

FDNY EMS HOSPITAL LOAD BALANCING OPTIMIZATION INITIATIVE

Initial Outcomes (January 14 – April 4, 2021)

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DEVELOPMENT OF FIRE DEPARTMENT OF THE CITY OF NEW YORK EMERGENCY MEDICAL SERVICES (FDNY EMS) HOSPITAL LOAD BALANCING OPTIMIZATION INITIATIVE

Based on lessons learned from the spring 2020 COVID-19 patient surge, FDNY EMS developed the hospital load balancing optimization initiative to perform preemptive patient load balancing across the 911 system. The initiative stems from a research collaboration between FDNY EMS and Columbia University's Department of Industrial Engineering and Operations Research and relies on the concept of system optimization.

HOW THE OPTIMIZATION PROCESS WORKS

Using FDNY 911 transport data and hospital bed availability data from the New York State Department of Health's daily HERDS survey, the optimization formula assesses gaps between supply (hospital capacity defined as available staffed beds) and demand (based on predicted transports in the vicinity of receiving hospitals for the next day, with the assumption that 40% of ambulance transports will result in an admission). The optimization is run each evening after receipt of that day's HERDS data, with the output of the optimization instituted by 8:00 p.m. and in effect for the next 24 hours. The optimization is only run for the Critical Care Category (CCC) General Emergency Department, which accounts for 80% of all transports. No specialty CCC codes are eligible for load balancing in this initiative.

APPLYING THE OPTIMIZATION TO HOSPITALS AND GROUPS OF HOSPITALS

These data are then applied at the FDNY atom level. For the purposes of EMS ambulance dispatch activity, New York City is divided into 2,388 unique geographic areas called atoms. When an atom is optimized, the hospital suggestion list produced by FDNY EMS's computer-aided dispatch (CAD) system is reprioritized to place area hospitals with anticipated capacity higher on the suggestion list while also considering the increased travel time. The EMS crew, in consultation with the patient, determines which hospital is ultimately selected for transport. The optimization reallocates only the number of atoms necessary to prevent hospital overload and does not reallocate all atoms surrounding a hospital.

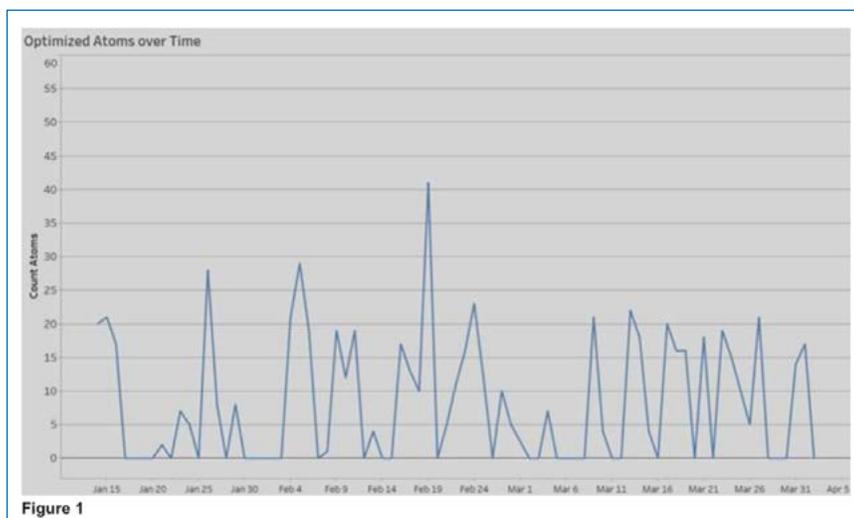


Figure 1

INITIAL OUTCOMES: JANUARY 14–APRIL 5, 2021

On January 14, 2021, FDNY EMS launched its hospital load balancing optimization initiative. From January 14 to April 4, on 45 of the 78 days (57%), the algorithm produced at least one atom with an optimized suggested



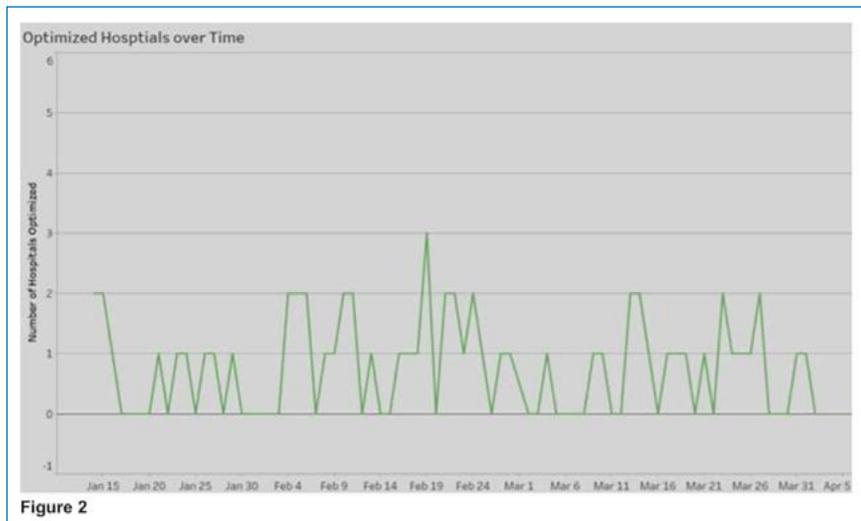
hospital, with an average of 14 atoms optimized. The maximum number of atoms optimized occurred on February 19 (Figure 1).

During this period, the optimized atoms affected five hospitals: NYC Health + Hospitals/Harlem, St. John’s Episcopal Hospital, Brookdale Hospital, Wyckoff Heights Medical Center, and Northwell Health’s Long Island Jewish (LIJ) Forest Hills. Of these hospitals, Wyckoff was optimized most often in terms of days (24 days), followed by Brookdale (19 days). See Table 1 on the following page. The maximum number of hospitals optimized occurred on February 19, with three hospitals optimized (Figure 2).

Table 1: Number of Days with at Least One Optimization by Hospital

Hospital	Days Optimized
Wyckoff Heights Medical Center	24
Brookdale Hospital	19
Northwell Health LIJ Forest Hills	8
St. John's Episcopal Hospital	7
NYC Health + Hospitals/Harlem	3

The table below details, for the five impacted hospitals, the total number of suggestions that were optimized through reprioritization of the hospital suggestion list (Column A). Columns B and C show, of those suggestions, how many and what percent resulted in the choice of a different area hospital. Brookdale had the greatest number of total suggestions optimized to a different hospital (284 suggestions) and the greatest number of optimized suggestions followed (40 suggestions). See Table 2. In total, roughly 13% of all optimized suggestions were followed.



CONCLUSION

The hospital load balancing optimization initiative carried out from mid-January through early April 2021 resulted in the optimization of a low number of atoms, impacting only a handful of hospitals and only a portion of the transports destined for those hospitals. This low impact was likely due in part to lower-than-normal 911 call volume, the conservative parameters appropriately set by FDNY

Table 2: Number of Optimized Suggestions and Suggestions Followed by Hospital

Hospital	Suggestions Optimized	Optimized Suggestions Followed	% Optimized Suggestions Followed
Brookdale Hospital	284	40	14%
Wyckoff Heights Medical Center	174	28	16%
NYC Health + Hospitals/Harlem	136	11	8%
St. John's Episcopal Hospital	55	3	5%
Northwell Health LIJ Forest Hills	38	6	16%
Total	687	88	13%

EMS, and the outstanding work of New York City hospitals in managing their internal capacity through a combination of interfacility load balancing, clinical care, and discharge planning. Much more optimization activity would likely occur in a scenario with higher call volume such as what was experienced during the spring 2020 patient surge.

The optimization initiative is an important first step forward in operationalizing pre-canting or preemptively taking patients to facilities that have the capacity and resources to meet their needs. This critical tool can contribute to regional patient capacity management during an event that stretches resources. FDNY EMS and other involved stakeholders—including New York City hospitals, the Greater New York Hospital Association, and City and State emergency management and public health agencies—anticipate learning more from this initiative and continuously improving the inputs and processes within it.