

Public Health Concerns Associated with the New York City Blackout of 1977

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Abstract The 1977 New York City blackout began at 9:36 p.m. on 13 July and lasted some 25 h until 10:39 p.m. on 14 July. The New York City Department of Health rapidly set up a Blackout Contingency Plan, established priorities, and mobilized its staff to address remedial interventions. Top priorities included water supplies, sewage disposal, perishable food supplies, hospital and emergency room services, solid waste disposal, beach contamination with untreated sewage, and assisting those on electrically powered home life support systems. The 1977 blackout occurred during an extended heat wave. An analysis of total deaths and deaths due to pulmonary and cardiovascular/renal diseases by day correlated with temperatures. However, there was no direct correlation with the blackout itself, in part perhaps because of the confounding influence of high temperatures. The increase of deaths on very hot days outside of the blackout period lends strong support to the relationship between increased deaths and high ambient temperatures. The 1977 New York City blackout was distinguished from those of 1965 and 2003 by violence, arson, and looting that occurred in several areas. These acts resulted in 204 civilian injuries, 436 police injuries, 80 firefighter injuries, and 1037 fires. The violence, arson, and looting caused extensive long-term physical and functional damage to certain areas of two boroughs of the city, Brooklyn and the Bronx. Although the New York City Department of Health had not previously established a disaster preparedness plan, its professionals quickly rose to

the occasion because they were able to draw upon vast public health practice experience and ingenuity.

Keywords New York City blackout of 1977 · New York City blackouts · New York City Department of Health · Effects of the New York City fiscal crisis

Introduction

Major electrical power failures are fairly uncommon. They are usually due to natural phenomena, equipment failures, system operational problems, and human acts such as vandalism, sabotage, and errors [1]. These natural phenomena include storms, icing, snow, sleet, wind, flood, and fire. In the case of the 1977 New York City blackout, the cause was lightning strikes at several points along the electric power system north of New York City [2]. The first of these lightning strikes occurred at 8:37 p.m. on 13 July 1977, north of the city. This was followed by others, which by 9:36 p.m. caused a loss of electrical power to most of New York City and Westchester County to the north. Electricity to these areas was provided by Consolidated Edison, Inc., a major utility company.

Such a widespread power loss immediately affected everything dependent on electricity, and all sectors of society. Compounding matters was that this power failure occurred during a brutal 10-day July heat wave, when temperatures were ranging on average as high as 97 °F. These high temperatures and the sudden loss of air conditioning created additional health concerns for the elderly and people suffering from a variety of co-morbid conditions. They also forced people without air conditioning out of overheated buildings onto the streets after dark, where they sought some relief (Table 1).

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Another compounding variable was that New York City was still in the throes of a severe fiscal crisis which had resulted in widespread reductions in public services. In addition, the U.S. as a whole was suffering from a prolonged economic recession which had resulted in higher unemployment rates. These variables are thought to have contributed to the widespread looting and arson that accompanied the blackout.

A dozen years before, New York City had experienced what is now referred to as the Northeast Blackout of 1965. It occurred on 9 November 1965, and affected not only New York City, but also sections of the states of Connecticut, Massachusetts, New Jersey, Rhode Island, Pennsylvania, and Vermont, and the province of Ontario in Canada [3]. This blackout was of relatively short duration, some 13 h, and occurred during a cool period of the year when the average temperature was 49 °F. In contrast to the 1977 blackout, the one in 1965 was due to human error. It was also relatively brief in duration compared to the roughly 25-h 1977 blackout.

The Northeastern Blackout of 14–15 August 2003 was 31 h in duration, a few hours longer than the one in 1977. However, it affected some 50 million people living in eight

U.S. states and parts of Canada. Included in this area were large cities such as New York, Cleveland, Ohio, and Detroit. The average temperature in New York City during this blackout was 82 °F (Table 2).

Each of the New York City blackouts resulted in public health and health care delivery effects. These were most extensively described for the 2003 blackout. A number of publications have focused on disaster preparedness and impacts on emergency medical services [4–7]. Others have described the health impacts, public health effects, and increased mortality associated with the 2003 blackout [8–10].

A number of issues described in reports on the 2003 blackout were also encountered in the 1977 blackout under consideration here. Beatty et al. in commenting on the 1977 blackout, state: “The blackout of July 13–14, 1977, was dominated by criminal activities. During the 26.5 h of the blackout, 3418 persons were arrested, primarily for looting. No archival information was available on the activities of Department of Health and Mental Hygiene (DOHMH) during this incident” [8].

These authors are correct in stating that the 1977 blackout was dominated by criminal activities such as

Table 1 Chronology of some events of the New York City blackout, 13–14 July 1977

Time/date	Event
8:37 p.m. 13 July	Lightning strikes the Buchanan South substation on the Hudson River
8:55 p.m. 13 July	Another lightning strike destroys two critical transmission lines
9:36 p.m. 13 July	Entire electrical system is shut down after efforts to counter disabling lightning strikes
13 July–14 July	Large scale civil disorders begin characterized by heavy looting, arson, and vandalism
9:57 p.m. 13 July	New York City airports close
13 July	As soon as power fails, subway system is paralyzed and traffic signals cease to function. Tunnels closed
13–14 July	Emergency power sources support most, but not all functions of the 66 voluntary hospitals, 19 not-for-profit nursing homes, and 17 large public hospitals
13–14 July	1809 incidents of arson and looting reported to the police
13–14 July	2931 arrests made by the police
13–14 July	204 civilians injured
13–14 July	436 police injured
13–14 July	80 firefighters injured
13–14 July	1037 fires reported
13–14 July	70,680 911 Emergency calls received, compared to 18,500 over a normal similar period
13–14 July	Elderly people stranded in high-rise buildings
14 July	Department of Health (DOH) quickly organizes a working group of key personnel at 7:00 a.m. to address public health and health effects of the blackout. This group continues to coordinate DOH activities throughout the day and for several days after electricity is restored
10:39 p.m.–14 July	Electricity restored to all of New York City

Table 2 Mean temperatures during three major New York City blackouts, 1965, 1977, and 2003. *Source:* Office of Vital Statistics, New York City Department of Health; References [3, 9]

Date	Mean Fahrenheit temperature (°F)
9 November 1965	49
13–14 July 1977	97
14–15 August 2003	82

arson, vandalism, and looting. However, there is significant archival information about both the issues that the Department of Health (later re-named the Department of Health and Mental Hygiene) had to address as well as its extensive activities during and after the blackout. While these were not published in peer-reviewed scientific journals, they were documented in the press and in reports to the Office of the Mayor. Information from the latter was incorporated into a comprehensive report on the blackout prepared by the Energy Division of Systems Control of Paolo Alto, California for the Department of Energy [11].

The New York City Department of Health in 1977

At the time of the 1977 blackout, this writer simultaneously held five health offices in New York City. These were: Acting Health Services Administrator, Commissioner of Health, Chair of the Board of Directors of the New York City Health and Hospitals Corporation, Chair of the Interagency Health Council, and Chair of the Board of Health. Two of these, Acting Health Services Administrator, and Chair of the Interagency Health Council, did not require direct operational responsibilities. The former was a legally required title to enable someone to be chair of the board of the city's 17 public hospitals system, the Health and Hospitals Corporation (HHC). The latter facilitated the ability of the Commissioner of Health to coordinate the activities of three other agencies with those of the Department of Health (DOH). These other agencies were the Department of Mental Hygiene, the Addiction Services Agency, and the Human Resources Administration.

The present writer's primary operational responsibilities were to lead the Department of Health and the Board of Health, and chair the board of the public hospital system.

In 1977, the DOH was still under the pressures of the city's fiscal crisis. It had lost 1700 personnel between 1974 and 1977, but still had a workforce of 4000 at the end of this period. Much of the personnel and financial reductions were in the area of personnel health services for people recently covered by Medicaid. These services were accessible to these people at clinics also operated by the public hospital system. In strategizing the reductions in the

department's services, the executive leadership had given a high priority to life-preserving services, and a low one to life-enhancing ones such as dental health and nutrition education. When the worst of the fiscal crisis was over in 1972, the core structure and functions of the department remained strong [12, 13]. Consequently, the DOH was in a robust state to deal with the problems presented by the blackout.

Some Personal Observations during the Blackout

People who live through widespread electrical power failures can often recall such details as to where they were and what they were doing when the blackout began. They can also recall by what means and when they learned that the power failure was not a local one in the area where they happened to be, but rather a widespread blackout.

As the then Commissioner of Health of New York City, I have vivid memories of many details of the 1977 blackout and of all the activities undertaken by the Department of Health and the Health and Hospitals Corporation to mitigate its effects on the health and well-being of New York City's population. The issues encountered by these two agencies are presented below. However, before describing them, I would like to present here some personal observations and experiences recorded in my daily diary.

On Wednesday, 13 July 1977, I held a cabinet meeting at 8:30 a.m. attended by all the leadership of the Department of Health. While the blackout was several hours off, this weekly meeting nonetheless focused on the important issue of inter-agency collaborations and cooperation, soon to become an imminent necessity.

The day was a very hectic one, full of meetings, including one concerning Columbia University's nuclear reactor, which had become a controversial issue. My wife and I had originally been scheduled to attend the opening of an exhibition of photographs from Upper Volta (now Burkina Faso) at the United Nations. However, we were unable to attend both because she had a class at New York University which was required for her Master of Arts degree, and because I was asked to inspect the new building of the State University of New York (SUNY) College of Optometry.

At 5:30 p.m., I met Dr. Alden Norman Haffner, the President of the SUNY College of Optometry at the new building site on Park Avenue South and East 27th Street in Manhattan. After touring the building, we met my wife at Washington Square following her class, and stopped at Dr. Haffner's apartment on East 36th Street for a visit. Because he and my wife greatly enjoyed opera, he played some VHS tapes made from older 78 rpm records of Enrico Caruso and Amelita Galli-Curci. Although I was not well informed about opera, I did say, "Galli-Curci seems to be

singing off key.” Dr. Haffner dismissed this by saying, “Because you are not an opera fan, your ear is not sensitive to the nuances of operatic music.” My wife agreed. However, I insisted that she was either singing off key or else the recording was defective. Again, they disagreed, until the lights dimmed for a few seconds. Clearly, something had affected the electrical supply. It was close to 9:00 p.m., and we decided to leave and go to our 25th floor apartment on East 83rd Street and Second Avenue. My wife and I had been married several weeks earlier on 4 June, and Dr. Haffner gave us a crystal bowl as a wedding gift. When the elevator arrived on the sixth floor, it was crowded, so much so that it was only with some effort that we were able to squeeze into it. I held the box with the heavy crystal bowl ahead of me and against the doors of the elevator. I have since dreaded what our fate would have been had the blackout begun when we were squeezed into that elevator. When we emerged from the building, the lights on the block were still on. However, as I recorded, “As soon as we had gotten into the car, the lights went out on the block. We drove toward First Avenue, and, when we arrived there, all the lights leading to the Queens Midtown Tunnel went out. The cab drivers stopped there, and all got out and looked up at the darkened buildings. As we drove north in the dark, we knew there had been a power failure. There were no functioning traffic signals, but volunteers were directing traffic on the streets. It was terribly hot and humid, and then it rained. On the car radio, we learned that there had been a major power failure in New York City and Westchester County” [14].

I immediately realized that depending on the duration of the power failure, there would be a broad range of problems that would need to be expeditiously addressed. Although my wife and I could have climbed the 25 floors to our apartment, it was clear that I could not remain there for long. Fortunately, one of my brothers was still living in our family home in Tudor Village in southwestern Queens County, and so we decided to go there at once. The Queens Midtown Tunnel, which gives access to the Long Island Expressway, was not yet closed. We chose this route because for most of the trip, we would not have had to deal with major intersections with non-functioning traffic signals. The tunnel was soon closed however, after we passed through it, as the ventilation system failed, leading to the buildup of carbon monoxide.

This was a time before cell phones and internet communications. Land-line telephones were then the best and surest means of distant communication. Even facsimile (FAX) communication was in its infancy and restricted to dedicated short distance locations. The DOH had recently set up a FAX line on a pilot basis between its headquarters at 125 Worth Street and the Bureau of Laboratories on First Avenue and East 27th Street, a distance of one mile.

Mayor Abraham D. Beame quickly set up a Blackout Action Center at the headquarters of the New York City Police Department. From there, he contacted all department heads to coordinate a collaborative response to the effects of the blackout. I, in turn, was in contact with the members of the Department of Health’s leadership and that of the HHC. The mayor initially wanted all agency heads to join him at the Action Center which, by the early hours of the morning, was crowded with press and media reporters. I told the mayor that I could be more effective at the department’s headquarters where a Blackout Response Group was being organized, and which met at 7:00 a.m. That so many of the department’s key staff were able to get to the department’s headquarters early in the morning, despite the paralysis of the subway system, is a tribute to both their dedication and ingenuity.

I, myself, set out at 5:30 a.m. via Atlantic Avenue in Brooklyn, the most direct route to the Brooklyn Bridge and the City Hall area of Manhattan, where the health department was headquartered. Before setting off, I could see that the western horizon was accented by smoke and red glare, the result of widespread arson. Atlantic Avenue runs through the neighborhoods of East New York, New Lots, Bedford-Stuyvesant, and Prospect Heights, where arson and looting were especially intense. I was amazed by the extent of the fires and the rampant looting, which were in full force as I went down Atlantic Avenue. At the intersection of Atlantic Avenue and Pennsylvania Avenue, a Strauss Automotive supply store was being actively looted, despite the constant ring of the alarm. I was shocked to see children as young as 10 years of age hauling automobile tires out of the store. Radio reports mentioned that looting was under way throughout the city. However, my eyewitness assessment was that it was far worse than the reports indicated.

Priorities of the Department of Health Blackout Contingency Plan

The key DOH leadership met at 7:00 a.m. and established priorities for its contingency plan. In addition personnel in various bureaus and divisions were asked to liaise with their counterparts in other city agencies. At this very early hour, contact was made with the heads of the Environmental Protection Administration, the departments of Water Resources, Sanitation, Consumer Affairs, and the Bureau of Water Pollution Control (Table 3).

The central administrative offices of the HHC were two floors above those of the DOH. This greatly facilitated collaboration. Once priorities were established by the DOH, they were discussed with other city agencies and the Office of the Mayor. Collective concerns focused on

Table 3 New York City collaborating agencies during the 1977 blackout

Environmental Protection Agency
Department of Water Resources
Department of Sanitation
Department of Consumer Affairs
Department of Parks and Recreation
Bureau of Water Pollution Control
Health and Hospitals Corporation
Fire Department
Police Department

hospital care services, emergency room functions, water supplies, water pollution control, and food safety (Table 4).

The police and fire departments and the Office of the Mayor were strongly focused on the widespread arson, looting, and vandalism taking place, even in broad daylight. In conversations with Mayor Abraham D. Beame that day, it was clear that he was surprised and shocked by these unexpected criminal acts which did not occur during the blackout of 1965.

Hospital and Emergency Room Services

Overall, most hospitals in the city were able to maintain some electrical power for key functions through the use of back-up generators. Emergency power systems had been mandated for hospitals in the city following the 1965 blackout. However, at some hospitals, the emergency back-up power systems were inadequate to cover all services. The same applied to voluntary hospitals [11]. At some institutions, staff demonstrated great ingenuity in dealing with absent back-up electrical power. Schaeffer and Salazar describe their heroic and successful efforts to care for

41 infants in a neonatal intensive care unit at the Jewish Hospital and Medical Center of Brooklyn for a 2-h period until the New York City Fire Department provided a small emergency gasoline generator placed on the roof near the nursery [15]. The above said, it should be pointed out that back-up power systems failed at very few hospitals, including the Jewish Hospital, Bellevue Hospital, and New York University Hospital. At the remaining 108 acute care hospitals, auxiliary power systems worked satisfactorily [16].

While it can be said that hospital services were satisfactory, they were by no means optimal. Staff shortages due to personnel not being able to report for work because of the absence of public transportation were widespread. However, many on-duty staff did remain and worked long hours. Basic back-up items such as flashlights, batteries, extension cords, and disposables were sometimes in short supply. There were delays in bringing emergency power systems on line, and technical problems occurred once they were operational. These emergency power systems often did not support food storage areas, blood banks, pharmacies, morgue areas, specimen storage areas, laboratory areas, and multi-unit telephone (key sets) systems. A few hospitals maintained battery-operated units for emergency operations in critical areas. Other areas such as boiler rooms, generator areas, and catheterization units lacked battery-powered back-up systems [11].

Table 5 displays comparative hospital emergency room visits at selected public hospitals for a pre-blackout day, 7 July, and the full blackout day, 14 July. The mean temperature on 7 July was 76 °F, while on 14 July, it was 97 °F. These data, collected through a post-blackout survey by the HHC, indicate that adult emergency room visits increased significantly in all four boroughs at most of the ten hospitals on the full blackout day. Data for Bellevue Hospital in Manhattan are not included because it closed its emergency room during the blackout due to the failure of

Table 4 Priority concerns for the New York City Department of Health during the 1977 blackout

Priority concerns
General public health
Perishable food supplies
Potable water supplies
Sewage disposal
Solid waste disposal
Beach contamination with untreated sewage
Potential spoilage of vaccines, biological, medications, and blood supplies
People on electrically supplied home life support systems
Integrity and adequacy of emergency room and hospital services
People, especially senior citizens, trapped in high-rise buildings
Rescue of people trapped in elevators
Dealing with a potential increase in the rodent population

Table 5 Comparative emergency room visits at ten selected public hospitals by borough, 7 July 1977 and 14 July 1972. *Source:* Post-Blackout Hospital Survey, Office of Systems Development and Operations, Health and Hospitals Corporation, 1977

Borough/hospital	Adult emergency		Pediatric emergency	
	Room visits		Room visits	
	7 July	14 July	7 July	14 July
Manhattan				
Harlem Hospital	222	314	8	N/A
Sydenham Hospital	56	107	7	20
Bronx				
Bronx Municipal Hospital	237	304	208	190
Lincoln Hospital	179	388	21	127
Brooklyn				
Coney Island Hospital	208	242	49	56
Cumberland Hospital	156	178	102	9
Greenpoint Hospital	116	177	43	76
Kings County Hospital	556	547	246	174
Queens				
Elmhurst Hospital	159	189	27	19
Queens Hospital	170	127	66	60

its back-up electrical power system. Pediatric emergency room visits increased at four of the hospitals on 14 July, but decreased at the other six. The large increase in pediatric emergency room visits at Lincoln Hospital from 7 July to 14 July (21 vs. 127) may have been due in part to injuries sustained by children who participated in vandalism and rioting. Of significance is the fact that clinic visits dramatically fell at all ten hospitals, probably due to the lack of public transportation that was key for keeping appointments [11].

The HHC survey of its hospitals, conducted after the blackout, also requested individual hospital information on visits to psychiatric emergency rooms, ambulance runs, and clinic visits. However, statistically valid comparisons between 7 July and 14 July 1977 were not possible for these categories because information was either not available or else not applicable.

It is tempting to attribute the sharp increase in emergency room visits to some hospitals located in areas where looting, arson, and violence were very prevalent. However, as Corwin and Miles indicate, these spikes in numbers on 14 July could have been heat related or else due to a shifting of more acute clinic visits to emergency rooms. An in-depth analysis of emergency room patient charts for 14 July might elucidate this issue [11].

Water Supply

Despite initial concerns, the city's water supply remained adequate. The reason for this is that the supply system relies on gravity to move water from reservoirs north of the

city through mains where a pressure of 60 feet is maintained. This means that in most areas of the city, gravity pressure is sufficient to deliver water up to five or six stories. Most multiple dwellings higher than six stories have roof storage tanks with capacities of 24–48 h. Very tall buildings routinely have pumps to assure an adequate supply in their roof storage tanks. That said, in certain areas of the city, gravity pressure alone is insufficient to deliver water up to five to six stories. As a result, pumping stations are located in these neighborhoods.

Given the extent of arson that occurred during the blackout and the need for the Fire Department to remove large amounts of water through street hydrants, there were concerns that pressure loss in the system could lead to back siphonage and contamination. However, this fortunately did not occur and bacteriologic examination of the water did not demonstrate any contamination [11].

Sewage Treatment

At the time of the 1977 blackout, New York City had 15 sewage treatment plants and 25 pumping stations. Westchester County, also affected by the blackout, had 12 sewage treatment plants and 33 pumping stations [11]. Electrical power is required for both the treatment and pumping of sewage. Failure of the former results in raw sewage flowing into adjacent bodies of water, while failure of the latter causes back-ups in the sewerage system with possible flooding of basements.

All of the sewage treatment plants had back-up electrical power systems that were capable of functioning for

short periods of time. In the early morning hours of 14 July, the first and only full day of the blackout, the Bureau of Water Pollution Control informed the DOH that the Hunts Point Sewage Treatment Plant's back-up electrical supply had failed. As a result, raw sewage was flowing into Eastchester Bay, Little Neck Bay, and the Long Island Sound. This meant that raw sewage was washing up on Orchard Beach in the Bronx, and on beaches on City Island, Eastchester, Little Neck, and Douglaston.

The DOH made a decision to classify the waters on these beaches as unsafe for bathers. This decision was strongly opposed by the Fire Department and by the then recently appointed First Deputy Mayor, Donald D. Kummerfeld. Their opposition was understandable. Both Kummerfeld and John T. O'Hagan, the Fire Commissioner, had legitimate concerns. They reasoned that if the beaches, especially Orchard Beach in the Bronx, were closed, people would seek relief by opening fire hydrants. This in turn would reduce the water pressure and greatly hamper fire-fighters dealing with fires due to arson. We in the DOH were also concerned about this unintended consequence, and also that a severe reduction in water pressure could lead to inadequate flow to multiple dwelling buildings. In addition, a lowered water pressure could set the stage for back siphonage and contamination.

However, despite these concerns, the DOH prevailed and went forward with a strong recommendation to the public not to bathe on any of these beaches for a 24-h period commencing at 4:00 p.m. on 14 July. We were hopeful that electrical power would be restored at the end of this period, which is what eventually occurred when the Hunts Point Sewage Treatment Plant became operational. At that point, the DOH classified these beaches as safe for bathing [17].

Limiting the beach closures to a 24-h period represented a compromise on the part of the DOH's original position of indefinite closure. For in the early hours of the blackout, no one was sure for how long the sewage treatment plant would be out of service. First Deputy Mayor Donald D. Kummerfeld and Fire Commissioner John T. O'Hagan, who originally opposed any beach closures, were able to accept an incremental approach starting with a 24-h moratorium.

Perishable Food Supplies

A high priority on the DOH's Health Contingency Plan for the Blackout was concern for the risks associated with eating re-frozen perishable foods, especially meats and poultry. In order to deal with this risk, the DOH sent out 150 inspectors, and the Department of Consumer Affairs fielded 80 inspectors to inspect and dispose of spoiled

frozen foods. These inspections began late in the day on 14 July and continued for several days afterwards. Included in these inspections were 6000 restaurants, 8000 diners, and several thousand food outlets and supermarkets [17–19].

This collaborative effort between the DOH and the Department of Consumer Affairs was coordinated with the Department of Sanitation to assure the safe removal of spoiled foods. In addition, the DOH launched an intensive health education effort through the press and media providing advice to the public about the disposal of spoiled food products [20].

DOH and Department of Consumer Affairs inspectors found that most food outlets, restaurants, and diners had already voluntarily discarded spoiled foods [17]. However, extensive efforts continued via the press and media to advise the public about which food products to discard. In order to assist the public, a Food Spoilage Hotline was set up. By 3:00 p.m. of the day after the blackout, 400 calls had been received about the disposal of spoiled foods. DOH sanitary inspectors also worked throughout the night of 14–15 July inspecting pasteurization plants in the city. They oversaw the proper disposal of spoiled milk [11].

Potential Spoilage of Vaccines, Biologicals, Medications, and Blood Supplies

The DOH issued advisories to pharmacies, hospitals, clinics, and the general public about the proper disposal of spoiled products in these categories. This effort was supported by a battery of telephones especially set up at the DOH headquarters to answer these questions as well as questions about any other issue related to the blackout.

The Office of the Chief Medical Examiner

City morgues in the four boroughs outside of Manhattan were located in public hospitals where there was emergency back-up electrical power. However, the central morgue, located on First Avenue in Manhattan, did not possess any back-up emergency electrical power. Early on the morning of 14 July, the Chief Medical Examiner, Dr. Domenick J. DiMaio, called to say that the morgue was without electricity. Bodies could have been transferred to the morgue at Bellevue Hospital, across the street from the Office of the Medical Examiner. The morgue at New York University Medical Center was adjacent to the medical examiner's building. However, it also was without back-up electricity. Transferring bodies to the borough morgues was not feasible because of their limited capacity.

Mayor Beame and his executive staff were operating at the Blackout Action Center at police headquarters, across

from the City Hall building. This building had a portable back-up generator. Since only a few security personnel were in the building, this writer contacted Mayor Beame and suggested that the City Hall building back-up generator be moved to the Office of the Chief Medical Examiner. He quickly agreed, and requested that the Fire Department move the generator and install it at the Office of the Chief Medical Examiner, where it successfully functioned.

Mortality Rates

Table 6 depicts the number of deaths by day and highest temperature for the month of July 1977. The number of daily deaths for the peak day of the blackout, 14 July, was 257, higher than that on any of the previous 13 days of the month. It is significant that a much higher number of daily deaths occurred after the blackout days of 13–14 July, reaching 273 on 19 July when the temperature reached 102 °F, 283 the following day when the temperature was 92 °F, and 298 on 21 July when the temperature was 104 °F.

These data would seem to support a conclusion that a daily increase in the number of deaths was temperature related during July 1977 rather than caused by the day-long blackout. Daily deaths rose as well after the blackout in tandem with very high temperatures. Table 7 presents the number of total deaths by day for the period 13–15 July 1977 and by two broad age groups, below 65, and 65 and above. These mortality data confirm those in Table 6, which demonstrate a mortality-temperature relationship more than a mortality-blackout association. They also demonstrate proportionally more deaths among the 65 years of age and older group.

One would expect during a heat wave that respiratory and cardiovascular deaths would rise. Table 8 does demonstrate a slight rise in deaths for 14 July, the peak day of the blackout. The total number of respiratory deaths was marginally higher at 26, compared to 20 for the day before and the day after. However, the overall numbers are small, and consequently the data could be due to chance alone. That said, the number of deaths are proportionally higher for those 65 years of age and older.

Table 9 displays cardiovascular/renal deaths for the period 13–15 July 1972. Here, the numbers are much larger and demonstrate a clear rise in deaths to 123 for the peak day of the blackout, 14 July. This compares to 75 the day before, 13 July. However, here again, high ambient temperatures constitute a confounding variable, and mitigate a firm cause-and-effect relationship between the blackout and an increased number of cardiovascular

Table 6 Total deaths and highest temperatures in Fahrenheit, July 1977, New York City. *Source:* Office of Vital Statistics, New York City Department of Health

Date, day	Total deaths	Highest temperature
1, Friday	193	87
2, Saturday	204	86
3, Sunday	188	84
4, Monday	202	88
5, Tuesday	228	95
6, Wednesday	223	85
7, Thursday	222	76
8, Friday	190	88
9, Saturday	187	89
10, Sunday	184	85
11, Monday	161	81
12, Tuesday	212	76
13, Wednesday	180	97
14, Thursday	257	92
15, Friday	210	96
16, Saturday	202	98
17, Sunday	197	97
18, Monday	243	100
19, Tuesday	273	102
20, Wednesday	283	92
21, Thursday	298	104
22, Friday	291	88
23, Saturday	208	87
24, Sunday	198	90
25, Monday	227	78
26, Tuesday	185	82
27, Wednesday	173	81
28, Thursday	197	80
29, Friday	179	82
30, Saturday	182	82
31, Sunday	219	88

Table 7 Total deaths for the period 13–15 July, 1977, New York City. *Source:* Office of Vital Statistics, New York City Department of Health

Age group in years	Date		Date		Date		Total	
	13 July		14 July		15 July			
	No.	%	No.	%	No.	%	No.	%
Below 65 years	74	41	85	33	69	33	228	35
65 years +	106	59	172	67	141	67	419	65
Total	180	100	257	100	210	100	647	100

deaths. As with total and respiratory deaths, the numbers were proportionally higher for those 65 years of age and older.

Table 8 Respiratory deaths for the period 13–15 July, 1977, New York City. *Source:* Office of Vital Statistics, New York City Department of Health

Age group in years	Date		Date		Date		Total	
	13 July		14 July		15 July			
	No.	%	No.	%	No.	%	No.	%
Below 65 years	6	30	11	43	8	40	25	38
65 years +	14	70	15	57	12	60	41	62
Total	20	100	26	100	20	100	66	100

Table 9 Cardiovascular/Renal deaths for the period 13–15 July 1977, New York City. *Source:* Office of Vital Statistics, New York City Department of Health

Age group in years	Date		Date		Date		Total	
	13 July		14 July		15 July			
	No.	%	No.	%	No.	%	No.	%
Below 65 years	24	32	25	20	20	19	69	23
65 years +	51	68	98	80	87	81	236	77
Total	75	100	123	100	107	100	305	100

Civil Disorder

The violence, arson, and looting that were so prominent during the 1977 New York City blackout have, over the years, come to dominate discussions of this event. As a member of the then mayoral administration, this writer witnessed these events first hand. Also, the DOH had to implement measures to safeguard its district health centers and child health clinics from arson and vandalism.

Most of the fires that were purposely set occurred in specific areas of the city. Of all the five boroughs, Brooklyn suffered the largest number of fires, especially along Linden Boulevard, Utica Avenue, Flatbush Avenue, Eastern Parkway, and Broadway. Looting was especially severe along Broadway in the Bushwick section of Brooklyn. The prime targets, as well as in Manhattan, the Bronx, and Queens, were grocery, furniture, clothing, appliance, and liquor stores [11]. Along Broadway in Brooklyn, the looting and vandalism affected over a score of city blocks, and resulted in the social and economic decline of Bushwick, which lasted for three decades afterwards.

In the borough of the Bronx, looting and arson were especially severe along the Grand Concourse and Tremont Avenue, where the resulting damage continued to have negative consequences for decades. It was estimated that looting and arson accounted for half of the total direct and

indirect economic costs associated with the blackout. These costs totaled 155 million dollars [11].

It was estimated by the Fire Department that 1037 fires were intentionally started, 60 of which were major. There were a total of 1809 reported incidents of property damage due to looting and vandalism. Injuries were sustained by 436 policemen, 204 civilians, and 80 firefighters.

Sadly, most of the owners of looted businesses never reopened, creating retail deserts, especially in areas such as Bushwick in Brooklyn. It has only been in the past few years that Bushwick is showing some early signs of recovery. However, this is after almost four decades.

Among the 2931 who were arrested for looting, 45 % were employed, 14 % were students, 10 % were on welfare, and 30 % were unemployed. The vast majority, 93.3 %, were men. Those between 16 and 25 years of age comprised 60.7 % of the looters, while 32.1 % were between 26 and 40 years of age. Only 7.2 % were 40 and older. Of significance is that 64.4 % had a previous arrest record [11]. In reviewing the data on looters who were arrested, one must be aware of the fact that they represented only a portion of those who participated in this activity. Also, many of the looters in possession of stolen property were themselves looted by others. Finally, it must be remembered that the majority of people who lived in areas where arson and looting were very prevalent did not participate in these criminal acts. Rather, they became the victims of the long-term consequences of these acts.

Discussion

The 1977 New York City blackout occurred on 13 July 1977 at 9:36 p.m. and ended at various times the following afternoon in different parts of the city. By 10:39 p.m. on 14 July, electricity was restored to the entire city. This blackout is historically remembered primarily for the violence, arson, vandalism, and looting that broke out in various areas of the city and which had not occurred during the 1965 blackout. Opinions vary about the causes of this violence and criminal behavior. However, some have postulated that the sweeping reductions in support services for the poor, caused by the city's fiscal crises, played a significant role. In addition, large groups of police were sent to guard major expensive shopping centers in Manhattan resulting in their absence in smaller local shopping areas which were then left vulnerable. Some have concluded that the violence of the 1977 blackout closely resembled civil disorder because of its collective nature and the involvement of people from all class groups in specific areas [11]. Certainly, the existence of an unrelenting heat wave that extended over several days and

placed enormous stress on disadvantaged populations living in crowded conditions was a contributory factor.

The brevity of the 1977 blackout, <20 h in some areas and overall 26.5 h for the entire city, mitigated much of its impact on public health and health care services. Nonetheless, the DOH had to mobilize all of its resources and collaborate with other city agencies and non-governmental organizations to address a range of issues. These included hospital and emergency room services, the city's water supply, sewage treatment, solid waste disposal, perishable food supplies, spoilage of biologicals, medications, vaccines and blood supplies, and rescuing those marooned in elevators or in high-rise apartments. It was estimated at the time that around a thousand New Yorkers were on electrically powered health maintenance equipment at home. The DOH put out radio information messages that urged such people to call the department so that rescue teams could transport them to hospitals.

An analysis of total daily deaths and those due to pulmonary and cardiovascular/renal diseases did not correlate with the blackout. Rather, total deaths and those associated with pulmonary and cardiovascular/renal disease correlated well with very hot days outside of the blackout period. For example, on 21 July there were 298 deaths, the highest for the month. This was a week after the blackout, but a day on which the temperature rose to 104 °F. The higher number of daily deaths on very hot days outside of the blackout period supports a death rate correlation with high temperatures and not with the blackout.

The 1977 blackout demonstrated that the DOH was able to quickly establish a Blackout Contingency Plan and mobilize its resources to address whatever challenges arose. The DOH was also highly successful in reaching the public via radio with important health information messages. Although the DOH had never established a disaster preparedness plan prior to the blackout, its professionals quickly rose to the occasion based on vast public health practice experience and ingenuity. As a result, the overall impact on the health of the city's population was minimal during the 1977 blackout.

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Compliance with Ethical Standards

Conflict of interest The author declares no conflict of interest.

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