel cuts. Existing building inspections (3.18) and fire-arson investigation (2.49) increase the likelihood of personnel cuts. However, of the five individual services, existing building inspections (OR = 1.74) influence the greatest movement in the chance of personnel cuts, above both total staffing (OR = 1.46) and department type (OR = 1.58).

Comparing both personnel cuts models finds that total staffing is the more important of the two demographic variables, though it does not produce the same level of effect as department type. While higher 3E index scores decrease the likelihood of personnel cuts, this effect is

probably limited to plan review and public education. Existing building inspections show considerable vulnerability to personnel cuts and fire-arson investigation shows moderate vulnerability. In other words, the larger a department is, the more likely it is to experience personnel cuts. However, within the larger total staffing categories, greater percentages of career personnel further increase the probability of personnel cuts. If and when personnel cuts are made, they will probably come out of the existing building inspections service followed by fire-arson investigations.

While these two models plainly illustrate which variables have the greatest influence on the likelihood of personnel cuts, they do not fully answer the question of short-term or long-term strategic approach. A more detailed crosstabs review finds that fire departments and other providers likely followed the short-term strategy path. Of the study sample for this inquiry (n = 812), 33.5% (n = 272) made personnel cuts. At first glance, this would seem to indicate that most 3E service providers took a longer-term approach. However, when compared to respondents also indicating budget cuts in FPC survey question 12 (n = 401), data reveals that 65% (n = 260) of respondents indicated cuts were made and they included cuts to personnel. Further, a crosstab comparing 3E service budget cuts against personnel cuts finds that cutting personnel occurs more often than not at every level except <5% cuts. When comparing department level cuts to loss of personnel in fire prevention, data shows that cutting personnel occurs more often than not at every level beginning at <2.5%.

This paints a different picture. The likelihood is that departments will look to personnel cuts first. Personnel cuts provide an easy fix as Scorsone and Plerhoples (2010) note. However, for many fire prevention units, there are not many personnel to cut. From chapter 4, this study found that the majority of communities staff these units with one to ten personnel, with a lean

towards the lower numbers. This does not make for a very deep savings well. Consider also that tasks are distributed among these personnel with the possible exception of plan review. From a practical standpoint, plan reviewers are retained because they are tied to a revenue stream. Personnel cuts come from the remaining personnel. The number of tasks that can physically be accomplished are scaled back. Emphasis is placed in new construction inspections as part of the plan review process and public education because of it effect and image potency. This leaves existing building inspections to bear the brunt of cuts.

Despite the importance of employees in delivering 3E services, the personnel cuts models in the preceding paragraphs demonstrate that they are vulnerable to cuts, following trends found in the literature. Personnel cuts create budget saving quickly, even at the sacrifice of service quality and capacity. Employees represent the collective experience of a department. When those positions are cut, that experience is lost. If the 3E service is transferred to another part of the department or another agency and the particular service curtailed, it will take years to recover that expertise and associated capacity (Berne and Stiefel 1993, Lipsky 2008, Pandey 2010). Stipak and O'Toole (1993) note four basic reactions to fiscal stress, of which only one involves cutting services. The other three focus on longer term strategies that maintain or improve capacity. The authors also found in their study of public sector managers that productivity improvement was ranked as important as reducing services and raising revenue during times of fiscal stress. Accordingly, I briefly explore whether departments took any actions that fall under longer term strategies.

Long-term Strategy – Compensatory Actions

Longer-term strategies are based upon attempts to increase capacity, improve productivity, or shift responsibilities (O'Toole and Stipak 1988). The survey work group

anticipated that some departments would take this longer strategic view, and implement some form of compensatory action to make up for substantial budget and personnel cuts, as well as program effectiveness. The FPC survey included two questions regarding compensatory actions. The first, question 25 (*Did your department take any compensatory action?*) invited only a yes or no answer and I use this to operationalize this as my dichotomous dependent variable. My sample is drawn from all respondents who provided an answer to this question in the FPC survey. I recoded the variable according to convention and retitle it *Compensatory Action*.

As in the last section on personnel cuts, I ran two logit models for compensatory action. Again, these serve as proxy measures, but for longer-term strategies. Looking at both of the compensatory models shows that neither total staffing or department types exhibits any influence on the likelihood of taking some form of compensatory action to make up for services losses. This tells me that department characteristics are not determinants such behavior. The critical determinant for increasing the likelihood of a department taking compensatory action are the provision scheme of its existing fire prevention program. These are reflected in the 3E index scores for departments. The higher the score, the more the services are provided and concentrated under the local fire department. Two separate comparisons of department level budget cuts and 3E service cuts with compensatory action shows that across all categories of cuts, departments took some form of compensatory action at an overall rate approaching 50%.

The two models are found in Table 6.3, in the third and fourth columns. The third model regresses the demographic characteristics, as well as 3E index on the dependent variable. It shows that of the three control variables, only 3E index is statistically significant ($p < .001$) and has a positive coefficient ($\beta = .73$) indicating that higher 3E index scores positively influence the odds that a department will take some form of compensatory action. Such results imply that

communities with robust, full-spectrum 3E service programs will try to preserve the effectiveness of these programs, even in the face of fiscal stressors. Compensatory actions show that these departments are implementing long-term strategies that include improving efficiency and productivity, such as consolidating services and intra-agency transfer of service responsibility. 3E program goals and objectives are important to local fire department decision-makers as a part of their community fire protection activities.

The third model as a whole is statistically significant ($\chi^2 = 21.48$, $p < .001$, df = 3, n =1148) and is a reasonable fit. It distinguished between those respondents who indicated compensatory action and those that did not. The statistics associated with the total staffing and department type are inconsequential regarding influence on increasing or decreasing the likelihood that compensatory action was taken.

In the fourth model I regress the department demographic variables of size and type against the dependent variable compensatory action. I disaggregate the 3E index and include each of the individual 3E services as control variables to identify under what provision schemes compensatory action is most likely to be taken. Only two of the seven control variables, existing building inspections ($p < .005$) and fire-arson investigation ($p < .05$), were statistically significant. Both have positive coefficients with existing building inspections ($\beta = .48$) showing greater influence than fire-arson investigation ($\beta = .25$).

Existing building inspections and fire-arson investigation show an increased likelihood of compensatory action. This tells me that these two services were likely targeted due to their ease of making service delivery changes. Responsibility for basic level existing building inspections is easily transferred to emergency response units. In fact, many departments assign this responsibility to front-line companies as part of the normal course of business and leave

technically detailed inspections to a few specialists. The same can be said for fire-arson investigation with the referral factor being the potential that a crime is involved.

Statistics shown in this fourth model indicate that none of the other five control variables contribute to its predictive value. Other 3E services may not be as easily amenable to long-term solutions. Further, if delivery of 3E services is already distributed within the fire department, such as public education, or among other providers, such as contracted plan review, the opportunities for long-term solutions may not be available. This fourth model in Table 6.3 also proves to be statistically significant ($\chi^2 = 30.65$, $p < .001$, df = 7, n = 1148) as a whole and a reasonable fit. It correctly identifies cases according to those who reported compensatory actions were taken and those that did not.

**Chapter conclusions**

In this chapter, I examined the third research question: *How did departments with different provision schemes strategically approach cuts to 3E services?* This question suggests that strategic cutback decisions are not made in a vacuum. Public managers must weigh trade-offs between community benefits, which services to cut, and organizational continuity. In large part, these strategic decisions hinge on both internal and external factors that affect the operating environment. Whether found in articles of incorporation or statutory responsibilities, department mission statements typically define the services to be provided. However, community conditions also drive the unique mix of services provided to the public. Certain conditions affect this platform, including the political, physical, and demographic environments.

Cuts to fire prevention services clearly affect community safety, but these cuts also affect the service organization itself and have the potential to alter mission, structure, and culture. This

third research question thus looks at some fundamental strategic choices and provides some leverage about how departments prioritize their fire prevention services.

Drawing on the literature, I focused my research in three specific areas. First, I examined the department-level baseline strategic choice of across the board versus targeted cuts. (Scorsone and Plerhoples 2010) observe that local government will first try across the board cuts. If the downturn is prolonged or severe, they will then turn to targeted cuts. This examination also provided relative information on the severity of the downturn and priority of fire prevention against emergency response. Next, I considered whether the department-level approach carried through to the fire prevention delivery level and how individual services were affected. At the point of actually cutting services, managers must consider citizen service expectations, political responsiveness, as well as tradeoffs between effectiveness, efficiency, and equity (Honadle 1984, West and Davis 1988). These value judgements are reflected in the choices on service cuts and the rank order of priorities among the 3E services. Finally, I conducted a brief look at whether short-term versus longer-term strategies were employed in making cuts. These elements are reflected in the use of personnel cuts and compensatory actions. While personnel cuts generate quick budget savings, they have long-term quantity and quality of service consequences for a department. Personnel cuts are usually indicative of short-term budget balancing strategies. Alternatively, compensatory actions, such as productivity improvements, aimed at preserving services suggest longer-term strategies.

Findings

The first analysis in this chapter examined whether cuts were targeted or across the board. Table 6.1 provides a foundation that indicates a majority of departments opted for the across the board approach. Additionally, test statistics confirm a strong positive relationship

between department budget cuts levels and 3E service cut levels. Finally, when also considering the response on FPC survey question 20, that roughly three-quarters of respondents (n = 263) indicated other department work units experienced cuts, it is clear that the preferred action was to make cuts across the board. This has the effect of preserving some service capacity and still focusing on the community's fire problem from preventive standpoint. However, it is also clear that a substantial minority of departments will opt for targeted cuts for reasons that are not disclosed in the FPC survey.

In the second analysis, I considered whether the preferred across the board approach continued into the individual 3E services and, was there any evidence of prioritization among the 3E services. A pattern of priorities emerges from Table 6.2. When budget cuts are necessary to deal with an economic downturn, total department staffing is the greatest predictor of cuts, followed by fire department type. From that point, the individual services exert their own influence, which varies both in magnitude and direction. The pattern also demonstrates that code inspections face the greatest probability of cuts and within that that broader category, existing building inspections are likely sacrificed first. Public education follows with a somewhat lower risk of cuts. Plan review appears moderately resistant to cuts influenced by the other 3E services, but not to cuts driven by department demographic factors. The chance of fire-arson investigation cuts seems only influenced by department size, though this has overlap into department type.

In the third part of my analysis, I examined whether cut decisions were made with an eye towards short-term or longer-term remedies. My analysis of both approaches is seen in the four models in Table 6.3. The first two models look at personnel cuts and demonstrate that both total staffing and department type exert significant influence and increase the odds of personnel cuts.

The larger a department, the greater the odds of personnel cuts to personnel. The same applies for department type. More career personnel in the department increases the odds that cuts will come from personnel. The local government budget crisis was made worse by the Great Depression. It hit all sizes of communities, but not all communities were hit equally hard. Data implies that for those that experienced difficulty, the situation was worse the larger the community and fire department, and for those protected by career-oriented departments. Compounding this plight, the more 3E services provided, the greater the likelihood of facing budget cuts. The second model indicates that when cuts are made, personnel likely will be cut from existing building inspections service. This action increases fire risk in the community by reducing service capacity and effectiveness in those communities hardest hit. All told, I take this mean that larger departments in financially struggling communities will favor short-term budget balancing approaches. The effect of budget balancing within a single budget cycle is detrimental to providing effective service.

However, the first two models show that departments with more developed fire prevention programs, as measured by the 3E index, appear to look at some longer-term strategies. This leads to the third and fourth models in Table 6.3 which evaluate whether departments were likely to take steps to make up for the loss of personnel and service capacity, indicative of longer-term compensatory strategies. The first thing apparent is the total lack of influence by total staffing and department type. This indicates this is not strictly a result of budgetary difficulties. More likely, this involves management approaches that takes in strategies of efficiency improvements (Stipak and O'Toole 1993), not just cuts. In the third model, higher 3E index values increase the likelihood that compensatory is taken. The fourth model shows that existing building inspections and fire-arson investigation are the services most associated with

longer term compensatory actions. This tells me that department management will entertain longer-term views when the services are more conducive to compensatory actions.

Overall, my analysis suggests that departments will approach retrenchment through across the board cuts. While across the board cuts may be the apparent norm, cuts to 3E services may still be prioritized within that broader approach. These actions are consistent with short-term budget balancing approaches that address shortfalls within an annual budget cycle, but do not address longer-term solutions. Within the mix of across the board and targeted cuts, the single most important variable affecting the probability of budget cuts is department size. While the evidence implies that departments will favor short-term strategies, there is evidence that some departments with more concentrated 3E programs will take steps to lessen the impact of cutbacks.

Discussion

This chapter set out to determine what strategies were used by the various organizations delivering 3E fire prevention services. I found that departments typically relied on across the board cuts even when department level cuts were extreme (>15%). Across the board cuts are indicative of an incrementalist approach to maintain a service even though it may be resourced below an effective level. Incrementalism provides for policy stability but does reinforce suboptimal behavior.

Service prioritization seemed more pronounced within the 3E services provided by departments. Analysis also showed that departments will employ compensating actions to make up for lost capacity, though the data does not reveal the extent of such actions. The data indicates that such compensatory actions occurred regularly, with roughly half of departments who reported budget cuts stating they took compensatory actions. This says that there were

some long-term efforts to improve productivity, but also imply smoothing strategies that reduce the impact of cuts.

Consistent with (Scorsone and Plerhoples 2010), it appears that most departments made across the board cuts during the Great Recession as did most local governments. However, there are more than a few departments that obviously made targeted cuts. At the extreme, two departments reported greater than 25% cuts to 3E services while cuts to the department budget cut was less than 2.5%. This level of disparity in some of the targeted cuts invites brief discussion. Targeted cuts should not be construed to mean that fire prevention is not viewed as important. It could reflect a department level resisting strategy by cutting an important program that forces elected officials to make the difficult choices between programs. Alternatively, it could simply be a management decision reflecting the priorities of elected and appointed officials that places the emphasis on emergency response. This would be consistent with rapid growth.

For example, in Montgomery County (MD), the fire and rescue service opened four new stations in response to population growth during years that overlapped the Great Recession. To make up the necessary personnel complement for these stations, 33 uniformed fire inspectors and supervisors were pulled from code enforcement and reassigned to operations. Responsibility for all 3E services except fire-arson investigation and public education aimed at seniors was transferred to the building department. Political leaders had been contemplating this move for several years due to the expense of uniformed firefighters compared to non-uniformed civilian employees. As indicated in earlier chapters, most 3E services are concentrated under the fire department. If uniformed firefighters are providing these services, then similar moves make budgetary sense.

Furthermore, the FPC survey did not delve into community economic conditions. The fact that a number of departments made targeted cuts may be the result of the unequal economic impact of the Great Recession. More than likely, these departments were located in larger, more populous communities. Work force characteristics and job market structure largely dictated which local areas experienced the sharpest declines (Thiede and Monnat 2016).

Emergency service demand or call load is a function of population served. Growing communities experience growing call loads. At the opposite end of the spectrum, declining communities with increasing rates of poverty and aging building stock also face increasing call loads (Tri-Data Corporation 1997). Prior to the Great Recession, housing booms in smaller communities increased service demand as population grew astronomically. Demand for service strained existing fire department resources. When cuts hit due to the sudden collapse of local government revenue streams, department efforts to maintain emergency response capacity may have forced them to forgo the chance to reduce unnecessary service demand.

Increased call load has a corroding affect in the ability to maintain service effectiveness and efficiency. There is a finite limit to the number of calls for service that a fire department can manage within established parameters for effective service. Beyond that point, response times and effectiveness deteriorate rapidly. Costs for excess calls for service is borne by the community at large in a classic case of Hardin's *Tragedy*.

While most departments indicated that cuts were made across the board, it does not say, that cuts were necessarily equal across the board. Two particular 3E services have the potential to drastically reduce the growth curve of service demand. These are existing building inspections and public education. Unfortunately, data indicates that of these two services, existing building inspections are at the greatest risk of being cut. Further, it is also obvious from

the data that cutting personnel from existing building inspections is a prevailing strategic choice for making up budget shortfalls.

As previously observed, cutting personnel is a short-term budget reconciliation approach to managing shortfalls. It does not address any long-term solutions that reduce demand on the fire department. For example, false alarms have been identified as a major source of response over-utilization with 45 false alarms for every 10 structure fires. Thirty-two percent of these are due to system malfunctions (Fire Analysis and Research Division 2011). One of the responsibilities under existing building inspections is to check for maintenance of fire alarm systems. Other systems include smoke control, stairwell pressurization, and sprinklers. Cutting of personnel from existing building inspections degrades the opportunity to prevent unnecessary responses from fire prevention systems neglect. Further, failure of fire control systems dramatically increases the risk to occupants and emergency response forces, while also increasing the demand for additional forces to control fire events.

However, in today's political environment, cuts to personnel has a good deal of political appeal. Personnel cutbacks receive extensive media coverage. From a public perspective, politicians can argue that something visible has been done, even if the result is counter-productive (Greenhalgh and McKersie 1980). What may have been a technical problem, is now subject to political judgement and political values.

From an emergency response standpoint, failure to fully engage all of the 3E services places emergency responders and the general public at greater risk. The mantra in today's construction industry is value-construction. In other words, lightweight construction engineered to meet minimum design criteria and heavily dependent on active fire protection systems rather than inherent fire resistance features to withstand an assault by fire. When these systems fail,

buildings burn and fail rapidly (Kerber 2012). Emergency response forces have a very limited opportunity to effectively intervene with positive results.

From the 3E fire prevention standpoint, fire departments and like agencies must explore alternative methods of effective service delivery. First, it is not necessary that fire departments deliver all five 3E services. Economic realities point elsewhere. Plan review and new construction inspections can possibly be passed off to a building department or similar agency, or even contracted out with uncertain implications for citizen and firefighter safety. There are other means to hold developers and builders accountable, such as licensing. Existing building inspections, those that occur once a building is occupied are more critical. No building ever remains static after occupancy. This is the period of greatest risk.

One alternative would be to shift the responsibility for existing building inspections to emergency response units. This is already practiced in many departments. These inspections are often high-level and focused on easily identified or frequent problems. Potential problems requiring more technical corrections are referred to specialists either internal or external to the fire department. Furthermore, firefighters are already in many commercial buildings as part of familiarization and pre-planning functions. Including inspection responsibility is simply an efficiency exercise. Public education should also be practiced from emergency response units. Research has shown prevention messages received from uniformed firefighters are given more credence and retained longer (Ta et al. 2006). Finally, fire-arson investigation can be accomplished by emergency personnel, as well. While arson investigations receive the press, origin and cause investigations are much more critical to identifying trends and conditions that need to be addressed to reduce fire incidents overall.

Departments must be open to changing their structural paradigm. They will need to develop strategies that improve flexibility and transition between modes of emphasis. Growing communities face different demands than stable or declining communities. At different times, different prevention approaches will be necessary. The U.S. fire service culture must change from an inward facing organization that focuses on emergency response proficiency to an outward facing organization that interacts with the community regularly in prevention efforts.

# CHAPTER VII

# CONCLUSIONS AND RECOMMENDATIONS

## The Problem

The basis for this study began with the Great Recession and the affects it was having on fire prevention providers across the United States. Exchanges in electronic chatrooms, and commentary in industry magazines, provided anecdotal evidence to suggest that fire prevention programs frequently were targeted first when budget shortfalls had to be closed. Fire prevention is a critical part of a community's strategic approach to reduce fire risk and the demand for emergency services. 3E services associated with fire prevention help serve two primary functions: 1) educate and change people's behavior so that they routinely practice fire safe behavior and 2) shift the cost of maintaining a fire safe environment onto the owner/occupants of buildings from the community at large. It also has the added benefit of being the most efficient means of reducing fire loss in a community.

Reducing service demand is critical to these communities because fire departments have limited service capacity. They span the boundary between public goods and common pool goods. Below its capacity threshold, the fire department is a public good. Cross that threshold and the fire department becomes a common pool resource. When fire department service is overused, the effect ripples through a

community resulting in longer response times, increased risk, poorer incident outcomes, and generally decreased levels of public safety. Increasing response capacity only reacts to immediate demand and does little to reduce the collective fire problem. A community's population is the primary driver of service demand, which, in turn, drives the size of the fire department. Furthermore, the scope of the fire department's mission has broadened in response to community demand which adds additional pressure.

Fire departments, whether all-volunteer, all-career, or somewhere-between, provide an expected government service and ensure public safety. Whether funded directly through tax dollars or through donations or some mixture thereof, economic downturns effect fire departments the same as other government services. Providing a fire department is an expensive community proposition regardless of department type, but especially so for those departments that rely to any extent on career personnel to meet service demand.

Economic difficulties are not new for local governments. Since the 1970s, local governments have repeatedly faced tighter budgets for a myriad of reasons. In parallel, local governments have likewise faced increasing service demand from their communities. The fire department has not escaped this dual-fold challenge. Following the Great Recession, constrained resources have become the *new normal* for all local government departments and services. Despite an external issue of environmental atrophy which would normally lead to organizational decay, fire departments are in no danger of problem depletion (Levine 1978). The issue becomes one of applying strategies to meet service demand in a diminished service environment.

External expectations and organizational culture influence the opportunities available to fire department leaders to close the gap between service expectations and budget. The

problem is that the most cost-effective option to increase investment in prevention and reduce service demand is not the most workable option. Environmental pressures, such as political expediency and budget cycles, as well as internal culture and the need to maintain organizational viability generally force decision makers to emphasize short-term strategies that favor response capabilities, while limiting long-term strategies that would decrease service demand. These pressures trap communities into suboptimal policy patterns in the face of diminishing resources.

In this study, I look at how 3E fire prevention service provision was affected by the Great Recession and the extended recovery. While this study uses the Great Recession as a backdrop, budgetary pressures from economic downturns and other factors (e.g. California's Proposition 13) are a fact of life and occur with regularity. Understanding the reaction of fire prevention providers to economic downturns will help inform policy-makers of the implications of funding priorities.

Research Questions

If the purpose of this study is to understand how 3E fire prevention service providers react to budgetary contractions, it is first necessary to identify how providers deliver those services. There is no optimum mix of services prescribed for all communities. Each community presents a different set of factors that affect the collective fire problem in that community. Communities consequently configure 3E service delivery relative to those factors, including service demand, historical precedent, political desires, legal requirements, and size and type of fire department.

Therefore, the necessary first step in my analysis was to develop a common tool for comparison and then apply this tool across various communities to arrive at typical service

delivery strategies. Such a tool must take into consideration factors that were expected to influence how fire prevention services are provided. These factors included community size, department size, and department type. This leads to the first research question, which involved both developing and applying a comparison tool:

1. How are 3E fire prevention services provided across different communities?

Answers to the first question established a baseline for comparison. It follows that the next step would be to determine how the Great Recession effected the various schemes identified in the first question. My analysis was predicated on whether a department made cuts to fire prevention. If so, analysis would also indicate which 3E service provision schemes were mostly likely affected by cuts and which individual 3E were likely affected. Further, given the uneven impact of the Great Recession, it was important to understand how the community size, department size, and department type features influenced the likelihood of budget cuts to these services. The second research question therefore asks:

2. Which department provision schemes were affected by the Great Recession cutbacks?

Finally, with my second in hand it seemed that the next reasonable query should look at the strategies used to implement cutbacks. Most research on local government cutback management is limited to macro-level reactions and strategies. The extant research focuses on how government adjusts across the breadth of its services. Accordingly, the third research question investigates:

3. How did departments with different provision schemes strategically approach cuts to 3E services?

**Results and Conclusions**

The answers to these three queries stem from an empirical analysis of a convenience sample of fire professionals. The Vision 20/20 survey took place in the wake of the Great Recession and offers us new perspectives on fire prevention efforts in the midst of significant economic constraints.

How Are 3E Services Provided Across Different Communities?

Question one essentially consisted of two parts. First, a common method of comparison was developed, which has been described as an essential first step before more rigorous study can take place. In the second part of the question, the means of comparison was then applied to the range of communities in the FPC survey.

Literature on fire department performance measures and public budgeting guided development of the common evaluation method, the 3E Index. Scholars have observed that any service that contributes to the fire department's mission should be included in an evaluation, in this particular case fire prevention, and the closer to the fire department having budget authority over the program likely reflects the importance of that service (Schaenman and Swartz 1974, Rubin 2010).

Development of the 3E Index was simple and straight-forward. The first five questions in the FPC survey asked who delivered a particular 3E service. Response options were ranked from one (*not provided*) through four (*provided by the local fire department*). This furnished a 3E score for each service. The 3E Index scores were then constructed by combining and averaging each of the individual service scores. The resulting 3E Index method consists of an ordinal scale that was applied to each observation (community/department) in the study sample. The lower the 3E Index score, the fewer

services are provided and more dispersed among providers, if provided at all. Higher index scores indicate more services are provided and that they are consolidated under the fire department.

When the 3E Index was compared across communities, three fundamental observations were made. First, more than half of all respondent communities receive all five 3E services through their local fire department. Second, larger community and department sizes are generally associated with higher 3E Index scores. Third, higher index scores are generally associated with reliance upon career staffing. These trends show that more 3E services are added and consolidated under the local fire department as career personnel are added. Clearly, all three demographic characteristics influence the provision of 3E services.

However, these associations do not follow straight lines. Rather, there are distinct transition points between categories for both population and department size. A transition point is also seen in department types between mostly-volunteer and mostly-career. It strikes me that these transition points represent two developments. From one perspective, these transition points speak to fire departments transitioning from public good to common pool good. Generally, it is at this point that fire departments begin to struggle with matching service capacity with service demand. The second development is the presence of sufficient career personnel to provide the resource capacity needed to begin delivery of 3E services and help move the department from a predominantly reactive stance to a more proactive stance. At these transition points, fire prevention services become increasingly important to meeting and controlling service demand.

When looking at the individual 3E services, it becomes evident that public education is the local fire department's core strength. Across all three demographic dimensions of size

and type, public education is provided by the local fire department. Another tendency in the provision of services is the remarkably consistent order of priority as fire departments add new 3E tasks. Again, across all three demographic dimensions, existing building inspections is picked up first, then new construction inspections followed by plan review. Fire-arson investigation is generally last. This demonstrates the presence of other providers, mainly in plan review and investigations. Certainly, even small communities have a building authority and law enforcement. Plan review and fire-arson investigation responsibility likely evolves with these organizations as the fire department transitions to include career personnel. However, viewed from a risk management perspective, this prioritization makes sense. As previously discussed, occupied buildings present a much greater risk than unoccupied buildings. Further, that risk increases the longer the building remains occupied. Accepting that the fire department has responsibility for mitigating any fire events, inspections of existing buildings plainly contribute to mission.

As more career personnel are added to a local fire department, the fire prevention scheme also encompasses service delivery through dedicated units. The staffing of these units is generally small except in departments above 250 personnel. Data shows that units are mostly staffed with between one and ten personnel. It may be that in many smaller volunteer-oriented departments, personnel are brought on board specifically to provide fire prevention services and limited operational duties, such as driving apparatus. Further, in small career-oriented departments, one or two-person fire prevention offices are not unusual, but with a much more limited scope of 3E services.

Which 3E Service Provision Schemes Were Affected by the Great Recession?

My analysis of the second question addressed identified which 3E provision schemes suffered budget cuts after the Great Recession. The first part of that analysis looked at trends in those departments that were making cuts. Data revealed that budget cuts were associated with increasing community size and department size, as well as department type. In other words, the greatest proportions of budget cuts occurred in all-career fire departments protecting our largest communities. There are some economies of scale in providing 3E services in larger population centers, particularly as part of a unified fire protection effort including emergency response. Increased concentration means more people and buildings can be reached with less effort. Conversely, when 3E services are cutback, larger segments of the population face increased risk.

The link between the trends in the characteristics of size and type of department is the proportion of career personnel. Survey data shows that the greater the proportion of career personnel, the greater the percentage of departments making cuts to fire prevention. Not only does the predominance of career personnel relate to the proportion of departments making budget cuts, but it is inversely related to the mix of service provision. Smaller departments and those that trend toward volunteer orientation, show a much greater mix of service providers and a clear inclination not to provide some services. The addition of career personnel leads to the expansion of the types of fire prevention service offered and consolidation of those services within the fire department. From a cutback budget perspective, consolidation is an established strategy for reacting to downturns by reducing redundant overhead.

Where actual service delivery schemes are concerned, my analysis found that individual 3E services were not similarly affected by cutbacks. Plan review shows some resistance to cuts, as does public education. In fact, a logit model reveals a statistically significant and negative relationship with the presence of budget cuts for both. Results associated with new construction inspections and existing building inspections were inconclusive, though there is some evidence that new construction inspections fare better when provided by entities other than the local fire department. This follows from new construction inspections being part of the new construction permit process. Results for fire-arson investigation are marginal in favor of increasing the likelihood of cuts.

In the cutback environment, services that do not have a strong constituency (i.e., internal to the organization or external to it) are sacrificed first. A logit analysis shows that the 3E Index score has an overall negative effect on the chance of budget cuts to fire prevention activities. Plan review and public education both demonstrate a negative and statistically significant relationship with the likelihood of budget cuts. In other words, services that are normally associated with a revenue stream and those that are low-cost, non-controversial, and image enhancing face less of a chance of experiencing cuts. Plan revue is normally associated with a revenue stream and probably has strong internal advocates. Public education is viewed favorably by the community. Whereas, existing building inspections generate pushback from powerful community constituencies.

How Did Departments with Different 3E Provision Schemes Strategically Approach Cuts?

Answering this third research question delved into the basic underlying strategies used by departments to make cuts to 3E services. Such strategies can take on dimensions of internal or external scope, shared or targeted sacrifice, and short- or long-term perspectives.

Consistent with research from the previous questions, the greatest predictor of budget cuts to fire prevention was total department staffing followed by department type.

Examination of the data revealed that the most common approach was to make across the board cuts that extended beyond fire prevention. This is consistent with other research showing that local government departments generally use this cut everything approach first and will resort to targeted cuts only when the retrenchment environment is deep or prolonged. In this FPC Survey, three quarters of the respondents to question 20 (i.e., Did any other work units in the department experience cuts?) answered yes. However, this does not automatically mean that emergency response shared in the cuts made to fire prevention. Depending on department size, cuts may have included administration, communications and training sections. Regardless, it shows that budget cuts were spread around for most departments.

The data also revealed that that some departments made very targeted cuts to fire prevention. A quarter of those respondents to question 20 indicated that 3E services were in fact targeted. This observation invites consideration of how the Great Recession impacted different communities. Economic impact varied across the country. Communities in rust-belt states were hit particularly hard where communities were dependent on manufacturing industries. Accordingly, targeted cuts could have roots in several explanations: 1) a department that has already made cuts to emergency response, 2) consolidation of 3E services within the fire department, 3) outsourcing of 3E services beyond the fire department, or 4) particularly deep cuts.

While across the board may have been the norm at the program level, this does not mean that individual services were not prioritized. My analysis shows that there are 3E

service preferences within fire prevention programs. Existing building inspections service is clearly sacrificed first, which stands at odds with results showing that this service is the first service added as departments increase in size. Perhaps this is the result of the relative ease of moving the inspection task function to emergency response units. Career-oriented fire departments already practice building familiarization at the company level. Requisite training could be delivered during normal duty times and the additional time commitment is marginal. Reassignment may be the approach of choice for a department desiring to maintain service provision. This action would show up as a cut to fire prevention if the service was transferred from a dedicated unit. In fact, those respondents indicating that cuts had been made to fire prevention also had a dedicated fire prevention unit.

Budget cuts or at least constrained resources have become the norm for most local governments. An important question is whether departments made cuts with an eye towards short-term budget balancing strategies or long-term strategies that can help reduce service demand. This research looked at two of these strategies: personnel cuts and compensatory actions with implications for short- or long-term strategies.

Analysis showed that cuts will more than likely take a short-term view in the form of personnel cuts, with the key driver being department size. Interestingly, data also showed that personnel cuts predominated in every category of department level budget cut from <2.5% to >15%. This confirms the literature observations that local governments and their departments will turn to personnel cuts first. Of course, this may simply be a reflection of the economic state of many communities. Operating and capital expenditures have already been cut to the maximum extent possible and it may be that there simply is nothing left but personnel.

Personnel costs are the single largest cost center in local government departments and cuts can lead to quick and sizeable savings. Nonetheless, personnel cuts also introduce a long term drag on departments. Aside from decreasing morale, personnel cuts have been shown to decrease mission effectiveness, and innovation, both of which lead to growing costs over the long-term (Berne and Stiefel 1993). Personnel cuts can also be seen as crossing between the scope of internalizing and externalizing cuts. The literature points to personnel cuts as an internalized response where the cuts are borne by the department. However, given that the fire department is a service industry, it also externalizes the effect on communities by cutting back upon the level and quality of service provided to the community.

Longer-term strategy perspectives were tested by looking at whether some departments took steps to minimize service impacts to the community. This was captured in the survey by asking if any compensatory actions had been taken. Of the 375 respondents on this question, 48.3% (n = 181) indicated that steps had been taken to compensate for the loss of service capacity. Compensatory actions were indicated in every category of fire prevention work unit budget cut from <5% to >25%, but were not tied to department size or type. Instead, they were tied to the 3E index scores. Higher 3E provision scores were related to negative parameters on the probability of budget cuts and a robust positive influence ($\beta$ = .73, $p$<.001) would take some type of compensatory action. Departments taking compensatory measures outweighed those not taking such action in the categories at or below 15% budget cuts. The reverse is true above 15%. These seems to indicate that for budget cuts above 15%, departments view compensatory efforts as more futile, than not, and they focus their remaining resources on emergency response. Overall, the data suggests to me that well-established expansive programs with higher 3E Index scores are more resistant to

budget cuts than smaller limited programs and departments providing such programs will take steps to maintain those functions.

**The Big Picture**

There are two fundamental community fire safety services delivered by local government. These are fire suppression and fire prevention. Both are critical to maximizing the effectiveness and efficiency in the provision of fire protection in a community. Each is comprised of different services that attend to emergency and non-emergency functions. In the case of fire prevention, those functions are the 3E services of plan review, new construction inspections, existing building inspections, and fire-arson investigation.

In 1973, *America Burning* reported that fire departments spent approximately five percent of their annual budget on fire prevention (NCFPC 1973). In the early 1990's, Schaenman (1993) reported that fire prevention expenditures had dropped to roughly three percent of budget, on average, for U.S. fire departments. Mirkhah (1999) reaffirmed the decrease in fire prevention investment in his study of major metropolitan fire departments. Schaenman (1993) further reported that countries who invest heavily in public education and code enforcement have consistently lower fire loss rates per capita than the United States, even with longer emergency response times. This was true across the developed world in 1993 and remains true in this century (Schaenman 2007, 2008, 2009).

This pattern coincides with the literature that documents local government fiscal stress beginning around the time of the tax-payer revolt of the late 1970s and continued through President Reagan's new federalism of the 1980's, into the Tea Party movement of the 2000's, and most recently, the Great Recession. Regardless of the cause, there has been a continual drumbeat of events that demand government provide more service, while at the

same time cutting back upon their necessary resources. This has dramatically changed local government priorities.

If budgets are a reflection of governmental priorities (Lewis 1981, Rubin 2010), then where the money flows should indicate which services local government and, by extension, departments prioritize. Remembering that only half of the total study sample reported making cuts to fire prevention is a fair indication that fire prevention remains a priority in many communities and for many fire departments. However, this also says that the Great Recession had a significant impact on the other half of departments.

Increasing Community Risk

This study indicates that half of the survey respondents to the FPC Survey have increased their community risk by cutting back on fire prevention services. Data indicates that 85% (n = 351) of those making cuts were mostly- and all-career departments. Looking at population protected, the data indicates that communities above 100-thousand population reported more cuts than not. For communities between 100- and 250-thousand, 55% (n = 71) of respondents reported cuts. For communities above 250-thousand, that rate jumps to 70% (n = 95).

While the analysis was drawn from a nonrepresentative sample, the results are still troubling. It means that dense, high risk population centers are cutting back on prevention. In other words, the career-oriented departments protecting 65.5% of the U.S. population are ending up with higher risk levels. Contrast that versus those fire prevention cuts found in smaller communities that are protected by mostly- and all-volunteer departments. These large communities already experience a high service demand due to population density.

Cutting back on fire prevention should exacerbate service demands in terms of call volume and incident severity.

However, the suggestion that high-population communities face the greatest threats from fire prevention cutbacks remains somewhat misleading. These larger communities also possess a much deeper resource pool. Smaller communities have relatively fewer resources on which to draw. In fact, rural localities, those protected by mostly-and all-volunteer fire departments, have greater proportions of poverty than more urban settings. Further, smaller communities suffer fire losses at higher per capita rates than more urban settings (Allareddy et al. 2007). Perlman and Benton (2012) found that the cost of living increases brought on by the Great Recession affected jurisdictions between 5,000 and 99,000 hardest. These communities have been slower to recover (Farrigan 2014). This limits the resources available to address collective community concerns. Budget cuts that do not appear drastic when compared to larger communities, may actually have much greater impact in those contexts.

Analysis on the 3E Index indicates that many of these smaller communities do not provide the full range of 3E services. Most provide only one or two services, typically public education through the local fire department, and plan review and fire-arson investigation through alternate providers. Data shows that 30%-50% of these smaller communities reported budget cuts. When fire prevention programs already operate at the margin, even small cuts can significantly impact a 3E program. This would explain the number of departments reporting loss of fire prevention personnel with department cuts below five percent, which is normally absorbable.

Regardless of rural to urban setting, community risk from lack of fire protection features increases when fire prevention functions are underprovided. Larger departments in urbanized settings should consider reconfiguring 3E service provision to take advantage of the resource slack in emergency units. One example for accomplishing this can be taken from the provision of advanced life support (ALS) emergency medical services. Despite early resistance, many fire departments now provide ALS services by including a paramedic on all apparatus. Nothing precludes the specialized training of a firefighter in public education or code enforcement. This would permit scarce resources to be shared or focused on fire prevention tasks that are not so easily co-provided, such as plan review.

For smaller volunteer-oriented departments, assistance could be solicited from other community organizations, such as faith-based organizations, to help reach out to community members. Another alternative probably more helpful to smaller, more rural volunteer-oriented departments could be found in state and federal level grants, though it is still applicable for larger departments. For example, FEMA *Staffing for Adequate Fire & Emergency Response (SAFER) Grants* are focused on funding emergency response personnel. The primary assignments requirements could be amended to include collateral fire prevention duties (FEMA 2019).

3E Service Audiences and Fire Prevention Cuts

Another factor that should be considered relative to fire prevention cuts is who the primary audience is for each 3E service. Each audience for a 3E services is fundamentally different. This likely has had a large impact on the perceived importance of the service, the decision of which services to cut, and the anticipated return on investment in services by the government/department.

The primary audience for plan review and new construction inspections is developers and builders. The intent is to ensure that the new construction meets the requirements of the appropriate zoning, site, building, and fire codes. Typically, no building is designed or constructed without an architect and/or engineer involved. The purpose behind plan review is simply insurance on the part of the community that the built environment is as safe as practicable at the time of construction. The community also has a financial stake in new construction that influences budget cut decisions. First, plan review and new construction inspections are generally associated with a direct revenue stream. Second, new construction, whether commercial or residential, improves the tax base of the community and provides an indirect revenue stream that helps keep local government functioning. Third, fire events in non-code-compliant structures take considerably more resources to control than those in compliant structures. Local government will likely not want to cut this service.

The audience for existing building inspections is two-fold. First, there are the building owners and operators. In commercial buildings, which includes leased multi-family residential, this audience forms a powerful, vocal political constituency, which tends to resent almost any (except the most cursory) involvement of government enforcement of fire safety systems maintenance in their buildings. Fires are infrequent events in such structures and maintenance of fire protection systems is easily prioritized below the maintenance of other building systems such as heat and air conditioning.

The secondary audience for existing building inspections are the occupants of these buildings. While this audience has the most to lose in unmaintained buildings, as a political constituency, they are loosely organized, if at all. When fires do occur, they tend to impact only a few persons at a time. However, when fire protection systems are not maintained, the

risk of harm to exposure from those fires increases dramatically. Incipient fires are not suppressed, smoke control fails to clear stairwells, and alarms systems cannot be heard. Thus, fires in these structures become low-frequency, high consequence events. Unfortunately, anything short of a catastrophic event will not generate sufficient political push to ensure that funding is available to provide this service. Furthermore, even though human behavior is the single largest cause of fires, legal doctrine prevents fire departments from inspecting the residential portions of multi-family building and single-family homes.

This leads to the 3E service audience for public education. The public education audience theoretically consists of every person in a community. However, in practice, public education focuses on younger and aged population groups. It has been demonstrated that these two groups are the most vulnerable to death and injury from fire, so that is where fire departments tend to target their efforts. These groups are not politically organized and have little voice in budget deliberations. However, they have high political and public salience that can be leveraged to maintain these programs.

Finally, there is the audience for fire-arson investigation. Unlike the other 3E services, it is important to recognize that fire-arson investigation is not a direct delivery public service in the same terms. For fire-arson investigation, the direct client is the government and insurance provider. Government is concerned with fire-arson investigation so that trends in cause can be identified and other services directed to reduce the risk and incidence of fire. In the rare case that the fire is arson in origin, the government's interest is in prosecuting a criminal case, which generally receives high priority. Likewise, the insurance industry is interested in fire cause to reduce potential risks, make insurance

payouts, or in the case of negligence, equipment malfunction, or criminal intent seeks to subrogate or avoid payouts.

Overall, the choice of which services will be cutback comes down to the political pressure that can be brought into budget deliberations. Those with weak political constituencies will be sacrificed first. This means that plan review and arson investigation are relatively safe from budget cuts. New construction inspections are safe when part of the building permit process. Existing building inspections have a strong adversarial and weak supportive constituency and will be sacrificed first. Service providers would do well to combine existing building inspections into emergency response forces to lessen the budget implications and make it more difficult to tease out direct costs. Further, the mere presence of uniformed firefighters to perform base-level inspections often serves to raise awareness and improve compliance (Ta et al. 2006). When combined with building familiarization exercises and approached from a public education perspective rather than a compliance perspective (May and Wood 2003), building owners and operators will likely be less resistant.

Practical Implications of Cuts to 3E Services

While fire prevention remains a priority in many communities, economic constraints force other communities to deemphasize fire prevention. This is concerning as most likely target of cuts is existing building inspections. Next to public education, these inspections have the greatest potential to make a positive impact on fire safety for those who live and work in a community, and for emergency responders protecting it. Unfortunately, failure to provide this service does not manifest in greater losses for several years after being cut.

Savings are made at current financial rates, but paid out in future inflated rates, making contemporary comparisons difficult (Wasem 2007).

Existing building inspections are intended to ensure that building owners and occupants maintain installed active fire protection systems function correctly when needed. This is a difficult proposition given that fires are infrequent, but high-consequence events. The associated risk is seldom perceived in realistic terms and the risk has increased with changes in construction methods and materials. At the time *America Burning* was written in 1973, construction techniques relied on natural materials that possessed a certain amount of fire resistance, such as dimensional lumber and solid wood doors. Furthermore, design features of the day accentuated inherent compartmentalization that slowed the spread of fire and combustion by-products. Finally, furnishings were also made of naturally occurring materials, such as cotton and wool.

That has all changed. Buildings are now constructed with value engineering in mind and then filled with synthetic furnishings. This means light-weight construction that is easily compromised by fire damage and a fire load with many times the heat release rate. A perfect example of the effect of these changes is illustrated by Kerber (2012). Whereas fires in legacy construction usually led to flashover in roughly 20-30 minutes, followed by collapse in around 40 minutes, modern construction techniques and living conditions result in flashover in as little as three minutes and structural collapse in under ten minutes. These are not survivable events for occupants nor for emergency responders.

New construction methods are highly dependent on fire protection systems to maintain structural integrity and allow occupants time to escape when fires do occur. This applies to all classes of building construction. Furthermore, new urban design calls for light-

weight construction, high density, tight configurations of buildings. From a fire protection standpoint, buildings less than 30 feet apart constitute a single fire area. This means a much heavier emergency response commitment when fire protection systems fail. Emergency operation objectives easily change from confining the fire to the room of origin to confining it to the building or block of origin. Planners need to start considering conflagration potential in resource analyses.

Unfortunately, most owners and occupants do not understand the importance of maintaining fire protection systems and neither do most firefighters. Existing building inspections function as insurance before the event for occupants and emergency responders. For the same reasons that changes in construction have increased occupant risk, they have increased risk to firefighters. If one compares the flashover and collapse time frames to recommended response times for career and volunteer fire departments, it can be seen that about the time firefighters arrive and begin operations, structural components will be starting to fail. Maintaining fire protection systems increases the time to flashover and structural failure allowing for occupant evacuation and for emergency responders to successfully intervene.

Greene and Andres (2009) found that human behavior is the most important factor in fire cause. Changing human behavior is the province of public education. Thus, the importance of public education, which really has several audiences. Fire departments tend to concentrate on the young and elderly, since these demographics have a tendency to be at greatest risk of injury and death. However, this risk is associated with an inability to react appropriately when confronted with a fire scenario. The audience in these situations should include young adults when risk taking behaviors emerge or middle aged adults who assume

care responsibility for young children and older adults. Subramaniam (2004) studied the lack of fire safety awareness in young adults and found that they changed behaviors fairly easily when confronted with actions that increased risk. These groups are just harder to reach, particularly in economically challenged communities where work and other factors constitute barriers to access.

There is another practical consideration to be made concerning cuts to 3E services. That is when services are cut rather than transferred internally or externally, it becomes extremely difficult to restore them. Given that personnel cuts seem to be the approach of choice, it must be understood that these cuts are short-term approaches to closing a budget gap. Unfortunately, personnel cuts also have long term consequences for fire departments, particularly in niche services, such as fire prevention. Loss of personnel equals loss of expertise and capacity. If personnel cuts are too deep, departments risk falling below an effectiveness threshold – the department no longer has the capacity to fulfill the service. Still worse, a department can find itself in a position when it is extraordinarily difficult to rebuild that lost capacity. Spinning up a program requires more investment than maintaining a program. There is always lag time between bringing on new people and having them produce a resulting effect within the community. Proficiency requires at least a year, if not two.

Further, fire prevention impact takes years to become obvious. It follows that departments may gamble that fire prevention could be cut to survive the immediacy of the budget downturn and be restored at a later date before the effect of 3E service cuts become pronounced. However, this becomes a quite difficult end to achieve within the short confines of a budget cycle. There is considerable competition among local government departments

for scarce resources. When 3E services are cut, it is more than likely not coming back. By way of example, the data in this research shows that when public education is not provided by the local fire department, it is seldom provided by another entity. In the overall study sample (n = 1200) only 2.8% (n = 34) of cases report public education is provided by another local organization. It would be a mistake to think that this only applies to public education.

In closing, it is worth noting that Southwick Jr and Butler (1985) observed that the elasticity of demand for fire losses were substantially higher than for relative wages expended to maintain a firefighting force. The critical implication of this relationship is that investment in alternative means of reducing fire loss, such as the 3E fire prevention services, will reduce the demand for more firefighters vis-à-vis the population protected. In other words, fire prevention is less expensive than buying fire trucks and firefighters. This research remains relevant given predictions for another downturn within the next year or two (Mauldin 2018). If past is prolog, it seems reasonable that the various delivery schemes will be subjected to the same economic stressors and reactions that further entrench suboptimal behaviors.

Suggestions for Future Research

The Vision 20/20 survey also asked questions on whether activities and resources were cut back across the five 3E services (in addition to personnel). Analysis on these variables might provide additional insight into service priorities and cutback strategies. These questions also included the possibility of categorical variables that would possibly give information of budget impact of the recession on capital items versus operating costs. This would help develop a better picture of the cutback strategies employed.

An important research question worth exploring is the apparent coincidence of the transition points in community size, department size, and department type. Certain external factors seem to come together that influence how communities chose to deliver emergency and non-emergency fire department services. Given the discussion on fire departments transitioning from public goods to common pool resources, research could provide a quantitative assessment of when service demand begins to overtake fire department capacity, particularly as is relates to the type of fire department providing service.

This research should also be expanded to tap into a representative sample of fire service providers. The inherent bias in the development of this study sample was unavoidable given the limitations of an unknown population and a means of contacting providers at the time the survey was conducted. Since then, a public website has been developed that provides a directory of fire departments (and stations) by state (see *https://firedepartment.net*). This website may provide a means of obtaining a true random sample to which the 3E Index could be applied.

Were that to be the case, the survey would need to be reconfigured to clarify perceived duplicate questions, such "Were activities cut back?" and "Were activity resources cut back?". Additional factors should be added to improve the strength of independent variables. These should include socioeconomic conditions, as well as fire rate and loss data. These data items would help inform decision-makers and policy in deciding on 3E fire prevention provision. Many local governments are still struggling financially and in many of these communities, the population is also suffering economically. There is a known link between service demand, loss, and socioeconomic conditions. Inclusion of these variables

would provide a richer, more robust picture of fire prevention service provision in a variety of community conditions.

Last and probably one of the most important studies that could reasonably be accomplished is a small-N or case study of whether the 3E Index has any relationship to the cost of fire[10] within a community. Variations in the 3E Index could be compared to this total cost of fire given reasonably comparable communities. Most of the necessary information is readily available or obtainable with minimal effort. While certainly not definitive, such a study would help establish the viability of the 3E Index as a tool for comparison and the effectiveness of different provision schemes.

[10] The cost of fire has been defined as including the cost of maintaining a fire department, the cost of fire insurance, the accumulated losses from actual fires, and the cost of installing and maintaining building fire protection systems (Hall 2012).

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

# Vision 20/20 Fire Prevention Cuts Survey

## About This Survey

The economy has forced local governments and public safety agencies to make tough budget decisions. Fire Prevention activities are among the first to be sacrificed when public safety agencies must implement cuts. Compounding the loss of public funds, the private sector faces the same economic pressures. Building owners and business managers may be curtailing or eliminating third-party testing of built-in systems and features or other safety programs to save money. This survey examines the level of cuts to Fire Prevention Services.

Instructions: Most of the questions in this survey require a single answer from predetermined selection options. Please select the one best answer based on your knowledge of your organization. Other questions will prompt you to select all that apply. For these questions, you may select one or more answers from the predetermined selection options.

***1. Which governmental agency provides the fire prevention service of plan review for new construction in your community?**

- ○ Local fire department
- ○ Local building department
- ○ Other local department
- ○ New construction plan review services are not provided by the local jurisdiction
- ○ New construction plan review services are contracted out
- ○ Not applicable

Other (please specify)

***2. Which governmental agency provides the fire prevention service of inspections for new construction in your community?**

- ○ Local fire department
- ○ Local building department
- ○ Other local department
- ○ New construction inspection services are not provided by the local jurisdiction
- ○ New construction inspection services are contracted out
- ○ Not applicable

Other (please specify)

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### Vision 20/20 Fire Prevention Cuts Survey

***3. Which local governmental agency provides the fire prevention services of existing occupancy inspections in your community?**

- Local fire department
- Local building department
- Other local department
- Existing occupancy inspection services are not provided by the local jurisdiction
- Not applicable

Other (please specify)

***4. Which local governmental agency provides the fire prevention services of public education in your community?**

- Local fire department
- Local building department
- Other local department
- Public education services are not provided by the local jurisdiction
- Not applicable

Other (please specify)

***5. Which local governmental agency provides the fire prevention services of fire/arson investigation in your community?**

- Local fire department
- Local building department
- Other local department
- Other Department (Federal, State, or Private)

Other (please specify)

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### Vision 20/20 Fire Prevention Cuts Survey

***6. What is your organization?**

- Local fire department
- Local building department
- State Fire Marshal's Office
- Other local department
- Other Department (Federal, State, or Private)

Other (please specify)

***7. What is the population of the community your department serves?**

- < 9,999
- 10,000 – 24,999
- 25,000 – 49,999
- 50,000 – 99,999
- 100,000 – 249,999
- 250,000 – 499,999
- 500,000 – 999,999
- 1,000,000

***8. What is the total staffing of your department including civilian and uniformed personnel?**

- < 24
- 25 – 49
- 50 – 99
- 100 – 249
- 250 – 499
- 500 – 999
- 1000 - 1999
- > 2000

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

### Vision 20/20 Fire Prevention Cuts Survey

***9. Is the fire department serving your community?**

- All career
- Mostly career
- Mostly volunteer
- All volunteer
- Not applicable

***10. Does your department have one or more work units dedicated to providing a fire prevention service? Fire prevention service refers to activities encompassing one or more of the first 3 E's: Education, engineering, or enforcement (code and investigations).**

- Yes
- No

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

### Vision 20/20 Fire Prevention Cuts Survey

**11. What is the total staffing of your combined fire prevention work units including civilian and uniformed personnel?**

- 0
- 1 – 5
- 6 – 10
- 11 – 20
- 21 – 30
- 31 – 50
- > 50

***12. Has your organization made cuts to fire prevention services in the last two years?**

- Yes
- No

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

### Vision 20/20 Fire Prevention Cuts Survey

**13. Were these cuts the result of a tightened budget?**

- ○ Yes
- ○ No

**14. What percent of the overall department budget was cut?**

- ○ < 2.5%
- ○ 2.5 – 4.9%
- ○ 5.0 – 7.4%
- ○ 7.5 – 9.9%
- ○ 10 – 15%
- ○ > 15%

**15. What percent of the fire prevention work unit(s) budget was cut?**

- ○ < 5%
- ○ 5 – 9.9%
- ○ 10.0 – 14.9%
- ○ 15 – 19.9%
- ○ 20 – 25%
- ○ Other

Other (please specify)

**16. Which fire prevention services were affected by the budget cuts? Check all that apply.**

- ☐ Fire investigations
- ☐ Fire/building code inspections
- ☐ Fire/building code plan review
- ☐ Public education
- ☐ Other

Other (please specify)

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

**Vision 20/20 Fire Prevention Cuts Survey**

***17. Were personnel cut from the fire prevention work unit(s)?**

- ○ Yes
- ○ No

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

### Vision 20/20 Fire Prevention Cuts Survey

**18. If yes, what percentage of personnel was cut from the fire prevention work unit(s)?**

- < 5%
- 5 – 9.9%
- 10.0 – 14.9%
- 15 – 19.9%
- 20 – 25%
- Other

Other (please specify)

**19. Which fire prevention work units were affected by personnel cuts? Check all that apply.**

- Fire investigations
- Fire/building code inspections
- Fire/building code plan review
- Public education
- Other

Other (please specify)

**20. Did any other work units in the department experience budget cuts?**

- Yes
- No

***21. Were fire prevention activities cut back?**

- Yes
- No

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

### Vision 20/20 Fire Prevention Cuts Survey

**22. Which fire prevention activities were cut back? (check all that apply)**

- ☐ Fire investigations
- ☐ Fire/building code inspections
- ☐ Fire/building code plan review
- ☐ Public education
- ☐ Other

Other (please specify)

***23. Were fire prevention activity resources cut back?**

- ○ Yes
- ○ No

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

### Vision 20/20 Fire Prevention Cuts Survey

**24. What types of fire prevention resources were cut back? (Check all that apply)**

- ☐ Organization infrastructure, such as vehicles, facilities, or telecommunications
- ☐ Training and education classes for employees
- ☐ Training and education classes for clientele
- ☐ Reference materials
- ☐ Public educational materials
- ☐ Other

Other (please specify)

***25. Did your department take steps to compensate for fire prevention activity cut backs?**

- ○ Yes
- ○ No

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

### Vision 20/20 Fire Prevention Cuts Survey

**26. Which, if any, of the following actions did your department take? (Check all that apply)**

- ☐ Combined work unit responsibility (i.e., investigations & after hours code enforcement)
- ☐ Internal transfer of responsibility (i.e., code enforcement to engine company inspections)
- ☐ External transfer of responsibility (i.e., plan review to another city/county/state department)
- ☐ Formal discontinuation of one or more fire prevention service(s)
- ☐ Contracting out specific fire prevention activities
- ☐ Expansion/increased use of community volunteers (Fire Corps, etc.) Not sure how to phrase this…
- ☐ Technological improvements
- ☐ Process improvements
- ☐ Other
- ☐ Not applicable

Other (please specify)

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

### Vision 20/20 Fire Prevention Cuts Survey

**27. If you answered External Transferability in in the question about actions taken, what services were transferred? (Check all that apply.)**

- ☐ New construction inspections
- ☐ Plans review
- ☐ Existing occupancy inspections
- ☐ Public education
- ☐ Fire/Arson investigation

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

### Vision 20/20 Fire Prevention Cuts Survey

**28. If you answered Discontinuation of Services in the question about actions taken, what services were discontinued? (Check all that apply.)**

- ☐ New construction inspections
- ☐ Plans review
- ☐ Existing occupancy inspections
- ☐ Public education
- ☐ Fire/Arson investigation

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## APPENDIX A – FIRE PREVENTION CUTS SURVEY INSTRUMENT

### Vision 20/20 Fire Prevention Cuts Survey

**29. Please provide a Point of Contact for follow-up questions, clarification of answers, and the second part of the survey. ALL IDENTIFYING INFORMATION PROVIDED IN THIS SURVEY WILL BE KEPT CONFIDENTIAL. Survey results will be made available through the Vision 20/20 Website upon completion of each part of the survey. Thank you for your valuable assistance.**

| | |
|---|---|
| Name: | |
| Title | |
| Email Address: | |
| Phone Number: | |

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# APPENDIX B – SURVEY INTRODUCTION EMAILS

Initial e-mail to survey candidates:

Subject Line: Survey to Assess Impacts of Cuts to Fire Prevention Programs

Dear Colleague,

As a fire professional you see first hand the loss and devastation that fires cause in peoples lives and the impact these catastrophic events can bring not only to them and their families, but the community as well. Vision 20/20 is working to solve this problem, but we need your help.

Vision 20/20 is a grassroots effort to help define and implement national strategies for fire prevention practices in the U.S. The goal of Vision 20/20 is a simple one - to marshal forces for the development and support of a national strategic agenda to prevent fire loss. The program is supported with funding from the U.S. Department of Homeland Security, Assistance to Fire Fighters Fire Prevention and Safety Grant program, and the Institution of Fire Engineers US Branch. For complete details on the Vision 20/20 program visit www.strategicfire.org

**So how can you help?**

The economy has forced local governments and public safety agencies to make tough budget decisions. Fire Prevention activities are among the first to be sacrificed when public safety agencies must implement cuts. The Vision 20/20 program is asking you to take a few moments to complete a short survey so that we can establish the initial impact these cuts in prevention programs are having on organizations across the United States.

**If you can take a few moments to help, simply click (insert hyperlink to survey here)**

This survey is completely anonymous and the collective results will be shared with the Vision 20/20 team as they work to coordinate efforts to improve fire prevention efforts across the nation.

Please feel free to share this message and invite other members of your organization to complete this survey.

**Please complete your survey response by (Insert date here – I'd suggest 30 days out from when email is sent.)**

Thank you,

Vision 20/20 Steering Committee

# APPENDIX B – SURVEY INTRODUCTION EMAILS

Second email – two weeks after first email.

Subject Line: Following Up on Survey on Cuts to Fire Prevention Programs

Dear Colleague,

A few weeks ago we sent you information on the Vision 20/20 program and our efforts at improving fire prevention programs across the nation and how you can help. Each year thousands of people lose their lives, tens of thousands of people are injured and billions of dollars in property are lost. These losses from fires are more than those from floods, hurricanes, tornados, earthquakes and other natural disasters combined.

In these difficult economic times, Fire Prevention activities are among the first to be sacrificed when public safety agencies must implement cuts. The Vision 20/20 program is asking you to take a few moments to complete a short survey so that we can establish the initial impact these cuts in prevention programs are having on organizations across the United States.

**If you haven't yet completed the survey, can you please take a take a few moments to help? Simply click https://www.surveymonkey.com/s/5YVL2VW**

This survey is completely anonymous and the collective results will be shared with the Vision 20/20 team as they work to coordinate efforts to improve fire prevention efforts across the nation.

Through the efforts of some of our colleagues, the International Code Council has agreed to distribute the survey to their membership. This will allow us to collect more rounded information and reduce any inadvertent bias. Accordingly, we are extending the closure date for the survey to provide the ICC members an opportunity to respond.

**Please complete your survey response by June 15, 2012. I will be closing the survey to responses at 10:00 PM EST on that date.**

Again, please feel free to share this message and invite other members of your organization to complete this survey.

Thank you,

Vision 20/20 Steering Committee

**About Vision 20/20**

Vision 20/20 is a grassroots effort to help define and implement national strategies for fire prevention practices in the U.S. The goal of Vision 20/20 is a simple one - to marshal forces for the development and support of a national strategic agenda to prevent fire loss. The program is supported with funding from the U.S. Department of Homeland Security, Assistance to Fire Fighters Fire Prevention and Safety Grant program, and the Institution of Fire Engineers US Branch. For complete details on the Vision 20/20 program visit www.strategicfire.org

# APPENDIX B – SURVEY INTRODUCTION EMAILS

Third email (send out day or two before stated deadline)

Subject Line: Deadline approaches for Survey on Impact of Cuts to Fire Prevention Programs.

Dear Colleague,
Friday, June 15 is the deadline for the Vision 20/20 program survey. If you haven't had a chance to complete your responses, we hope that you can take a few moments now to do so. Your input is a valuable part of our work to strengthen fire prevention efforts across our country.

**To complete this short survey, simply click https://www.surveymonkey.com/s/5YVL2VW**

This survey is completely anonymous and the collective results will be shared with the Vision 20/20 team as they work to coordinate efforts to improve fire prevention efforts across the nation.

Please feel free to share this message and invite other members of your organization to complete this survey.

**Please complete your survey response by close of business June 15, 2012.**

Thank you,

Vision 20/20 Steering Committee

**About Vision 20/20**

Vision 20/20 is a grassroots effort to help define and implement national strategies for fire prevention practices in the U.S. The goal of Vision 20/20 is a simple one - to marshal forces for the development and support of a national strategic agenda to prevent fire loss. The program is supported with funding from the U.S. Department of Homeland Security, Assistance to Fire Fighters Fire Prevention and Safety Grant program, and the Institution of Fire Engineers US Branch. For complete details on the Vision 20/20 program visit www.strategicfire.org

# APPENDIX B – SURVEY INTRODUCTION EMAILS

Final email – send out day after initial deadline

Subject Line: Deadline extended for Fire Prevention Survey

Dear Colleague,

Responses were so overwhelming, we have extended the completion deadline for the Vision 20/20 program survey to (Insert date – I would say approximately a week out – or the first Friday following.) If you haven't already done so, it's not too late to provide us important data as we work to improve fire prevention programs across the nation. But you must act quickly.

**To complete this short survey, simply click (insert hyperlink to survey here)**

This survey is completely anonymous and the collective results will be shared with the Vision 20/20 team as they work to coordinate efforts to improve fire prevention efforts across the nation.

Please feel free to share this message and invite other members of your organization to complete this survey.

**Please complete your survey response by close of business (Insert deadline date here.)**

Thank you,

Vision 20/20 Steering Committee

# APPENDIX C – IRB APPROVAL

**Oklahoma State University Institutional Review Board**

| | |
|---|---|
| Date: | 05/22/2018 |
| Application Number: | AS-18-47 |
| Proposal Title: | Fire Prevention Service Provision in a New Age of Local Government Retrenchment |
| Principal Investigator: | MIKE DONAHUE |
| Co-Investigator(s): | |
| Faculty Adviser: | Marten Brienen |
| Project Coordinator: | |
| Research Assistant(s): | |
| Processed as: | Exempt |

**Status Recommended by Reviewer(s): Approved**

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The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes to the title, PI, adviser, other research personnel, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any unanticipated and/or adverse events to the IRB Office promptly.
4. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB Office at 223 Scott Hall (phone: 405-744-3377, irb@okstate.edu).

Sincerely,

Hugh Crethar, Chair Institutional Review Board

VITA

Michael Anthony Donahue

Candidate for the Degree of

Doctor of Philosophy

Dissertation: FIRE PREVENTION SERVICE PROVISION IN A NEW AGE OF LOCAL GOVERNMENT RETRENCHMENT

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, 2019.

Completed the requirements for the Master of Science in Environmental and Waste Management at University of Maryland University College, College Park, Maryland in August 1999.

Completed the requirements for the Bachelor of Science in Fire Science Management at University of Maryland University College, College Park, Maryland in December 1991.

Experience:

Firefighter/Rescuer with Montgomery County Fire and Rescue Service from October 1977 through December 2012. Retired as Assistant Chief/Section Head, Office of the Fire Marshal.
Contract Instructor with United States National Fire Academy from May 2012 to present.

Professional Memberships:

Certified Fire Protection Specialist (National Fire Protection Association)
Mid-Atlantic Life Safety Conference Steering Committee
International Fire Marshals Association