Fire Department Performance Management: Is Public Policy on the Map?

BY KAT SONIA THOMSON

IN THE 1970S, THE FIRE DEPARTMENT OF NEW YORK (FDNY) infamously embarked on a reduction in fire companies that largely fell on the shoulders of the communities suffering from the greatest number of fires in the city.[1] In 2003 and again in 2011, the FDNY, by and large, repeated this policy by placing cuts, planning additional cuts, and reducing staffing in the areas of the city that suffer the highest levels of structural fire loss, civilian casualty rates, and medical incidents. This article explains the underlying policy trade-off that takes place in the case of fire department allocation decisions by comparing the budget cuts in New York City (NYC) in the 1970s and those of today.

One of the biggest surprises of NYC's fire department resource allocation process is the remarkable lack of empirical research and analysis on the parts of the FDNY, the Mayor's Office, and other relevant public policy stakeholders such as think tanks or academia. As will be demonstrated, this lack of research can be disastrous from a public policy perspective. A theoretical explanation of the resource allocation policy trade-off is presented and followed by an analysis of fire and medical incident data for NYC between 2002 and 2010. The article will conclude with a discussion on the need to improve research and reporting processes in the public policy process of fire department management.

THE PUBLIC POLICY TRADE-OFF

Practically speaking, NYC faces a trade-off between *equity*—described as a matter of equalized response times to all citizens guaranteed by equal placement of resources, regardless of hazard and *efficiency*, where companies could be clustered in proximity to known hazards.[2] This trade-off was first galvanized in the 1970s when Mayor John Lindsay tasked the NYC-RAND Institute with designing mathematical models to more efficiently place fire companies. In a 1975 journal article reporting the success of their work, the RAND scientists explained the basis for their method in the following manner:

> The authors have used the response times of fire companies to fires as an operational measure of effectiveness, which relates well to the Department's objective of reducing loss of life and property. It is presumed that if a new policy results in shorter response times, it will also result in fewer lost lives and less property damage, even though the magnitude of the effects is unknown.[3]

The authors identified areas of the city with "favorable response times" and determined that a fire company could be closed in those areas "and still leave response time as good as or better than other regions of the same hazard."[4] The idea was to cut costs by "improving balance" in response times across areas of the city with similar hazard ratings. The balance was determined by a model of predicted response time as a function of the area and number of companies available.[5] Consequently, the RAND Institute recommendations resulted in relocations or closures of companies in areas of the lowest response times and opening of companies in the areas of high response times.

Beginning in the late 1970s, two scholars from Columbia University, Deborah Wallace and Roderick Wallace, wrote several academic articles critiquing the cuts and relocation of fire companies by the fire department as recommended by the RAND Institute. The scholars spent years looking at structural fire data and statistically analyzing the relationship between structural fire instance and issues of social policy in NYC. The authors summarized what they felt were key shortcomings of the RAND models for resource allocations, as follows:

> In addition to the strange statistical regularities, these criticisms included: (i) Questions of the appropriateness of model-calculated travel time as the principal design criterion for fire service, rather than empirical (i.e., data derived) indices of loss of life, injury, property damage and unit work and availability patterns, (ii) that RAND's 'analytic' models were 'validated' only by comparison with a simulation model, and grossly conflict with firefighting realities in New York City, (iii) the fire service cuts based on the RAND-HUD models caused severe degradation in virtually all empirical measures of fire-fighting effectiveness, and (iv) these declines in effectiveness appear

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Figure 1.

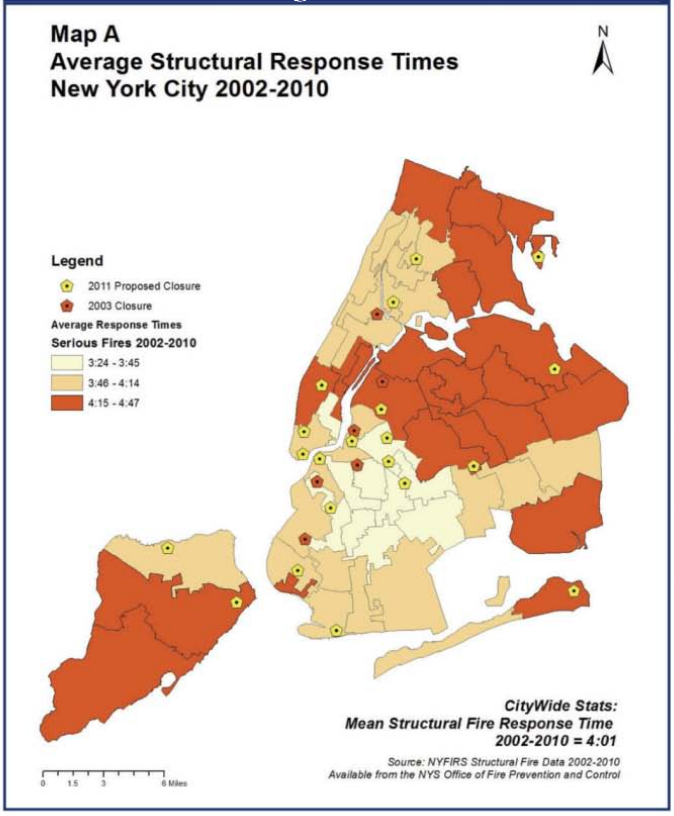
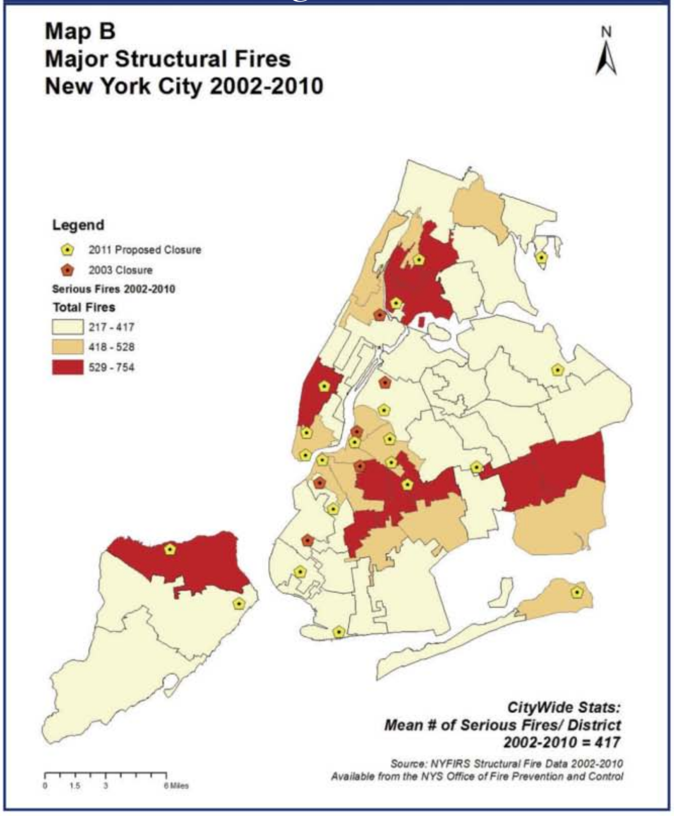


Figure 2.



to have triggered a geographically spreading recurrent fire epidemic which continues to consume neighborhoods in New York City.[6]

The Wallaces focused on two main policies in their critique—the 35 companies that were cut between 1972 and 1975 and the 1975 reduction in firefighter staffing levels of engines (from five firefighters per company to four) and ladder companies (from six to five).[7] By looking at the location of cuts and reduction in staffing with regard to incident data and subsequent incident increases, the Wallaces gave the startling finding that "the general pattern for removal of companies (was) from high fire incidence areas."[8]

CASE STUDY: NYC 2003 AND 2011 FIRE COMPANY CLOSINGS LIST

The following case study examines the location and potential effect of two rounds of firehouse closings in NYC using New York's Fire Incident Reporting System data spanning more than 21,000 structural fire incidents between 2002 and 2010. In 2003, Mayor Michael Bloomberg closed six fire companies. On May 18, 2011, the FDNY released a list of 20 additional companies that were slated to close. According to the fire department's Engine and Ladder Company Analysis Report,[9] the criteria used to generate the list of company closings for 2011 were based on three variables:

- Average apparatus response times for first- and second-due companies. It is not clear from the FDNY report whether response times include all incidents or structural fire incidents, as the report does not specify.
- Occupied structural workers per company. "Occupied structural workers" is used by the department as a representation of engine or ladder company workload. The problem with using this metric is that a run for a "food on the stove" incident is weighted equally to a run for a serious fire. To better reflect workloads, serious fire runs should be weighted more heavily.
- The number of runs (total and medical) completed by each company.

As a consequence of the three variables used to make closing decisions, most of the 20 companies slotted for closure as released by the FDNY in 2011 were in high-fire, high medical run instance neighborhoods. This gives weight to the conclusion that the trade-off aspect of service delivery the department sought to preserve was a minimal impact on overall average response times throughout the city. This approach is not the same as minimizing the impact of the cuts on outcomes (i.e., the preservation of life and property), as will be shown below.

MINIMIZING RESPONSE TIMES VS. MINIMIZING LOSS

This section depicts two types of metrics by which fire company allocation might be decided. The map on the left (Map A, Figure 1) considers the first metric—*response times*. Map A shows average response times for serious structural fires in the city over the period 2002-2010.[10] Each city council district is broken into one of three categories (below average, about average, and above average response times), based on actual incident response times. Overlaid on this map are the 2011 proposed company closings in addition to the 2003 closings. Here, we can see the current FDNY metric for closings at work: Companies are for the most part allocated for closure in areas with the lowest average response times (areas shaded light yellow). Companies are being pulled from these areas while companies in areas where higher than average response times exist (depicted in red) are for the most part left untouched.

Map A is essentially the only way in which the fire department is letting the public "see" the influence of the cuts (except the department does not provide these maps). The cuts, therefore, are met with weak resistance because they appear to have the least amount of "impact." Map B (Figure 2) tells an entirely different story. Using the exact same data, a picture of the second metric—*fire hazard or need for protection*—emerges. Areas shaded in red illustrate areas of the city with the highest fire density and the increased phenomena of civilian casualty and property loss [see Map C (Figure 3) for civilian casualties from structural fire].

Medical incidents comprise the largest proportion of fire department calls. Map D (Figure 4) provides a picture of the relationship between company closures and areas of high medical run density. Across all three hazard maps, it is apparent that the locations of cuts coincide with the areas of the city that have heavy demand for protection. In fact, 21 of the 26 cuts are either directly in or immediately adjacent to areas with the highest fire and medical run instance in the city. These analyses are very basic, yet they clearly illustrate how a majority of the instituted (and proposed) cuts lie in the areas of the city that have the highest need for protection and the lowest average response times.

What Map A vs. Maps B, C, and D tell us is something very relevant about the geography of response times and incident hazard for NYC. Where the RAND authors gave the impression that low response times coexisted with lower rates of loss of life and property by their models, in truth, low-response-time areas coexist with high-loss areas. The two are one and the same. That is because resource allocation ebbs and flows. In times of fire department growth, the city has historically placed companies in areas of high fire density, resulting in lower response times by additional resources, reducing travel times in high-instance areas. In times of budget cuts, these same areas become targeted for cuts by virtue of their response times, which is counterintuitive to the initial rationale for placing companies in these areas to begin with.

The use of response time minimization citywide as the primary means to mitigate property loss and civilian death rates during cuts is to say response times determine both. But it is the incidents themselves that cause property loss and civilian casualties. When it comes to allocation (whether it is new companies or cuts), the above demonstrated coexistence of low-response-time areas with high-loss areas reverses the prevailing intuition of decision-point hierarchy. Therefore, the department should preserve companies, first, in areas where incidents occur and, second, where longer response times exist. Otherwise, the horse is being placed before the cart.

SO WHAT ABOUT PUBLIC POLICY?

It would be a disservice to the people of NYC not to attempt to identify the characteristics of those communities that will

Figure 3.

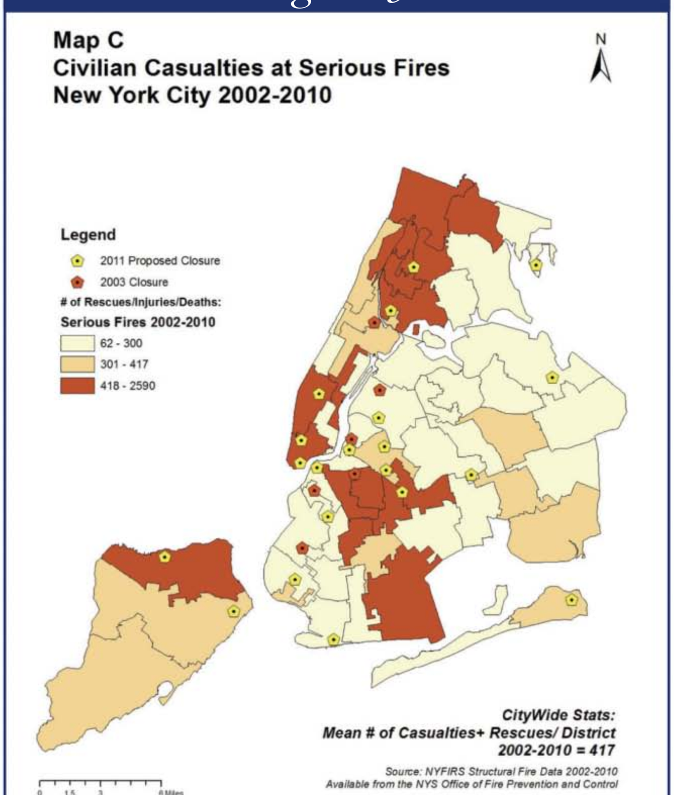


Figure 4.

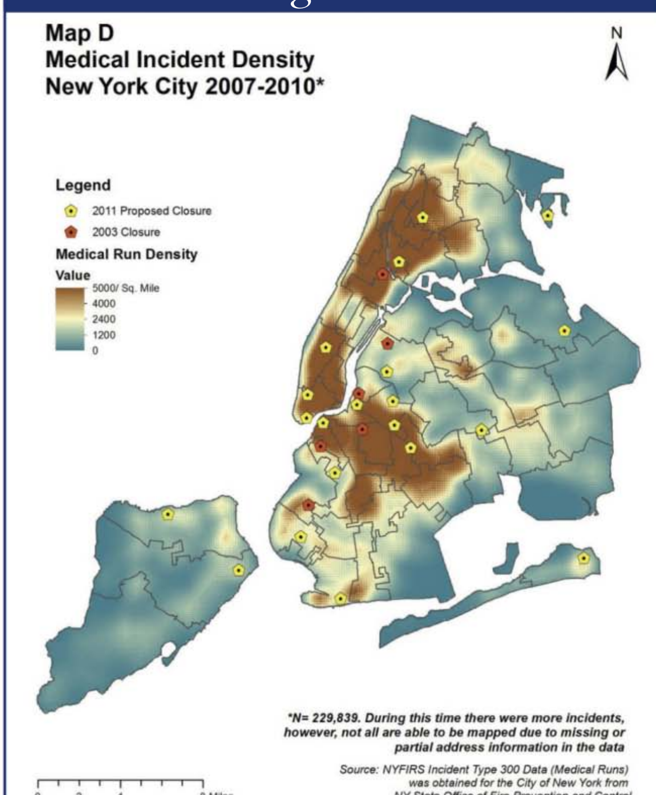


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Figure 5.

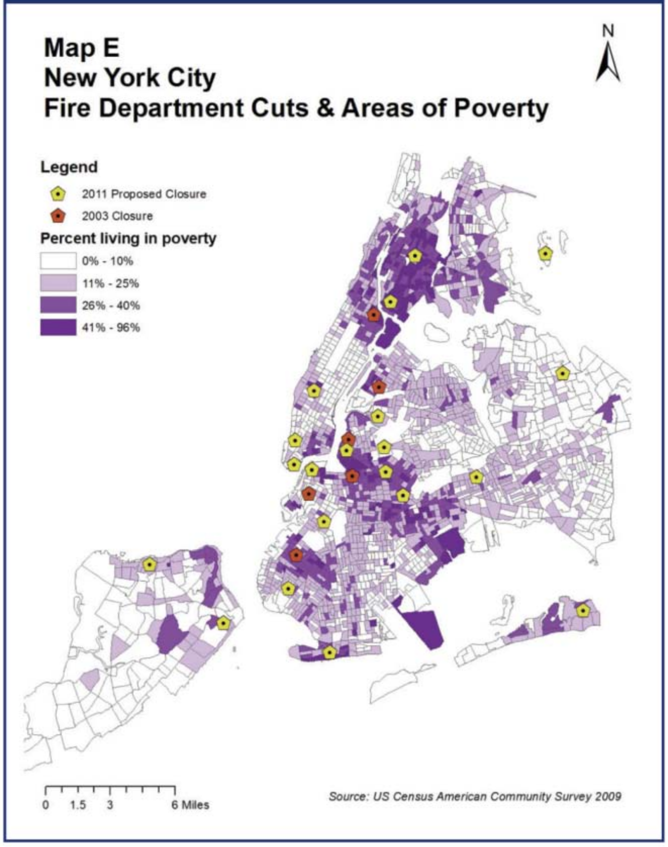


Table 1.

Comparison of Census Tracts by Structural Fire Instance
New York City Serious Fires, 2002-2010
Number of tracts in the sample = 2,216
"High-Fire Tract" is defined as having higher than average (9) serious fires

	Low-Fire Tract N=1,305	High-Fire Tract N=911
Mean (average) # of Serious Fires	4.8	16.5
Range of Serious Fires	0-9	10-46
Population	2,785	5,124
Median Household Income***	$56,120	$48,522
Immigrant Population (Age 12+)***	151	352
Single Male Households***	53	106
Single Male Renters***	32	81
Single Female Households	153	406
Single Female Renters***	94	336
Children < 5***	189	370
Percent Living in Poverty***	14%	22%
Children < 18***	608	1,214
Total Renters***	556	1,415
Total Owners**	436	509
Renters per Population***	19%	27%
Owners per Population***	16%	10%

Source: American Community Survey 2006-2010 Estimates
Available at: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t
NYFIRS Data 2002-2010 Structural Fires (10-75 or Greater Alarms)

Table 2.

Serious Fires by Structure Type 2007-2010

Building Type	Number Of Fires	Percent
1 - Fire Resistive Structure	1,397	16%
2 - Fire Protected Structure	395	5%
3 - Non-Fire Resistive Structure	4,940	57%
4 - Wood-Frame Structure	1,949	22%
5 - Metal Structure	35	0.4%
6 - Heavy Timber Structure	25	0.3%
Total	**8,741**	**100**

Source: NYFIRS Data 2002-2010 Structural Fires (10-75 or Greater Alarms)

be affected by company closures. In the 1970s, the majority of areas experiencing a reduction in fire department protection were also the areas of the city facing the most economic hardship. Map E (Figure 5) shows how the cuts line up with areas of poverty in the city in both 2003 and 2011. Once again, there is a replication of the 1970s' impact in 2003 and 2011 from a public policy perspective. The areas of dark purple have the greatest proportion of residents living in poverty, as calculated using five-year estimate data for 2006-2010 from the Census Bureau American Community Survey.[11] Map E looks very similar to Maps B, C, and D, indicating some correlation between poverty and fire/medical incident instance exists.

The visual relationship between structural fire and poverty presented in Map E can be validated by connecting census tracts to serious fires.[12] The 2,216 census tracts in NYC were joined with the 21,340 serious fires reported between 2002 and 2010. Next, the census tracts were partitioned into two groups based on the calculated mean value of nine serious fires per tract. Tracts containing between zero and nine serious fires were categorized as "low-fire tracts," for a total of 1,305 tracts. The remaining 913 census tracts experienced between 10 and 46 serious fires and were categorized as "high-fire tracts."

Table 1 provides a comparison of mean characteristics between low- and high-fire tracts, including population, income, occupancy status, family type, and poverty status. All means reported here are statistically significantly different from each other with greater than 99-percent confidence.

It is immediately apparent that areas of higher-than-average fire instance are very different from areas of low-fire instance. High-fire tracts are populated with lower-income residents, are composed of more single-parent households, have higher populations of children, contain greater proportions of people living in poverty, and have higher rates of renters than owners per population. Table 1 provides a very simple way of seeing the face of structural fire loss that has not been provided by the FDNY or by the Mayor's Office. If 21 out of 26 cuts line up with the areas of the city that have the highest fire instance, then it can also be concluded that the cuts are aimed at the most disadvantaged residents of the city. By definition, this is a "disproportionate impact."

Beyond recognizing the fact that fire instance correlates with areas of high poverty is the need to recognize the technical relationship between fire instance and structure type. Since 2007, the FDNY has recorded building type in its NYFIRS database; according to these data, serious fire occurs mostly in residentially occupied, nonfire-protected or wood-frame structures (see Table 2). Seventy-nine percent of serious fires between 2007 and 2010 occurred in nonfire-resistive or wood-frame structures. Not only are cuts lined up in high-fire density, high-poverty tracts, but the structures in these same areas are also the most vulnerable.[13]

Recall that the proportion of renters in high fire-instance areas is also much greater than the proportion of homeowners. Because renters are not required by law to be insured, there is no official way to estimate the number of uninsured. In the wake of the crane collapse in the Upper East Side of NYC in April 2008, a random survey of Upper East Side renters conducted by the New York State Insurance Department found only two out of 32 tenants had renter's insurance.[14]

The Insurance Research Council estimates that approximately 43 percent of renters were covered nationwide in 2008. However, an article appearing in *Insurance Journal* in 2008 estimated this number to be lower in NYC because of the high cost of living.[15] The structural phenomenon of high-fire-instance areas and the probable lack of contents insurance among renters combine to exacerbate the public policy impact of reducing fire protection.

Section 5.1 of the FDNY Strategic Plan states the department is planning to "better assess and quantify fire and hazard risk in the community in terms of the possibility of loss or injury and assign defined, quantifiable values of risk and hazards."[16] The department is planning to establish a risk-based inspection program—the Coordinated Building Inspection and Data Analysis System (CBIDAS)—that will hinge on asset fragility and loss probability with the goal of improving both prevention and suppression response for the city. The FDNY calls the initiative "one of the most important management initiatives in the modern history of the FDNY," and says, "It will enable the FDNY to concentrate its fire prevention resources on the buildings and neighborhoods facing the greatest risk of serious fires."[17]

Such an initiative stands to fail if the fire department releases a list of company closures a year later that disproportionately target these same high-risk areas. The net effect is a reduction in building inspection capacity and protection. Essentially, the folks in prevention need to be chatting with the folks in protection to secure the best outcome for the city.

RESPONSE TIMES 2010: A GLOBAL MEASURE PERSPECTIVE

Since most policy recommendations (and critiques) surrounding fire department performance focus on response times as the predictor for actual outcomes, this next section provides a template for more comprehensive reporting. In Fiscal Year (FY) 2011, the FDNY reported the citywide average response time as four minutes and three seconds (4:03) for structural fires in its Vital Statistics.[18] Averages are generated by taking all of the structural response times for the entire city

Figure 6.

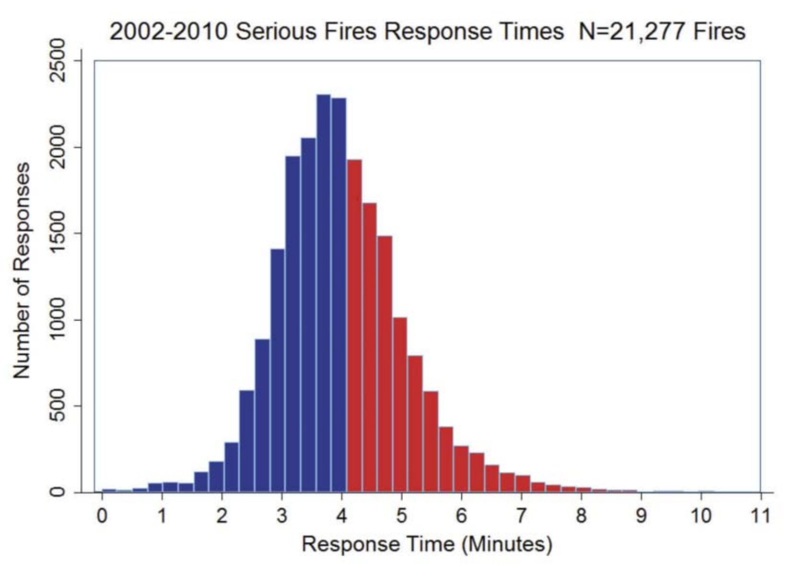


Table 3.

2002-2010 Serious Fires

Response Times	Cases	Percentage	Minimum	Maximum
Response Time = 4:00 or Less	11,597	54%	0	4
Response Time Exceeds 4:00	9,731	46%	4:01	14:50
Total	21,328	100%		

of New York, which are summed up and then divided by the total number of incidents. Because response time is reported for the city as a whole, this metric is considered to be a global measure of performance. At first glance, NYC residents are led to believe that they should receive a response time of approximately 4:03 for a given structural fire. This sounds very acceptable to the general public, and this simple average is the number the fire department hangs its hat on.

An estimate of average response time between late 2002 and 2010 reveals the FDNY 2011 estimate is essentially stable over a longer time frame using this same metric. During the nine-year period, serious fires on average received a response time of 4:01. What the simple average does not reveal are some other important characteristics of the data that should also be reported. For starters, the distribution of the data tells us that response times ranged from 0:00 minutes to a maximum of 45:17.[19] Fortunately, only a very small portion of serious fires had a response time of 11 minutes or more (n = 40).

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*, is the national guideline. Section 5.2.4.1.1 states:

> The fire department's fire suppression resources shall be deployed to provide for the arrival of an engine company within a 240-second travel time to 90 percent of the incidents as established in Chapter 4.

Figure 6 provides a graph of all response times that were less than 11 minutes (n = 1,300) for serious fires from the same period. Areas in red are the frequency of incidents that received a response time in excess of 4:00. Between late 2002 and 2010, a total of 9,731 serious fires, roughly 46 percent, exceeded the national guideline (see Table 3). By simply looking at the distribution of the data, we already have a better sense of what is going on citywide than is currently reported. The more comprehensive the analysis and reporting on global response time, the more likely the fire department is to best serve its constituents. But is this enough?

RESPONSE TIMES 2002-2010: AN INTERNAL (LOCAL) MEASURE PERSPECTIVE

Deborah and Roderick Wallace of Columbia University advocate the value of looking at the micro (or community-level) perspective to pick up on the variance in response times across communities. When the FDNY provides such an analysis, response times are reported at the fire company level. For example, in the 2011 Engine and Ladder Company Analysis, Engine 161, located at 278 McClean Ave. in Staten Island, was said to have a "First Arriving Travel Time" of 3:38. This sounds like an excellent response time, as it clearly falls well below the NFPA 1710 four-minute guideline. When I calculated the response times for the area in which Engine 161 is located, I find that the reality is much different. Fully 63.3 percent of all serious fires in that neighborhood since 2002 have received a response time that exceeds four minutes. The range of response times for that area ranges from 54 seconds to 14 minutes and six seconds. By the FDNY metric, we definitely have reason to believe that the area served by Engine 161 is faring well, but a more in-depth analysis shows how using the average alone does not tell the whole story.

By situating their response time analysis at the fire company level, the fire department keeps the impact fairly ambiguous because most citizens are not aware of where companies are located in the city. Table 4 lists the *areas* slated for company closure as the unit of analysis to link the impact of the cuts back to the communities being affected. My estimates of response time averages for the affected areas are nearly identical to the fire department estimates for the apparatus; this is a reflection of the use of the same data and method. Taking the analysis just one step further than what is offered by the FDNY, a very problematic truth comes to the surface: Not a single area is in compliance with NFPA 1710, Section 5.2.4.1.1 in having 90 percent of its actual response times below the four-minute benchmark. It's not even close.

Table 4.

FDNY Closure Criteria: Comparing Structural Response Time Impact

Proposed Closure	Council District	FDNY Estimate CY 10 Pre-Closing Response Time	First Arriving Travel Time — Author's Estimate: 2002-2010 Structural Incident Data, Serious Fires: Average (Mean)	Min. Response Time	Max. Response Time	% of Responses > 04:00
E004 42 South St. Manhattan	1	3:56	3:52	0:42	10:09	39.7%
L008 14 North Moore St. Manhattan	1	3:52	3:52	0:42	10:09	39.7%
E026 220 West 37th St. Manhattan	3	4:29	4:16	0:23	43:12	52.9%
L053 169 Schofield Ave. Bronx	13	4:44	4:31	0:46	13:13	64.6%
E046 460 Cross Bronx Expwy. Bronx	15	3:44	3:49	0:29	8:09	39.5%
E060 341 East 143rd St. Bronx	17	3:24	3:55	0:34	12:15	41.3%
E306 40-18 214th Place Queens	19	4:49	4:42	0:28	7:59	72.7%
L128 33-51 Greenpoint Ave. Queens	26	5:31	4:23	0:00	8:34	61.0%
E294 101-20 Jamaica Ave. Queens	30	3:40	4:19	1:35	10:03	54.0%
E328 16-19 Central Ave. Queens	31	4:21	4:35	1:26	10:59	70.1%
E205 74 Middagh St. Brooklyn	33	3:28	3:50	1:30	10:51	38.7%
E206 1201 Grand St. Brooklyn	34	4:01	3:33	1:46	7:02	28.6%
E218 650 Hart St. Brooklyn	34	3:16	3:33	1:46	7:02	28.6%
L104 161 South 2nd St. Brooklyn	34	3:45	3:33	1:46	7:02	28.6%
E233 25 Rockaway Ave. Brooklyn	37	3:08	3:25	1:26	7:55	21.3%
E220 530 11th St. Brooklyn	39	3:38	3:45	1:14	9:25	37.6%
E284 1157 79th St. Brooklyn	43	3:39	3:51	1:26	10:07	39.4%
L161 2929 W 8th St. Brooklyn	47	4:39	4:02	0:00	45:17	40.1%
E157 1573 Castleton Ave. Staten Island	49	3:26	3:59	0:32	31:46	44.6%
E161 278 McClean Ave. Staten Island	50	3:38	4:47	0:54	14:06	63.3%

The closest area to meeting this guideline is Council District 37, where 21.3 percent of its responses exceeded the four-minute response time between late 2002 and 2010 (this is more than double the NFPA allowance). District 13 in the Bronx and Districts 19 and 31 in Queens suffer incredibly high response times; 64.6 percent, 72.7 percent, and 70.1 percent, respectively, of responses to the most critical fires are in excess of four minutes.

When the list of companies slated for closure was released, the fire department was the sole disseminator of response time data regarding the cuts and was, therefore, able to diminish the perception of impact. The public was in essence "guaranteed" a new response time by the fire department as the statement of a single predicted number, which is misleading. Exact methods employed by the FDNY in cut selection were not fully disseminated either; methodology should always be a common feature of a transparent policy-making process. The department did not provide the public or other stakeholders with an opportunity to scrutinize its methods by holding its closure selection criteria too close to the chest. The additional elements about response times at the internal (local) level using real data as provided here are not released by the fire department for good reason: For cuts to be politically viable, the impact must necessarily be underreported.

APPLICABILITY OF NATIONAL STANDARDS

One of the concerns highlighted in a report by the Office of the Public Advocate with regard to the budget cuts of 2011 was the applicability of the NFPA model to NYC. NFPA 1710 provides the following definition for the typical building that firefighters from across the country should face:

> 5.2.4.2.2* … (is) a structure fire in a typical 2000 ft² (186 m²), two-story single-family dwelling without basement and with no exposures… (NFPA 1710, 2010, p.12)

In the above definition, "no exposures" means the building is not attached to an adjacent building. This "typical" structural fire scenario is the basis for the national standard dispatch protocol, and it is the primary criterion used to determine adequate staffing and resource levels most career fire departments adhere to. So exactly how "typical" are the buildings in NYC? According to data compiled from the NYC Department of Finance Mass Appraisal System File and the NYC Department of City Planning, only 12 percent of buildings in this city meet the criteria for a "standard structure." NYC remains an incredible outlier in terms of the complexity and expanse of protection area—or fire load. One in three buildings on average is greater than two stories, and there are almost 38,000 buildings that are five or more stories tall, and at least 9,060 buildings meet the definition of a high-rise (seven stories or 75 feet). Eighty-eight percent of our buildings are either attached or semiattached, have a full or partial basement, are above two stories, or are some combination of all three. Therefore, the FDNY is dealing with approximately 713,000 buildings that are more challenging to protect than the national "average structure" as defined by the NFPA.

Because New Yorkers are protected by the largest fire department in North America, residents might expect that they have the highest level of fire and emergency service protection in the country. The 40 largest cities in the United States were compared by the number of uniformed firefighters, engines, ladders, and firehouses per resident. NYC ranked 34th in terms of the level of fire protection per capita offered to its residents in 2010.[20]

The residents of Memphis, Tennessee; Cincinnati, Ohio; Pittsburgh, Pennsylvania; Rochester, New York; Baltimore, Maryland; Cleveland, Ohio; Newark, New Jersey; and Indianapolis, Indiana, were among the most adequately covered citizens of big cities. Memphis residents enjoy the coverage of 2.73 firefighters per 1,000 people, whereas New Yorkers are getting by on less than half that amount, at 1.33 firefighters per 1,000 residents. This number does not reflect daytime population gains to NYC and is, therefore, a conservative estimate.

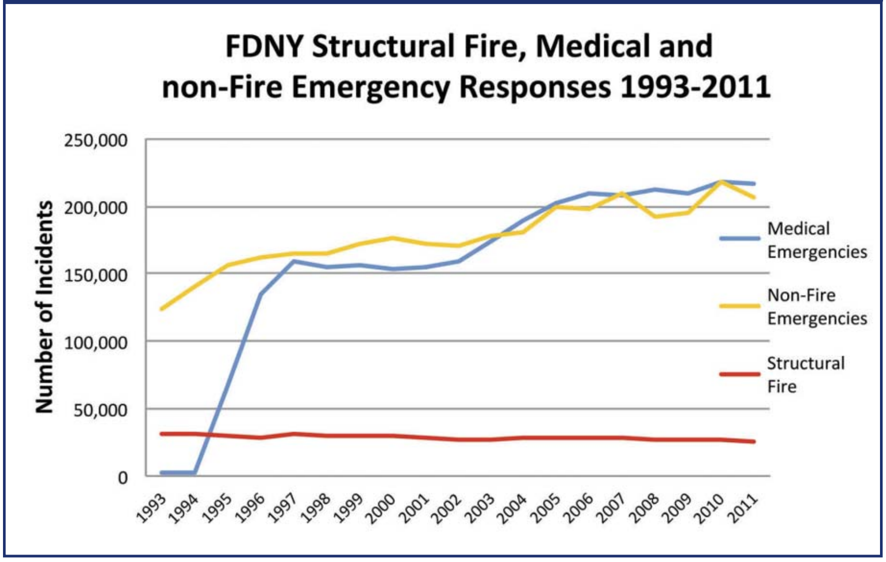
There are 20 cities with more firefighters per capita than New York City, including Newark; Cincinnati and Columbus, Ohio; Boston, Massachusetts; Chicago, Illinois; and San Francisco, California. New Yorkers have about a third of the engine coverage of neighboring Newark, with just 0.23 engines per 10,000 residents, whereas Newark has 0.61 engines per 10,000 residents. Indianapolis boasts 2.7 times more engines per resident than NYC. Compared to Cincinnati, NYC has 2.25 times fewer ladders—0.15 ladders per 10,000 residents compared to Cincinnati's 0.36/10,000. Indianapolis has 1.8 times as many fire trucks per 10,000 residents. Even Detroit can afford 1.5 times more trucks per 10,000 residents than NYC. In terms of firehouses, of the 40 cities surveyed, NYC is in last place, with just 1.25 firehouses available per 50,000 residents. Pittsburgh has almost four times the coverage, with 4.65 per 50,000 residents. An additional 24 cities all have at least twice as many firehouses per capita than NYC.

ALIGNING MISSION WITH PERFORMANCE MANAGEMENT

The primary mission of the FDNY is the protection of life and property, as evidenced by the department's mission statement: "As first responders to fires, public safety and medical emergencies, disasters, and terrorist acts, FDNY protects the *lives and property* of New York City residents and visitors."[21]

In fulfillment of that mission, and in providing a summary of that mission to the public, the fire department releases an annual assessment of its performance with Vital Statistics, a two-page summary of half a million responses. The three main indicators cited from Vital Statistics by the department and the mayor are (1) response times, (2) the number of fires (structural and nonstructural), and (3) civilian deaths. By focusing on these three metrics, the department has been able to illustrate a positive picture of fire, emergency, and medical incident demands in New York City from year to year. Again, if we look at incident data in a different way, another story emerges. A graph of 20 years of incidents reveals an overall

Figure 7.



increase in nonfire emergency and medical responses in the past 20 years, with a relatively stable level of fire incidence in the big picture (Figure 7).

In addition to what is collected in NYFIRS, the FDNY keeps other large databases that detail data such as firefighter injuries and building characteristics. NYFIRS data are known for having errors and flaws, but part of their reliability (hence usability) exists in those variables generated by computer-aided dispatch, including incident type, address, arrival (response) time, and unit cleared times. Combined, fire department data have the capacity to deliver valuable information regarding the protection of life and property that would help the FDNY make better decisions regarding the management and allocation of its resources. The following types of analyses are currently missing:

1. Maps of fire, emergency and medical incident instance, density, severity, frequency for the city, over time.
2. An analysis of patterns of displacement caused by fire damage in the city by occupancy type/use, structure type, and so on.
3. Surface maps of actual response times showing geographic areas of the city that tend to have higher than acceptable response times.
4. Maps of civilian casualties, including emergency medical runs, fire-related injuries, and rescues.
5. Analysis of the impact of simultaneous multiple alarms in the same geographic area on key outcomes such as property loss and civilian casualties.
6. Property loss and property saved.

In 2008, I was assigned to develop a means for the fire department to report property loss. The initiative was part of a larger project initiated by the commissioner of strategy and planning to improve performance measurement. I presented the FDNY with a host of viable property loss estimation methods, some of which could be generated in-house using NYFIRS data and International Code Council rebuilding cost data and others which could be acquisitioned through fire insurance payout data. Both had their limitations; however, in combination, the weaknesses of one method could be overcome by the incorporation of the other method into the overall property loss estimate. At the end of the assignment, I managed to coordinate the delivery of five years of insurance payout data from fire loss, spanning 2002-2006 for all five boroughs across a host of occupancy types, aggregated to the borough level. The report and the data acquisition were never published or disseminated to the public.

Finally, I will restate the more subtle but relevant reporting and analysis flaw that should not be downplayed. By reporting key indicators such as the number of incidents, average response times, and occupied structural workers at the fire company level, there is a lack of connection with the actual area being served—and thus the people who are ultimately affected. This keeps the performance management of the fire department completely disconnected from the people who suffer from fire, emergency, and medical incidents—thereby rendering the perception of community impact intangible. This is why it is absolutely critical to place the analysis of emergency response allocation back where it belongs, with the area and the people it affects.

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The analysis and policy discussion presented in this article are by no means exhaustive or complete. So much more needs to be done. Still, this article helps to illuminate a crucial void in the public policy aspect of fire department management using NYC's 2003 and 2011 budget cuts as a case study. In the 1970s, 27 of the 35 cuts landed squarely in the areas of the highest need for protection. In 2003 and as proposed for 2011, at least 20 of the 26 cuts had the same problem. Whether cuts were formulated by the RAND Institute in the 1970s or by simplified average response time comparisons, as was done in 2011, it is clear that the policy tradeoff that won is *equity of access* through equalized response times instead of *efficiency*, by minimizing the impact on life and property.

External stakeholders such as the media and advocates of public policy were unable to pick up on or adequately critique the cuts in 2003 and 2011 because of the fire department's reporting deficit regarding the metric and the impact. The press could only weakly regurgitate the fire department's conclusions about the consequence. As a result, the repetition of the 1970s cuts in 2003 and 2011 went unnoticed. A simple overlay of incidents with closures would have provided the empirical light bulb of the faulty metrics used in both eras.

At the very least, two key things need to happen: More stakeholders need to "weigh in" on this important policy trade-off, and a comprehensive analysis of the fire landscape needs to occur. ●

PUBLIC POLICY ●

ENDNOTES

1. This conclusion was demonstrated in several academic journal articles by two Columbia University professors, Deborah and Roderick Wallace, and appeared in articles and books published in 1975, 1980, 1990, 1993, and 1998.

2. Kolesar, P and Walker, W. (1974) "An algorithm for the dynamic relocation of fire companies," *Operations Research*, 22(2):249-274, (quote from p. 250).

3. Ignall, E. et al, (1975). "Improving the deployment of New York City Fire Companies," *Interfaces*, 5(2):48-61, (quote from pp. 50-51).

4. *Ibid.*, p.58.

5. The model to determine average travel distance and response time was known as the "square root model" and can be found detailed in several publications from RAND during the 1970s and as referenced throughout the 1975 Ignall, *et al* article.

6. Wallace, D and Wallace, R. (1980). RAND-HUD Fire Models, *Management Science*, 26(4);18-422 , (quote from p.419).

7. Note that these same policies were (are) on the table in New York City in 2011, with the 20 companies slated to close in addition to the reduction in staffing levels of 60 engine companies from five firefighters to four starting on February 1. In both cases, the cuts would be largely concentrated in the busiest areas of the city.

8. Wallace, R. and Wallace, D. (1979) *Studies on the collapse of fire service in New York City 1972-1976: The impact of pseudoscience in public policy*, University Press of America, Washington, D.C., (quote from p. ii).

9. The report is available at http://www.nypost.com/r/nypost/2011/05/18/media/2011ClosingDraft.PDF.

10. By looking only at serious structural alarms, this analysis provides a glimpse into incidents that carry the heaviest economic and social cost to New Yorkers. Obviously, there are several less damaging incidents that the FDNY respond to that should also factor into such an analysis of closures, and any conclusions here should be taken with that in mind.

11. Available at: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t.

12. A census tract is a small area of land with roughly similar populations that is the basis for dividing up the city for the census. There are 2,216 census tracts in New York City.

13. This claim is based on fire data and not on buildings data; the reader should bear this in mind.

14. Available at: http://www.insurancejournal.com/news east/2008/04/03/88813.htm.

15. Available at: http://www.insurancejournal.com/news/east/2008/04/03/88813.htm.

16. New York City Fire Department, Strategic Plan 2009-2010, p.16. Available at: http://www.nyc.gov/html/fdny/pdf/publications/FDNY_strategic_plan_2009_2010%20Final.pdf.

17. *Ibid*, p.11.

18. Available at: http://www.nyc.gov/html/fdny/pdf/vital_stats_2011.pdf.

19. A response time of zero minutes seems impossible; however, this is an actual data point from NYFIRS data.

20. The full benchmark survey results for the 40 largest cities are available at www.ufoa.org/fire_research.

21. Source: http://www.nyc.gov/html/fdny/html/general/mission.shtml.

● **KAT SONIA THOMSON** first worked on performance management for the Fire Department of New York in 2008 and has been a fire operations research consultant in New York City since 2010. She is a PhD candidate at Columbia University, Teachers College. She also has 14 years of wildland fire operations experience and serves as an air attack officer with the province of Alberta in Canada.