FIRE FIGHTER SAFETY AND DEPLOYMENT STUDY

National Fire Service Data Summit

Proceedings

Jason D. Averill
Lori Moore-Merrell
Kathy A. Notarianni
Robert Santos
Doug Wissoker

Moderated by:
Dennis Compton

U.S. Department of Commerce
Gary Locke, Secretary

National Institute of Standards and Technology
Patrick D. Gallagher, Director

May 2011

NIST Technical Note 1698

May 2011

National Fire Service Data Summit
Proceedings

Jason D. Averill
Lori Moore-Merrell
Kathy A. Notarianni
Robert Santos
Doug Wissoker

Moderated by: Dennis Compton

U.S. Department of Commerce
Gary Locke, Secretary

National Institute of Standards and Technology
Patrick D. Gallagher, Director

Certain commercial entities, equipment, or materials may be identified in this document in order to describe an experimental procedure or concept adequately. Such identification is not intended to imply recommendation or endorsement by the National Institute of Standards and Technology, nor is it intended to imply that the entities, materials, or equipment are necessarily the best available for the purpose.

National Institute of Standards and Technology
Technical Note 1698

31 pages (May 2011)
CODEN:

Funding provided through DHS/FEMA's Grant Program Directorate for FY 2009 Assistance to Firefighters Grant Program — Fire Prevention and Safety Grants.

This report is an output of the Multiphase Study on Firefighter Safety and Deployment team and reflects a joint effort between NIST, the Commission on Fire Accreditation International-RISK, International Association of Fire Chiefs, International Association of Fire Fighters, Urban Institute, and Worcester Polytechnic Institute.

Abstract

Effectively managing a fire department requires an understanding of and an ability to demonstrate how changes to resources will affect community outcomes. It is imperative that fire department leaders, as well as political decision makers, know how fire department resource deployment in their local community affects community outcomes in three important areas: firefighter injury and death; civilian injury and death; and economic loss. To facilitate this, fire department leaders must have reliable statistical data useful for optimization of response both prior to and during an incident. However, even with recent technological advances and substantial fire department efforts in data collection, the fire service is unable to scientifically quantify experiences to determine the relative effectiveness of different deployment configurations, including: type of emergency event, staffing levels/crew size, asset configurations, response time frames, frequency and manner of personnel training, and fire prevention programs.

To address this situation requires the attention of research scientists, policy makers and the firefighter community alike. Accordingly, the purpose of this project was to develop a technical basis for data collection and reporting to enable leaders to match resource investments and resources deployed to the risks in the community they serve. Stakeholders from across the fire service industry, including firefighters and chiefs, data entry specialists, data vendors, local union leadership, federal agencies, insurance industry, and standards developing organizations, attended the summit and contributed to the discussion. During the course of the summit, participants identified specific data needs from differing stakeholder perspectives, identified data gaps which hamper efforts to address the identified needs, and identified possible steps to enable a technical basis for capturing data about the resources deployed when firefighters and paramedics respond to fire and EMS events. These steps provide a roadmap to a future where the fire service has performance data which support science-based decision-making.


NIST
National Institute of
Standards and Technology
U.S. Department of Commerce


IAFC
INTERNATIONAL
FIRE CHIEFS
ASSOCIATION


A
I
F
F
AFL-CIO
CLC


WPI


CFAI RISK


URBAN
INSTITUTE

Table of Contents

Background

Many fire departments across the nation are being challenged by budget crises, rising call volume, personnel and equipment shortages, security issues and the overall expectation to do more with less. Effectively managing these challenges requires a basic understanding of how changes in resources affect community outcomes. Specifically, it is imperative that fire department leaders, as well as political decision makers, know how fire department resource deployment in their local community affects community outcomes in three important areas; firefighter injury and death, civilian injury and death, and property loss.

However, even with recent technological advances and substantial fire department efforts in data collection, the fire service is not yet able to scientifically quantify experiences to determine the relative effectiveness of deployment decisions, including the type of emergency event, staffing levels/crew size, asset configurations, response time frames, frequency and manner of personnel training, and fire prevention programs. A technical basis must be developed to gather data that enables leaders to match resource investments and resources deployed to the risks in the community they serve. Data gathered must be easily accessible, shared, and must follow necessary policy mandates.

This symposium was part of the Multiphase Study on Firefighter Safety and Deployment Project. The study team has been working for several years to develop science-based tools for the fire service in order to optimize a fire service leader's ability to match resources to risks. Incident data collection remains on the critical path towards project success. After significant multi-year effort to collect fire and EMS incident data from a statistical sampling of fire departments across the United States, this symposium was arranged in order to not only share the project team findings with a broad stakeholder group (representative of the diverse needs and interests of the modern fire service), but also document other data collection efforts, in order to identify a viable path to a national fire service data infrastructure.

Participant Disclaimer: This report is a high-level summary of the discussions which occurred at the National Fire Service Data Summit. This report should not imply endorsement or support of the discussion or recommendations by any specific participant or organization. At no time during the meeting was there a vote or any process which may be interpreted as consensus.

Objectives

The objectives of the National Fire Service Data Summit were four-fold:

1. Gather information on data needs from a broad range of participants.

2. Share the research experience of the Multiphase Study on Firefighter Safety and Deployment Project, with particular focus on availability, collection, and interpretation of basic resource deployment data.

3. Discuss the need for and the potential utility of a national fire service data collection and reporting system, with focus on the stakeholders.

4. Develop recommendations for data collection processes, as well as data elements that can be consistently collected and analyzed by local fire departments to enable measurement of the department's availability, capability and operational effectiveness.

To accomplish these objectives, the summit was broken into five sessions over two half-days. These proceedings follow the chronology of the summit. In Session 1, after a brief welcome and introduction from Dr. Kathy Notarianni and Chief Dennis Compton, the participants introduced themselves. The remainder of the session was dedicated to identifying obstacles to fire service data collection, performance measures, and data elements. In Session 2, the Multi-Phase Study team presented the results of work completed to-date, including findings from scientific literature, fireground experiments, and an ongoing survey. Lessons-learned from the survey effort informed discussions for the rest of the summit. In Session 3, participants discussed gaps and deficiencies in the existing data collection efforts. These deficiencies were associated with an increased the burden to the fire service, the usefulness of the data, the motivation for entering quality data, and the accuracy of the data.

Session 4 started Day 2 of the summit. Participants were distributed into one of three groups; 1) candidate data elements or metrics, 2) research needs, and 3) recommendations going forward. Each group met in parallel and then reported a summary back to the whole summit. The summit concluded with a group discussion of the key steps along the path toward a national fire service data set. Nine key action-oriented steps were identified, including which steps could be conducted in parallel and which steps required input from prior actions.

Day 1

SESSION 1. PURPOSE AND GOALS OF THE SUMMIT

The goal of the summit was to develop recommendations for data collection processes, as well as a list of data elements that can be consistently collected and analyzed by local fire departments in an effort to measure the department's availability, capability, and operational effectiveness.

Dr. Kathy Notarianni opened the workshop with a welcome to the participants, a review of the agenda, and key logistical issues. Kathy discussed how each participant was invited specifically to share their wisdom and their experiences related to fire service data. Kathy also spoke on how the group as a whole represented a wide range of key stakeholder organizations such as: fire service leaders, city managers, the fire data industry, and organizations that currently collect fire data such as NFIRS and NFPA. Briefly, each of the participants introduced themselves, demonstrating the diversity of stakeholders present at the meeting. A list of participants is shown in Appendix A.

Chief Denny Compton, the moderator for the workshop, reviewed the needs, potential outcomes, challenges, and the overall workflow for the summit. He began with a review of the core values for the fire service noting that data collection should support evaluation and improvement of an individual fire department's ability to deliver on basic core principles. These values, developed in consultation with fire service leaders during a previous stage of the MultiPhase Study, include protection of lives, property and the environment, through preparedness, prevention, public education, and emergency response with an emphasis on quality services, efficiency, effectiveness, and safety. These principles framed and focused the subsequent discussion.

The remainder of and central theme of Session 1 focused on facilitated input from the participants as to what information is needed in order to measure the performance of a fire department. It became clear from this input that there are significant needs in the fire service community which could be addressed through data collection and analysis. These include data associated with community risks and the deployment of fire department resources responding to those risks. The participants discussed how consistent and high-quality data would support analysis to inform and optimize fire service decision-making.

BRAINSTORMING SESSION: DATA ELEMENTS

The participants identified numerous obstacles impeding the ability of fire service leadership to analyze data in a way that informs deployment and standard-of-cover decisions, maximizes service delivery to the community, minimizes risks to firefighters, and allows meaningful and informative outcome comparisons between cities with similar demographics and capabilities. A primary challenge involves the differing methods for data collection. Many fire departments collect similar data in different ways which is an obstacle to comparing outcomes between similar communities. This is due to the fact that several data collection systems serve purposes other than informing the fire service. The obstacles identified by the group are summarized below.

- The National Fire Incident Reporting System (NFIRS) was created after the America Burning Report in the 1970's to characterize the incidence of fire in the United States. Limited fire service response information is collected since the primary purpose is to characterize the main attributes of the fire incident.
- Each individual fire department collects incident response information for internal use and generally issues an annual report. There are a variety of software vendors that support this enterprise. However, each vendor and each fire department, customize their data collection such that it generally cannot be easily or reliably compared between fire departments.
- The Occupational Safety and Health Administration (OSHA) and many insurance companies require standardized reporting for fire incidents that involve firefighter injuries. However, these reports are generated in varying formats, limited in availability and do not collect information about the responses that do not result in firefighter injuries thus preventing causal analysis.
- The National Emergency Medical Service Information System (NEMSIS) collects standardized data on pre-hospital EMS response and care and may be a role model for how to design and implement a national fire service database; however, the scope of this database currently precludes characterization of the typical response to a working fire.
- Although there may be local, regional, or state data reporting systems which require fire service input, the lack of standardization presents a barrier to aggregation at the national level.
- There is lack of adequate attention to data quality. Fire service data entry systems have multiple data entry points, are not consistent in the quality of reporting and oversight, and have limited use at the local level.

To address these obstacles, the summit participants focused on three primary tasks:

1. Identify operationally relevant data elements that can be collected by all fire departments.
2. Compile recommendations for data collection at the local fire department level and for vendors.
3. Identify pathways to compile quality data for research use at the national level in an effort to inform policy at the local level.

BRAINSTORMING SESSION: FIRE DEPARTMENT PERFORMANCE MEASURES

The remainder of the first session consisted of brainstorming devoted to identifying performance measures. Prior to starting the discussion, three basic components of fire department performance were proposed and defined for the participants:

- Availability — The degree to which the resources are ready and available to respond.
- Capability — The abilities of deployed resources to manage an incident.
- Operational Effectiveness — A product of availability and capability, it is the outcome achieved by the deployed resources or the ability to match resources deployed to the

risks to which they are responding.

For the remainder of the session, participants identified important characteristics of availability, capability, and operational effectiveness, as shown below.

AVAILABILITY

- Type of system – paid on call, volunteer, and career staff
- Number of firefighters and staff employed
- Count and consistency of resources available – variable or constant staffing levels
- Intergovernmental protocols (mutual or automatic aid), prior arrangements, and legally defined agreements
- Time of day
- Ability to effectively communicate the type of event and identify resource availability
- How busy the units are – more runs means less availability
- Define available – What time delay still counts as available?
- Crew status questions: where are they, what are they doing, how many people, and are they with the apparatus?
- Number and type of equipment/apparatus
- Properly maintained equipment/apparatus

CAPABILITY

- Preparedness
  - Identify risks in the community
  - Surveillance to ID type of incident in order to define needed resources
  - Demands of what is being protected and the risk level
  - Standards to describe what resources are appropriate for a given incident type
  - Extent of prevention activities that went into the system prior to the event
  - Built-in fire protection systems
  - Infrastructure – roads and water supply
- Numbers and selected characteristics of people and equipment deployed
  - Certification and training level of responding personnel
  - Experience of personnel
  - How much equipment is deployed initially and in total
- What is the capacity of the resources?
  - Water supply characteristics – hose, tank size
  - Notification / dispatch system for incidents
  - Crew size per responding unit
  - Number/type of units responding
- Service level objectives (expectations) for the community, may or may not match the risk
  - Acceptable community risk – tolerance of the community to loss
- Capability may vary throughout the course of the day due to changing risks and/or resources (due to call volume)
- Other things that impact the ability to deploy – weather, traffic
- The impact of time, if resources cannot be applied in a given time, may lose the opportunity to control the outcome
- Ability to identify when an incident started as a particular incident type and ended as another (level of escalation)

OPERATIONAL EFFECTIVENESS

- Key critical tasks of any event – medical, hazmat, special ops, fire
- Conceptual model that links resources, incident type, and goals
- Adequate staffing for critical tasks
- Magnitude of incident or injury – sometimes no matter what we do or how quickly we get there, we cannot change the outcome
- Coordination - Ability to properly coordinate the deployed resources
- Definition of effectiveness
  - What are the outcomes we are looking for?
  - Better definition or more accurate reporting of property loss
  - Define the situation at the time the fire department was called to measure the fire department impact
  - What we do versus what was inevitable
- Measure of the vulnerability of the property
- Time-to-task completion, defined tasks
- Systems solution – our best efforts are impacted by other pieces of the system — detection, notification, alarm handling — have great capacity for impacting effectiveness
- Recovery and salvage — capture the ability to take something at a point and prevent further damage

BRAINSTORMING SESSION: DATA ELEMENTS

Following the brainstorming session, the participants were asked to define specific data elements for each category both on an incident-specific and on a global scale. It can be seen from the data elements summarized below, that of primary interest at the incident scale is accurate logging of key times of completion of tasks from time of call receipt through the completion of the response. At the global scale, the timeline is also of key interest along with standardizing both terminology used and formats for collecting data elements.

GLOBAL

- How many firefighters and other staff are available
- What response agreements are in place
- Standardized date/time formats
- Data elements in Commission on Fire Accreditation International (CFAI) needs assessment
- Budget of a particular department and how it compares with other departments of similar size and community demographics and with their outcomes
- Standardized terminology and data elements
- Standardized responses (resources deployed)
- Three timelines, what the fire department is doing, timeline of the fire, and people on-site and their actions all intersect and impact each other
- Cascade of events — NFPA1710, ISO, CFAI — some events are well timed through the organizations, need to identify other things that are important from a research basis and mantain consistency

[1] While all suggestions recorded during the workshop are captured in these summaries, the authors have combined redundant concepts or moved elements to the appropriate category in order to improve clarity.

- Events happen before fire department arrival that impact the outcome of the incident; data should start with an idealized time line and boil down to those that can be collected or inferred
- Some understanding of the fact that some records should be excluded due to data errors or outliers
- Need to measure the arrival conditions against the outcomes
- Capability to capture modifications to unit capability during the day — (e.g. are they short a person during a patient transport?)
- Availability is hard to identify — it is difficult to capture what resources were deployed — and difficult to capture the time of effective response force assembly
- Can show apparatus capability but harder to capture personnel credentialing over time
- What is the critical tasking for handling a particular risk in order to measure effectiveness
- Proxy measures – (e.g. use of time)

INCIDENT SPECIFIC

- Turnout time
- Response time
- Comprehensive timeline for an incident
- Standardized benchmarks — such as call ring time
- Pre-incident times — time of the event occurred that caused the incident (e.g. when the pot was placed on the stove, if possible)
- Arrival time of the first apparatus
- Time of arrival and assembly of effective fire fighting force
- Time of fire attack (water on fire)
- At the patient's bedside
- Hazmat timeframes (and other high risk, low frequency events)
- What was going on at the time of notification
- Did crew respond from station — with or without AVL (automatic vehicle locator)
- Were all of the first-due units available when dispatched?
- Impact of mutual aid – need to know about availability of those routinely used resources
- What's happening with the firefighter when dispatched — weather — impacts travel times and personnel effectiveness
- More detail on the incident (e.g. the condition of the property, the injury, severity, and characteristics of the person, the damage, and what it will take to make things right)
- Measuring the outcomes – matching an injury to an event
- How do we determine percent property lost or saved?
- National EMS Information System (NEMSIS) and other system correlation to describe patient injuries and outcomes
- Property loss — insurance industry knows property loss — fire service needs better way to estimate loss

Day 1

SESSION 2. STATISTICAL AND EXPERIMENTAL DATA TO SUPPORT RESOURCE DEPLOYMENT DECISIONS

In Session 2, the principal investigators from the Firefighter Safety and Deployment Study presented their primary project findings with a focus on those relevant to the establishment of best practices for the fire service.

BACKGROUND AND OVERVIEW

Dr. Lori Moore-Merrell presented the overall chronology of the multi-phase project. The long-term objective of the project is to optimize a fire service leader's capability to deploy resources to prevent or mitigate adverse events that occur in a risk/hazard filled environment. The study has accomplished several key milestones in support of this objective. These include a comprehensive literature review, identification of the key elements of community risk, creation, implementation, and analysis of a database for incident data collection, and conduct and analysis of residential fireground experiments.

First, a comprehensive literature review was conducted. This review identified prior studies that have explored the underlying factors which ultimately affect three primary community outcomes: firefighter injuries and deaths; civilian injuries and deaths; and property loss. This literature review may be downloaded from the project website at http://www.firereporting.org/studyreports.php .

COMMUNITY RISK MODEL ELEMENTS

A critical step in this project was to create a community risk model that showed both the key elements of community risk and how they related to one another. The model shown in Figure 1 and it's elements are described below.

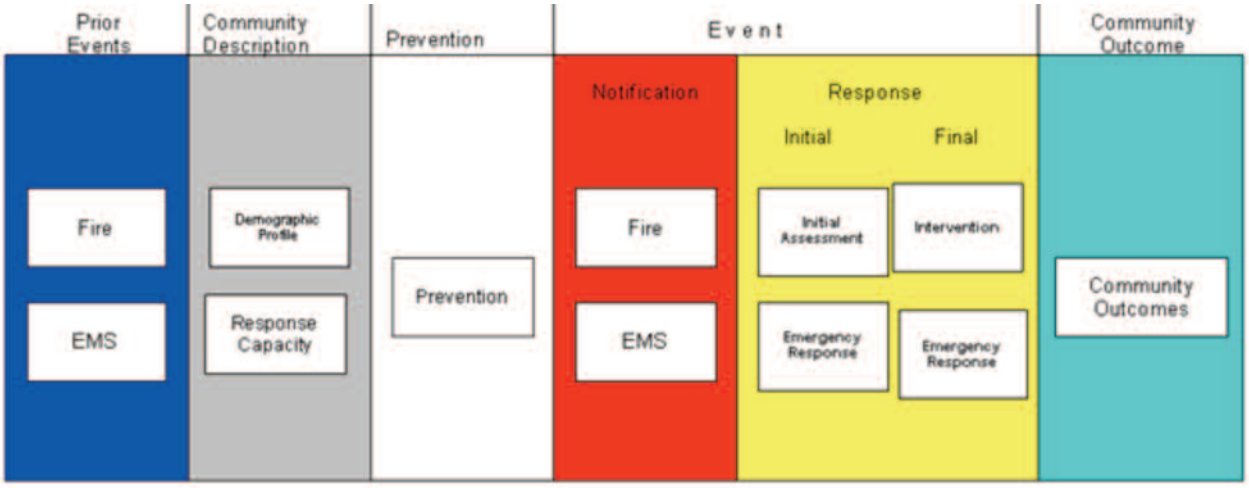

FIGURE 1: PROPAGATION OF COMMUNITY RISK

- Prior Events:
  - The historical fire loss record and EMS response history for a community are starting points for predicting future outcomes.
- Community Description:
  - The demographics of a community have a strong correlation to the frequency and type of fires. These factors include population density, median income levels, race, age and type of housing and other structures, road capacity, including natural barriers such as rivers or mountains, and others.
  - Response capacity of the fire department, including the number and location of stations, equipment and personnel, training,
- Prevention:
  - Community investments in prevention and inspection programs and mandated fire protection assets (fire hydrants, automatic sprinkler systems, e.g.)
- Event Characteristics
  - Initial assessment
  - Notification and dispatch time
  - Pre-arrival interventions
    - automatic suppression
    - manual (non-fire department) suppression or emergency aid
  - Response time and size of initial deployment
  - Capability of responding personnel
  - Total deployed assets
- Community Outcomes: Civilian and firefighter injuries and deaths and property losses

INCIDENT DATA COLLECTION

Following the overview, Dr. Lori Moore-Merrell reviewed the design and distribution of a customized incident survey. The team first reviewed existing data collection instruments, including NFIRS and various commercial software packages, to determine how to best leverage existing resources. Based upon the literature review, it was determined that no existing data collection instrument contained the breadth of data content that would be necessary to make statistically significant conclusions at the policy-level. Thus, the project team developed a comprehensive survey that could be posted on the web and accessed by participating fire departments around the country.

In order to select a representative group of fire departments to participate, The Urban Institute designed a generalizable statistical sample of over 400 fire departments. The sampling plan was designed assuming 75 % departmental participation as well as the provision of 100 fire (working structure fires only) and 100 EMS (ALS cardiac and trauma incidents only) incidents per department (totaling about 33,000 fire and 33,000 EMS incidents). This database then formed the technical foundation for a community risk-response model applicable to areas covering over 75 % of the US population. Over a period of three years (which spanned the initiation and deepening of the U.S. economic recession), the recruitment process yielded a response rate of 18 % and produced 7,000 fire incidents and 7,000 EMS incidents. This response level fell short of the number of incidents necessary to draw statistically valid conclusions about the ability of a fire department to match resources to risks in the community. While the effort to collect the necessary data through the custom survey continues, it underscores the need for a national database of science-based measures which are specifically designed to inform the U.S. fire service and local community decision-makers.

RESIDENTIAL FIREGROUND EXPERIMENTS

The study team designed an experimental program to establish a scientific foundation for the deployment of resources to structure fires, beginning with the most frequent and most deadly structure fire type: a low hazard detached single-family residence. Mr. Jason Averill described the purpose, methods, and findings from NIST Technical Note 1661: Report on Residential Fireground Experiments. The full report can be downloaded from the study website at **http://www.firereporting.org/studyreports.php**.

One purpose of the experiments was to validate the findings of the incident survey through parametric experimental design methods. Conducting fire department response experiments controls for many of the factors which might otherwise confound interpretation of incident data in the real world. The experiments allowed the same number of firefighters, arriving at the same time to the same type of fire to be compared to the outcome when only one of those variables were changed. This maximizes understanding of the relative effects of response time and crew size to various fire severities and provides validation and insight into the results of the incident survey. Another purpose of the experiments was to provide a technical basis for the NFPA 1710/1720 standard (the national standards for the deployment of fire service).

The fire crews were always deployed using a total of four apparatus: three engines and one truck plus a chief with an aide. The first-due engine arrival time was varied, the separation between the subsequent arriving apparatus and the crew size was changed between experiments (two-, three-, four- and five-persons per apparatus). Twenty-two tasks were identified and measured from time to initiate and complete for all experiments.

For overall scene time (time to complete all 22 fireground tasks), the four-person crews operating on a low-hazard structure fire completed all the tasks on the fireground (on average) seven minutes faster — nearly 30 % — than the two-person crews. The four-person crews completed the same number of fireground tasks (on average) 5.1 minutes faster — nearly 25 % — than the three-person crews. On the low-hazard residential structure fire, adding a fifth person to the crews did not decrease overall fireground task times. However, it should be noted that the benefit of five-person crews has been documented in other evaluations to be significant for medium — and high-hazard structures, particularly in urban settings, and is recognized in industry standards.

There was a nearly 10 % difference in the "water on fire" time between the two- and three-person crews and an additional 5 % difference in the "water on fire" time between the three- and four-person crews (i.e., 15 % difference between the four- and two-person crews). There was an additional 5 % difference in the "water on fire'" time between the four- and five-person crews (i.e., 20 % difference between the five- and two-person crews).

The four-person crews operating on a low-hazard structure fire completed laddering and ventilation (for life safety and rescue) 30 % faster than the two-person crews and 25 % faster than the three-person crews. The three-person crews started and completed a primary search and rescue 25 % faster than the two-person crews. The four- and five-person crews started and completed a primary search 6 % faster than the three-person crews and 30 % faster than the two-person crew. A 10 % difference was equivalent to just over one minute.

For occupant rescue, three different "standard" fires were simulated using the Fire Dynamics Simulator (FDS) model. Characterized in the Handbook of the Society of Fire Protection Engineers as slow-, medium-, and fast-growth rate, the fires grew exponentially with time. The rescue scenario was based on a nonambulatory occupant in an upstairs bedroom with the bedroom door open.

Independent of fire size, there was a significant difference between the toxicity, expressed as fractional effective dose (FED), for occupants at the time of rescue depending on arrival times for all crew sizes. Occupants rescued by early-arriving crews had less exposure to combustion products than occupants rescued by

[2] As defined in the handbook, a fast fire grows exponentially to 1.0 MW in 150 seconds. A medium fire grows exponentially to 1 MWin 300 seconds. A slow fire grows exponentially to 1 MW in 600 seconds. A 1 MW fire can be thought-of as a typical upholstered chair burning at its peak. A large sofa might be 2 to 3 MWs.

late-arriving crews. The fire modeling showed clearly that two-person crews cannot complete essential fireground tasks in time to rescue occupants without subjecting them to an increasingly toxic atmosphere. For a slow-growth rate fire with two-person crews, the FED was approaching the level at which sensitive populations, such as children and the elderly are threatened. For a medium-growth rate fire with two-person crews, the FED was far above that threshold and approached the level affecting the general population. For a fast-growth rate fire with two-person crews, the FED was well above the median level at which 50 % of the general population would be incapacitated. Larger crews can rescue most occupants before the worst effects of atmospheric toxicity, particularly with slow- and medium-growth rate fires. Statistical averages should not, however, mask the fact that there is no FED level so low that every occupant in every situation is safe.

WHAT WAS, WHAT COULD HAVE BEEN, WHAT MAY BE

AN ANALYSIS OF INCIDENT DATA

For the final segment of the second session, Mr. Robert Santos presented the preliminary results of a statistical analysis of the available incident data. The session was titled "What Was, What Could Have Been, and What May Be" to reflect the small number of incidents available from which to generate statistically significant conclusions. However, the analysis was important in order to explore the potential for how quantitative analysis might reveal insights into improved outcomes for service delivery by fire departments across the country.

As noted previously, the customized incident data collection produced roughly 7,000 of each incident type (fire and EMS). These data were insufficient as they did not total the number of incidents required for powerful statistical analysis. Therefore, the research team pursued an alternative approach which may yield the appropriate number of incidents, albeit with fewer data elements. In other words, lacking quantity in the comprehensive survey, the team used a standard data extract to produce the requisite quantity of data using custom extracts from FireHouse and ZOLL customers. In this way, the research team obtained a number of 2009/2010 events which met the inclusion criteria with a relatively simple data extraction. However, inspection of the available data revealed quality concerns in the 8,000 fire events included in the data. Therefore, lacking quantity in the first approach and quality in the second approach, the findings presented at the symposium were used for illustrative analyses only.

A statistical model was developed to identify critical factors predictive of civilian or firefighter injuries or property loss. The illustrative model controlled for property value, total equipment deployed, initially deployed, total deployed (for loss only), travel time, total staff deployed (for injuries only), structure type, and population density. Before regressing, investigators took the natural log of dependent variables (loss and number injuries) and "amounts" (initial and total equipment, property value). Finally, the illustrative analysis accounted for department level clustering.

While the "findings" are not repeated here (remember that they were illustrative only and lacked statistical power worthy of reprint), relationships between key deployment variables and outcomes seemed plausible and were promising of insight if only more event data were available. An environmental limitation likely to challenge the interpretation of any statistical analysis is that of "endogeneity." Endogeneity occurs when environmental variables (which are supposed to be independent of the outcomes) are correlated with the outcomes. For example, a greater total number of apparatus and firefighters would be deployed to a mature working fire that had spread prior the call to dispatchers. The higher deployment numbers do not cause the higher loss; it is the higher magnitude of the event which is producing higher deployment values (endogeneity).

In conducting the statistical analysis of incident data, several challenges were identified which bear further discussion at the symposium. First, there were many missing key data items. Missing data were found in all data elements and some departments had as much as 60 % of their data missing. Additionally, there were unusable/implausible data from 12 of the 40 departments, such as property values of zero, crew sizes of one on engines, trucks, quints, within department deployment configurations, and implausibly low event numbers. Finally, there were inconsistent data interpretations, including the coding of times and structures.

The EMS data were unusable based on NFIRS extraction, despite the availability of 51,000 events. This dilemma was primarily due to the fact that the "patient status" field, the key outcome data item, was optional, and therefore almost entirely missing from the dataset. Missing data for optional fields provides a powerful lesson about the methods of data collection which are likely to be successful; in other words, when given an options, most participants opted-out.

The research team also learned from the custom incident survey that "patient improvement" is complicated. Traditional measures such as pulse are often dependent on the patient's overall condition and are difficult to interpret as a standard (e.g., what is an "optimal pulse"?) and the database was often missing a second set of vitals from which to measure change in the patient condition.

In summary, a national database for fire service deployment is not simply an issue of "more data." We need better data. Data collection would likely benefit from standardization. Data entry is not uniformly appreciated by participating departments and this situation should be addressed nationally as a change in the culture of the fire service. Information management systems could benefit from technical training, quality assurance practices (process control), and higher priority from leadership.

[3] Certain commercial entities, equipment, or materials may be identified in this document in order to describe an experimental procedure or concept adequately. Such identification is not intended to imply recommendation or endorsement by the National Institute of Standards and Technology, nor is it intended to imply that the entities, materials, or equipment are necessarily the best available for the purpose.

Day 1

SESSION 3. EXISTING GAPS OR DEFICIENCIES IN DATA COLLECTION PROCESSES

Session 3 was a brainstorming session to identify gaps and deficiencies in the current data collection infrastructure. Chief Denny Compton facilitated the session, which revealed four primary gap areas. These gaps (burden, usefulness, motivation, and accuracy) are key to the success of national fire service data collection. For clarity, each of these element are defined in the context of the symposium: burden refers to the effort required to complete data entry; usefulness refers to the inherent value of the data elements to fire departments and local communities; motivation refers to the commitment of the participants to produce accurate and complete reports; and accuracy requires that the elements be measurable and reproducible and the analysis yields reliable and effective conclusions.

BURDEN

- The data for an incident may not only come from the firefighter at the fire station — some may come from dispatch (in order to minimize duplicate data entry) and some may be entered later when damage estimates are known (to improve accuracy)
- Ensure that data are harmonized among other public safety data sets — e.g., police crash report data/dispatch data/ EMS treatment data
- Complete capture of the best information vs. timely completion of the data entry — difficult with investigation completion and patient outcome
- Some of the elements in NFIRS were put there to make it easier to collect the data — e.g., property classification
- Use NFIRS where possible to ease retraining
- Firefighters often choose the easiest path in form or data entry
- Ease of data collection
- Recognizing technology refresh time tables — fractured data depending upon the specific technology
- A deficiency is that we think that everyone needs to collect everything.

USEFULNESS

- May not be enough local data to inform local decisions
- Current databases were created to document the fire problem, not necessarily to answer policy questions, deployment issues, everyday issues faced by fire service managers — nor to inform decision-making
- All fire departments consider themselves unique — difficult for vendors to produce standard software
- When collecting data, personnel need to think about how to get data out later
- NEMSIS allowed all data elements that are submitted to be included as long as they could be defined. Only turned on by organizations that wanted that particular data element. Not everyone was required to collect non-critical data
- Need to have data related to fire service core values (defined earlier in report)
- No usable data back to localities from NFIRS — to the chief or to the firefighter
- Remember that there is a lag, vendors need to incorporate changes — updates — this will take time to implement change — especially in computer aided dispatch systems
- Focus on data that we really need for a specific purpose
- Difficulty: One person's rabbit hole is another person's gold mine

MOTIVATION

- Need to provide firefighters with reasons that fire data are important.
- Marketing strategy — make people want to do this — here is how the information will be used.
- Culture and accountability issue in the fire service. Paramedic reports get QA and are well-done. Fire reports do not get the same level of QA.
- Apathy — lack of accountability and leadership — understanding the importance of the data
- Firefighters do not see value in the data or think that they will ever need it
- Law of Unintended Consequences: Caution should be taken with individual incentives — do not push response times at the expense of safety
- No perceived external stakeholders for the firefighter's data
- How do we make the chief care — external factors influence EMS data
- Lack of incentive - put a financial incentive to fire data — such as what was done with NIMS after 9/11
- No feedback to firefighters or fire companies — robust reporting for motivation
- "Incomplete" is rewarded in data entry, less paperwork, fewer questions, less risk
- Funding for any change is going to be difficult to get — need to have a rationale for change
- State NFIRS systems may be harmed, USFA has traditionally been funded at a level that does not allow them to do the things with data that they might be able to do if they had funding
- A couple of states have left NFIRS — need to stay on the same page

ACCURACY

- Endogeneity is a big problem (see previous discussion in this report).
- Civilian and firefighters fatalities are difficult to combine because they have different causation.
- Lack of training for personnel entering data or producing reports
- Lack of accuracy of the data that are provided
- How to verify or validate the importance of data elements
- Variability among different people entering data for the same incident — different interpretations
- Lack of follow-up complete a record after the investigation is complete
- When changes are made to the data collection system, software updates lag and people entering reports may not know about the changes
- Lack of definitions / Consistency of terminology
- Standardization of data — completeness and quality — only collect what is needed depending upon what information is needed — use of software to help guide data collection — follow up if reports are not done

Day 2

SESSION 4. DEVELOP RECOMMENDATIONS FOR DATA COLLECTION

To begin the second and final day of the symposium, the participants were divided into three groups for parallel discussion sessions. The first group focused on identification of candidate data elements and their associated metrics. While identifying existing metrics was key, identifying gaps where concepts are not currently well-measured is also important in order to initiate metric development research.

The second group was tasked with identifying overall research needs. These results may help agencies or researchers prioritize a future research agenda. Finally, the third group was tasked with identifying the key steps on the path forward at the conclusion of the symposium. At the conclusion of the small group sessions, one representative orally summarized the results for the benefit of the entire group. The combination of these three working groups informed the final session, in which participants discussed how to achieve the goal of a national fire service data collection and reporting system. The oral summaries are presented here while the raw information captured on the easels (notes from each group) is presented in the appendices.

GROUP 1: IDENTIFY CANDIDATE DATA ELEMENTS/METRICS

The first group was tasked with identifying critical data elements and metrics necessary to enable fire service leadership and community leaders to conduct community risk analysis and match the necessary resources to those risks. Dr. Clay Mann summarized the findings of the group by indicating that data elements and metrics should consider the following desirable attributes:

- Collect response times at the unit level separate from the incident
- Better assessment of risks to which firefighters are responding
- Harmonization of code sets with other public data sets
- Electronic data collection rather than paper-based
- Ability to geocode an incident to census tract data to better describe the environment
- Integration of other data sets on an incident that could be merged with the fire data without the need for reentry
- Capture prior calls to which fire personal responded in order to account for fatigue
- Condition of the apparatus
- Dispatch system
- Situation upon arrival — is the fire out?
- Description of building, including the degree of compartmentation, fire protection systems, etc…
- How many firefighters are on the scene at any given time (with electronic time stamp)
- Strategy implemented (defensive or offensive fire attack?)
- Time stamp with compliance with protocols

Specific data elements and metrics are shown in the appendix.

GROUP 2: RESEARCH NEEDS

The second group was tasked with identifying key research needs that relate to data collection and performance measures for the fire service. Chief Randy Bruegman summarized the findings for the group, which included a list of research priorities:

- How do we benchmark fireground tasks that are completed, capture those benchmarks, and relate them to the outcome of the incident?
- How do we find and integrate pieces of data that happen before the incident which impact the incident, such as age of structure, occupant characteristics, and building maintenance?
- How do we best use post-incident analysis to inform future deployment decisions?
- What fire department activities have the most impact on the outcome of the incident? What type of fire service investment in community prevention activities gives the best bang for the buck? What are proper metrics to evaluate prevention effectiveness?
- How do we optimize of the utilization of our resources, including efficient use of firefighter and fire company down-time or alternative deployment strategies?
- What will the demands on the fire service be 20 years from now? Can we anticipate them?
- In view of our expanding mission, what are the impacts of sprinkler mandates and retrofits (or lack there of) on deployment?
- Does acceptance of risk differ by community and how do we measure and what are the right questions?
- How do we create models of efficiency (consolidation, mergers, redundancy of resources) where it is needed and how do we assess change?
- How do you know when you have it right? What does success look like? Would success differ by community?
- How do we make a connection between prevention and operational outcomes (firefighter safety / civilian safety / property loss)?
- How do we measure the impact of multiple agencies operating together?

GROUP 3: RECOMMENDATIONS GOING FORWARD

Dr. Greg Mears summarized the recommendations from Group 3. A national database for the primary benefit of fire departments and local leadership is needed. The database would be used to drive and optimize local policy and deployment of resources. The nation needs a system that describes attributes of the fire service, description of incidents, and community outcomes — in other words, a complete description of the sandbox where all of this occurs. The national database would be developed through a consensus process where all agree on the key data elements and metrics, all can use and analyze the data, establish quality assurance, and provide for an automated process to move data through the system from local to a national database with minimal burden on the participants. The group divided the problem into three categories: the front-end (data entry and user interface), the data system (storage and retrieval of data), and the back-end (data analysis and visualization).

The front-end issues include the need to develop and communicate standard definitions, ensuring that current standards for definitions used in other disciplines or standards documents are preserved (when possible). The user interface for software needs to be intuitive and easy-to-use, including business logic. Industry should develop a consensus for a minimum data set (number of elements required in order to submit an incident), but with capability for local preferences and customization to be captured. When possible, the system should leverage automatic entry — objective information from devices and instruments - in order to avoid the need to enter the same data more than once. This minimizes burden to the data entrant and minimizes the opportunity for errors. The front-end needs to consider the time needed to complete data entry in order to improve timeliness of entry, and consequently the timeliness of access to information — completeness and consistency checks during data entry can be flagged in real-time to ensure accurate up-front entry. Additionally, a standardized interface should be considered to minimize the difficulty of using new software packages. Finally, the fire service should create a culture of ownership over the quality of the data process. For example, making data entry completeness and accuracy a part of employee evaluation/promotional process would positively affect key aspects of data entry.

The data system should allow for peer review — a qualified critical evaluation of the data. Peer-review protection, similar to those that exist for medical data entry would protect the personnel involved in the process and engender improvement. A national standard with which vendors could demonstrate compliance (possibly through third-party certification) would provide common functionality and ensured performance to the user (somewhat like a seal of approval) while allowing for optional differentiation among the vendor software outside the standard components. The data system should also have the following attributes:

- Ease of configuration and maintenance,
- Available on multiple platforms,
- Ability to insert business rules in the dataset to assure completion,
- Ease of customization beyond standard for local needs (e.g., keeping track of moose / vehicle incidents in Maine), and the
- Ability to merge and manage multiple data standards (as they change over time).

The back-end of the national data infrastructure should enable timely reporting and:

- Ensure robustness and flexibility of query,
- Ensure knowledge of completeness and quality,
- Enable standards for important reports (to ensure comparative capability across jurisdictions)
- Enable standards for archiving data,
- Enable exchanging data across systems,
- Provide the ability to move data from the local to regional to state to national systems, and
- Be automated with intrinsic quality controls.

Ideally, there would also be international harmonization and benchmarking of performance levels for all departments.

SUMMARY OF GROUP DISCUSSION

While the goal of a national database for the fire service was much too complicated and important to finalize within the short amount of time left in Session 4, a number of important points were raised.

First, in order to maximize the opportunity for success, there needs to be a consensus process that involves the full range of stakeholders. The fire community needs to develop an atmosphere of ownership and empowerment that includes communicating that the positives of quality data will outweigh negatives.

The process for data collection and exchange must be carefully considered. A working group could identify best technologies and methods — look at what is there, listen, and pick the best and gravitate towards proven technology. Also, using lessons learned from sectors that have developed national databases (e.g. ER visits, cancer screening, NEMSIS) can minimize the challenges going forward.

The process for data collection and exchange must also provide base application on the web or provide a common path for access in order to maximize participation so that jurisdictions with small or tight budgets will still have access to the minimum data elements and functionality.

The process for data collection and exchange must find ways to drive adoption through strong leadership. If the stakeholders are united in message and believe in the value of the effort, the opportunity for success will be improved. Mechanisms to increase participation should consider the efficacy of both carrots (e.g. federal programs or grants), as well as sticks (e.g. regulations or losing access to grant programs). For adoption at state or local level, model legislation / regulations could be developed to assist with implementation.

Finally, different roles for current stakeholders should be considered including a data flow where local departments could report directly to the national level, data could flow back to the states and the national level data center could then coordinate reporting information and recommend data for policy rather than having these coordinated at the state level.

Day 2

SESSION 5. THE PATH FORWARD

The final session of the symposium focused on the path forward. The goal of this session was to create a roadmap towards a national fire service data set. In summary, the participants identified nine key steps, generally in series, with some sub-steps which could be implemented in parallel to the others. For each step, the group identified both the basic purpose or objective of the step, as well as any roadblocks or obstacles which might impede progress.

STEP 1: IDENTIFY THE STAKEHOLDERS

The first step was to identify and engage all of the stakeholders. The importance of using a consensus process was a popular point during the discussions and this ensures that key viewpoints are invited to be part of the process from the beginning.

The roadblocks may include identification of funding sources for the meetings and potential tension between the technical and policy objectives of the outcome.

STEP 1A: DEVELOP EDUCATIONAL STRATEGY

Step 1A is to develop a national educational strategy. This would involve identification of the benefits for each stakeholder and for all stakeholders. This effort would create a sense of shared ownership - we all have to own it. In addition, a multi-mode communication strategy should be developed and managed through the stakeholder group.

Possible roadblocks include dealing with organizational or personal agendas. Some groups may not be as interested in performance measures as other groups. If the benefits are not perceived to outweigh the potential downside, people will not support or participate in the process.

STEP 1B: DEVELOP MODEL LEGISLATION POLICY

Fire Service organizations should consider developing model legislation for adoption by federal, state, or local jurisdictions. The model legislation does not mean simply mandates, but should consider ways to remove obstacles (e.g. peer review protections). Ideally, the model documents would enable and empower participation rather than require compliance.

Possible roadblocks include the potential for unfunded mandates that can be a significant burden to many constituents. There may be difficulty with the legislative process.

STEP 2: IDENTIFY FUNDING

The process must identify a source of funding in order to support the substantial effort required for all of the critical steps. DHS grants were identified as a possible source of funding. National organizations would also need to be involved. There may need to be an effort to create awareness at the funding sources.

Roadblocks include the many competing priorities, the current state of the economy, elections and changing priorities, and vacancies in key funding positions. Additionally, the project should be focused– making it too big for anyone to get their arms around it will limit the potential for funding sources.

STEP 3: DEVELOP A CONSENSUS PROCESS

The process should create a formal guiding coalition of representatives from all stakeholders including fire service, local decision-makers, insurance representatives, software vendors, etc... The coalition should have a formal consensus process, balancing the perspectives to ensure that voices have equal input to the process. There may be value in creating a stakeholder group that is not managed by an existing fire service organization.

Possible roadblocks include the absence of support of a major stakeholder or disagreements over the balance of the group.

STEP 4: DEFINE DATA ELEMENTS AND OUTCOMES

Defining the data elements and outcomes will be a primary outcome of the stakeholder group. The outcomes should continuously be driven by the core values described earlier in this report.

Possible roadblocks include scope creep (e.g. the temptation to keep adding more and more capability to the system and thereby making it too burdensome) or the flip-side: difficulty with consensus on the critical minimum set of elements and outcomes.

STEP 5: DEVELOP METRICS

A direct function of Steps 4 and 5, robust metrics should be developed for each data element and outcome. In some cases, metrics do not exist and research will need to be conducted to ensure the validity and quality of new metrics.

Potential obstacles to the development of metrics include the lack of existing or validated metrics. Another possible roadblock may be the difficulty in collecting the metric (e.g. time to water on fire).

STEP 6: DEVELOP STANDARDIZED REPORTS

Standardized reports should produce actionable and intuitive output for use by fire department and local decision-makers. A valuable feature of standardizing the reports is that it would enable comparative analysis across jurisdictions. This will require broad and committed stakeholder input It is possible that a sub-group (e.g. MetroChiefs or Urban Fire Forum) could serve as a pilot for the program.

A possible roadblock is the development of consensus from fire service organizations regarding what a “standard” report should or should not require. If the standard report relies on data elements that are difficult to collect or lack validation to the outcomes, consensus may be challenging.

STEP 7: DEVELOP DATA STANDARD DEFINITIONS AND SOFTWARE

Standardized export functions needed to minimize the variation among vendor software. NFPA 1221, NFPA 1710, and NFPA 1720 are national standards that have existing fire service definitions. Coordination among existing standards, and other documents such as those promulgated by the Commission on Fire Acceditation International or the National Fire Academy will minimize conflict or confusion. This step may involve the academic and research communities. There will be a need for strong centralized leadership to develop a straw document with which the industry can work.

Possible roadblocks include the time that might be required to produce the standard reports or the difficulty in reconciling already conflicting definitions in the fire service community.

STEP 8: EXPLORE OTHER DATA SYSTEMS AND TECHNOLOGIES

All available data systems and technologies should be considered. Major vendors should be a key component in identifying the strengths and weaknesses of alternative approaches. At this stage, having enough resources in a central place and identifying where the data is and how it can coexist with other data systems will be critical to success.

Possible roadblocks include the constraints imposed by necessary integration with other data systems, scalability, cost, robustness, and security. Some data systems are local or state (e.g. realtors, property managers) and will require a high degree of coordination. Some external data systems may be in conflict with program goals.

STEP 8A: LINK AND EXTRACT FROM OTHER NATIONAL DATABASES

Ensure that programming allows for the seamless import and export of data. Move in the direction of making key fields more compatible with existing software. Identify who does what and who gets access to data at various steps.

Roadblocks include methodology of data exchange, that may influence the path that data take to the central database, security (authentication and verification), the need to stay current as external systems evolve, and possible battles among service providers.

STEP 9: DEVELOP NATIONAL FIRE SERVICE DATA SYSTEM

Finally, the national database will need to develop a significant infrastructure – possibly requiring two-way state support and technical assistance center responsive to all stakeholders.

Roadblocks may include maintenance of effort to get to the final goal, ownership and maintenance costs required to sustain continued operations, and buy-in from all of the stakeholders.

Acknowledgments

Kevin Roche — Phoenix Fire Department (official scribe at the summit)

Kristin Davis — IAFF (Slide template agenda layout and Proceedings Report layout)

Sandy Henderson — IAFF (slide content and video set up)

Hongxia Ma — IAFF (video splicing/audio files)

Ray Ranellone — WPI (meeting coordination assistant)

Stephanie Rennane — UI (research assistant)

Appendix A: List of Attendees

Marty Ahrens
Manager, Fire Analysis Services
National Fire Protection Association

Jason D. Averill
Leader, Engineered Fire Safety Group
National Institute of Standards and Technology

Rick Black
Program Manager
Center for Public Safety Excellence

Kurt Bressner
City Manager
City of Boynton Beach

Paul D. Brooks
Executive Director
CFAI-Risk, Inc.

Chief Randy Bruegman
Fire Chief
Anaheim Fire Department

Christian Callsen Jr.
Chief Operating Officer
The Optima Corporation

Teri Caswell
Management Analyst II
Fairfax County Fire and Rescue Department

Robert W. Cobb
National Director, Risk Decision Services
ISO

Chief Dennis Compton
Chairman
National Fallen Firefighters Foundation

Richard K. Fagan
Technical Advisor Program Manager
Center for Public Safety Excellence

Traci Frazer
Computer Support Specialist
ITS

Dan Greensweig
Associate Administrator
National League of Cities

Peter L. Gorman
Chief of Staff
International Association of Fire Fighters

Jay Gunsauls
Director of Training
Emergency Reporting

John R. Hall, Jr., Ph.D.
Division Director, Fire Analysis and Research
National Fire Protection Association

Elizabeth Harman
Asst. Administrator, Grant Programs Directorate
U.S. Department of Homeland Security/FEMA

Sanjay S. Kalasa
Vice President
FIREHOUSE Solutions

Shawn S. Kelley
Director Strategic Services
International Association of Fire Chiefs

Dennis B. Light
Assistant Fire Chief
Yuma Fire Department

N. Clay Mann, Ph.D., MS
Associate Director of Research
Professor, Department of Pediatrics
National EMS Information System Technical Assistance Center

Greg Mears, MD
Associate Professor & North Carolina EMS Medical Director
University of North Carolina-Chapel Hill

Chief William Metcalf
Treasurer
International Association of Fire Chiefs

Bruce J. Moeller, Ph.D.
City Manager
International City/County Management Association

Lori Moore-Merrell, DrPH, MPH
Assistant to the General President
International Association of Fire Fighters

Raj Nagaraj, Ph.D.
Vice President of Engineering
Deccan International

Jim Narva
Executive Director
National Association of State Fire Marshals

Kathy A. Notarianni, Ph.D., P.E.
Head, Dept. of Fire Protection Engineering
Worcester Polytechnic Institute

Brad Pabody
Chief, National Fire Data Center
U. S. Fire Administration

Raymond Ranellone Jr.
Worcester Polytechnic Institute

Kevin Roche
Assistant to the Fire Chief
Phoenix Fire Department

Paul Rottenberg
FireStats

Robert Santos
Senior Institute Methodologist
The Urban Institute

Stewart Smith
Product Manager
Zoll

Debbie Sobotka
Deputy Director
Center for Public Safety Excellence

Todd Tuttle
Greensboro Fire Department

Doug Wissoker
Senior Research Associate
The Urban Institute

Appendix B: Charts from Small Working Groups

CHART NOTES FROM GROUP 1: IDENTIFY CANDIDATE DATA ELEMENTS AND METRICS

A — Initial Deployment Measures
B — At Scene
C — Outcomes
Framework — Context — 1) What we do, 2) When done, 3) What outcome

- NFPA 1221
- Turnout time by units
- Travel time by/unit
- Effective response force
- Define risk of response
- Population density of response
- ICD9 codes
- ICD10 codes
- SnoMed codes
- Rx codes
- Staffing total number
- Training - type/amount of time — structural, EMS, Hazmat
- Age, years of experience
- Census block
- Topography, physical access
- Demographics
- Certifications
- Crew size
- Environmental factors
- Unit level specifics
- Initial response force
- Outcomes
- Census tract
- Geocode data
- Response time
- PSAP challenge
- Call processing tracking and pickup
- Standards/Policy Compliance
- Time Stamp/Outcomes — what, when, effect
- Condition of apparatus
- Condition of firefighters
- Dispatch method
- Location of apparatus
- Census block data
- Situation upon arrival
- Compartmentation
- Change in flame spread
- Threshold
- Defensive
- Firefighter injuries - lost time

CHART NOTES FROM GROUP 2: RESEARCH NEEDS

- Capture expansion of tasks on deployment model
- Comparison of crew size, i.e. 2 person crew with quick response, or 5 person crew with slow response
- How to create environment where all personality types can work together successfully
- Adjust for new culture
- Fire staffing based in individual community size and growth
- Establish continuing forum
- ** Benchmarks for fireground tasks (time stamps)
- Adjust for environmental conditions
- Data for setting standards
- Determine critical tasks — outcomes
- Reliable data
- How do we mine date from existing databases with increased accuracy
- What FD activities can positively impact fire prevention
- ** Research into in-field electronic data capture that incorporates
  - Pre-incident
  - Incident
  - Post-incident data
- Create palette that is populated by in-field data
- Ways to increase accuracy and reliability of firefighter input
- Incentive pathways to encourage better data
- Show clear impact to community
- Assess community view on loss/needs
- Impact of sprinklers on risk and deployment
- Research of increased demands on the individual firefighter
- Optimum usage of firefighters
- Change of fire service in next generation
- Study/apply similar changes as seen in police department
- How to get fire service to engage community.

CHART NOTES FROM GROUP 3: THE PATH FORWARD

Front End

- * Standard definitions
- Knowledge of definitions
- * Usability (business, logic driven/protected)
- Easy to use user interface, complete data, valid, pertinent to the event at entry
- * Industry consensus for a minimum data set (#, requirement, min, max)
- * Bigger than NFIRS or any other existing data system, maybe modular
- * Ability for local preference/customization — what's important locally
- Automatic entry — objective info from devices and instruments — avoid need to enter the same data over and over
- * Timeliness of entry
- * Reality (volume, time needed to complete data entry — balance on time demands for user)
- * Timeliness of access to information — completeness and consistence checks while incident can be recalled if corrections are needed
- Ownership (entry) — making data part of employee evaluation/promotional process
- Completeness of entry
- * Customized when needed
- Multiple software should be avoided — one entry for the report … for singe entry — common user interface
- Standard operations for entry

Appendix B: Charts from Small Working Groups

Data System

- Peer review/protection — look critically at the info and be sure that info will not end up in the paper, allows for improvement
- Compliant software testing/approval — does not need to be the same package but common functionality to the user — seal of approval
- Multiple software solutions - Maybe web based or buy a software package
- Ease of configuration/maintenance
- Multiple platforms
- Business logic/validation — ability to insert — rules in the dataset to assure completion
- Ease of customization beyond standard
- Timeliness of QM
- Merge/manage multiple data standards — standards also change over time
- Performance measurement (ISO, etc.)
- Define incident or topic — inclusion criteria — how often will a report be prepared
- Admin functions

Back End

- Reporting
- Timeliness
- Robust (needs to be)
- Ease of Use
- Knowledge of completeness/quality
- Education of Admin level to use-apply
- Standardized reports
- Archive
- Automated data exchange
- Local region state region national
- International harmonization
- Linear data submission
- Benchmarking

Use the data — needs to be timely and needs to be accessible — across jurisdictions

Think about what reports will look like and make sure that the data is there

Understanding what the quality and completeness of the data set is

Ability to archive information, ability to run reports for specific time periods

Automation on the data exchange — local collection needs to move to the national database seamlessly — should be automatic

Look internationally — how can the datasets work together

Logical path for the data to travel to the national data set

None of this will work unless we have the capability to work with one another

Recommendations

- National database
  - Policy driven (state and national)
- User attributes
- Firefighter injury
- Incident
  - Property
  - Operations
  - Patient
- Demographic
- Consensus Standard
  - Definitions
  - Reports
  - Exchange

References

i. Averill, J., Moore-Merrell, L., Barowy, A., Santos, R., Peacock, R., Notarianni, K., Wissoker, D. NIST TN 1661: Report on Residential Fireground Field Experiments. National Institute of Standards and Technology, Gaithersburg, MD. 2010.

ii. Backoff, R. W.; et al. (1980). Firefighter Effectiveness – A Preliminary Report. Columbus Fire Division, The Ohio State University.

iii. Cushman, J. (1982). Report to Executive Board, Minimum Manning as Health & Safety Issue. Seattle, WA Fire Department, Seattle, WA.

iv. McManis Associates and John T. O'Hagan and Associates (1984). "Dallas Fire Department Staffing Level Study," June 1984; pp. I-2 & II-1 through II-7.

v. NFPA (2004). NFPA 1710: Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments. National Fire Protection Association, Quincy, MA

vi. McGrattan, K. B. (2006). Fire Dynamics Simulator (Version 4): Technical Reference Guide. NIST Gaithersburg, MD. NIST SP 1018; NIST Special Publication 1018; 109 p. March 2006.

vii. The SFPE Handbook of Fire Protection Engineering, 3rd Edition. DiNenno (Editor). National Fire Protection Association, Quincy, MA.