

City of New York

OFFICE OF THE COMPTROLLER

Scott M. Stringer COMPTROLLER



AUDITS AND SPECIAL REPORTS IT AUDIT

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Audit Report on the Epic Electronic Medical Record System That NYC Health + Hospitals Implemented at the Elmhurst Hospital Center

SI17-079A

January 31, 2018

http://comptroller.nyc.gov



THE CITY OF NEW YORK OFFICE OF THE COMPTROLLER SCOTT M. STRINGER

January 31, 2018

To the Residents of the City of New York:

My office has audited the Epic Electronic Medical Record System (Epic EMR) that NYC Health + Hospitals (H+H) implemented at the Elmhurst Hospital Center (Elmhurst HC) to determine whether it is performing as designed and planned. We perform audits such as this to ensure that City agencies' systems, technology development, and resources are efficient, secure, and operate in the best interest of the public.

The audit determined that Elmhurst HC's Epic EMR, which became operational in April 2016, is generally performing as designed and planned. H+H's Enterprise Information Technology Services (EITS) group has a sufficiently strong computing environment (hardware, software, communications infrastructure) to run Epic EMR, as well as the technical resources to help maintain the Epic EMR for continued day-to-day operations. However, the audit revealed an area of concern: although EITS maintains a 24-hour, 7-days-per-week, agency-wide helpdesk facility to support users in need of technical assistance, its data indicates that the average time frames in which it resolved higher-priority service-restoration issues affecting the Epic EMR at Elmhurst HC significantly exceeded its own targets. Of particular concern, we found that on average, EITS takes more than two times longer than its own targets to address "Medium, High, and Critical" service restoration requests. This is a condition that, if not addressed, could potentially affect the delivery of services to patients.

The audit recommends that EITS should assess its helpdesk operations with regard to the resolution of reported Service Restoration incidents to identify the probable causes for missing targets, such as, if applicable, a lack of resources, inadequate training, or others, and develop solutions to improve the timeliness of its resolutions. If implemented, these efforts should mitigate the potential risk of service delivery delays to patients.

The results of the audit have been discussed with H+H officials, and their comments have been considered in preparing this report. Their complete written response is attached to this report.

If you have any questions concerning this report, please e-mail my Audit Bureau at audit@comptroller.nyc.gov.

Sincerely.

Scott M. Stringer

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THE CITY OF NEW YORK OFFICE OF THE COMPTROLLER AUDITS AND SPECIAL REPORTS IT AUDIT

Audit Report on the Epic Electronic Medical Record System That NYC Health + Hospitals Implemented at the Elmhurst Hospital Center

SI17-079A

EXECUTIVE SUMMARY

We audited the Epic Electronic Medical Record System (Epic EMR) that NYC Health + Hospitals implemented at the Elmhurst Hospital Center (Elmhurst HC) to determine whether it is performing as designed and planned.

NYC Health + Hospitals (H+H) was established by the New York State Legislature in 1969 as the Health and Hospitals Corporation (HHC), a publicly-funded, public benefit corporation, to provide physical and mental healthcare in New York City. H+H is comprised of more than 90 patient care sites throughout the City, including hospitals, neighborhood health centers, long-term care facilities, and it provides home care services. As such, H+H is the largest municipal healthcare organization in the country.

On January 16, 2013, H+H entered into a 15-year, \$302 million contract agreement with Epic Systems Corporation (Epic Systems) to replace H+H's then-20-year-old electronic medical record (EMR) system with an Epic EMR system at all of H+H's patient care facilities, including 11 hospitals, 4 long-term care facilities, 6 diagnostic treatment centers, and more than 70 community-based clinics. An EMR is a digital record of a patient's complete medical and treatment history that can be accessed by a medical office or hospital.

The Epic EMR roll-out at H+H is a large-scale, multi-year capital- and expense-funded implementation project involving third-party software, hardware, interfaces, implementation services and application support. As of June 30, 2017, \$94 million had been spent of \$144 million budgeted for the Fiscal Years 2013-2019 implementation phase of Epic EMR.² H+H's Enterprise Information Technology Services (EITS) group is responsible for implementing Epic EMR across

¹ The *NYC Health + Hospitals* name was established in November 2015 as part of a rebranding initiative of the New York City Health and Hospitals Corporation.

² The FY 2013-2019 implementation phase of the contract is funded by \$76 million in capital funds and \$68 million in expense funds.

all H+H facilities. EITS is also responsible for providing user support for Epic EMR as well as other information technology operations within the agency.

Elmhurst HC's various departments and facilities use Epic EMR to record and process the flow of information regarding patients seeking and receiving medical care at the hospital and its affiliated clinics, from intake to discharge and subsequent follow-up care. Overall, 18 Epic EMR modules (each representing a set of clinical specialty functions or features) were installed at Elmhurst HC for its various user departments.

H+H's EITS operates a centralized helpdesk to support Elmhurst HC's Epic EMR users. The centralized helpdesk addresses users' general support issues such as resolving access and printing problems. Moreover, the EITS helpdesk, in accordance with its Service Level Agreement (SLA) with Elmhurst HC, is responsible for resolving Epic EMR Service Restoration issues that either limit or interrupt functionality or work flow.³

Audit Finding and Conclusion

Our audit determined that Elmhurst HC's Epic EMR, which became operational in April 2016, is generally performing as designed and planned. H+H's Enterprise Information Technology Services (EITS) has a sufficiently strong computing environment (hardware, software, communications infrastructure) to run Epic EMR, as well as the technical resources to help maintain the Epic EMR for continued day-to-day operations.

However, the audit revealed an area of concern: although EITS maintains a 24-hour, 7-days-perweek, agency-wide helpdesk facility to support users in need of technical assistance, its data indicated that the average time frames in which it resolved higher-priority service-restoration issues affecting the Epic EMR at Elmhurst HC significantly exceeded its own targets. Of particular concern, we found that on average, EITS takes more than two times longer than its own targets to address "Medium, High, and Critical" service restoration requests. This is a condition that, if not addressed, could potentially affect the delivery of services to patients.⁴

Audit Recommendation

The audit made the following recommendation:

 EITS should assess its helpdesk operations with regard to the resolution of reported Service Restoration incidents to identify the probable causes for missing SLA targets, such as, if applicable, a lack of resources, inadequate training, or others, and develop solutions to improve the timeliness of its resolutions.

Agency Response

In its response, H+H agreed with the audit finding and reported that it has implemented the audit recommendation by adding skilled resources and training in the Epic helpdesk oversight.

³ Epic EMR Service Restoration issues are incidents impacting users or workflow that require a fix. A Service Level Agreement is a written agreement between a service provider and its customers defining services to be provided in qualitative and quantitative terms.

⁴ The helpdesk facility provides agency-wide operational support relating to general computer application performance or usage issues, and provides support for Epic EMR issues.

AUDIT REPORT

Background

NYC Health + Hospitals was established by the New York State Legislature in 1969 as the Health and Hospitals Corporation, a publicly-funded, public benefit corporation to provide physical and mental healthcare in New York City. H+H is comprised of more than 90 patient care sites throughout the City, including hospitals, neighborhood health centers, long term care facilities, and it provides home care services. H+H's mission is to extend comprehensive health services to all New Yorkers.

On January 16, 2013, H+H entered into a 15-year, \$302 million contract agreement with Epic Systems Corporation to replace H+H's then-20-year old electronic medical record system with an Epic EMR system at all of H+H's patient care facilities, including 11 hospitals, 4 long-term care facilities, 6 diagnostic treatment centers, and more than 70 community-based clinics. The contract covers software licenses, system implementation, training services and software support and maintenance.

An EMR is a digital record of a patient's complete medical and treatment history that can be accessed by a medical office or hospital. EMRs have advantages over paper charts as they provide clinicians and medical professionals the ability to: (1) track patient data over time; (2) easily identify patients due for preventive screening or checkups; (3) check on the status of patients' conditions, e.g. blood pressure readings or vaccinations; and (4) monitor and improve the overall quality of patient care. One of the key features of Epic EMR is that it provides transportability of patient records between medical facilities running the same or compatible systems.

The Epic EMR roll-out at H+H is a large-scale, multi-year capital- and expense-funded implementation project involving third-party software, hardware, interfaces, implementation services and application support. As of June 30, 2017, \$94 million had been spent of \$144 million budgeted for the Fiscal Years 2013-2019 implementation phase of Epic EMR. H+H's Enterprise Information Technology Services group is responsible for implementing Epic EMR across all H+H facilities. EITS is also responsible for providing user support for Epic EMR as well as other information technology operations within the agency.

The rollout of EPIC EMR throughout H+H hospitals and facilities is scheduled to occur in stages from 2013 through 2020. In April 2016, Epic EMR became operational and available for use by more than 4,500 active/authorized users at Elmhurst Hospital Center and its 128 affiliated clinic units that provide a variety of medical services. User access is assigned based on prescreening of each user's training, qualifications and functional role(s). There are over 400 predefined, assignable user roles within Epic EMR; a user's assigned role determines his or her access to the various Epic EMR features.⁵ Users with multiple job responsibilities may be assigned more than one user role, commensurate with their need to use EPIC EMR features to complete the tasks for which they are responsible.

Elmhurst HC's various departments and facilities use Epic EMR to record and process the flow of information regarding patients seeking and receiving medical care at the hospital and its affiliated clinics, from intake to discharge and subsequent follow-up care. (See Appendix I for detailed information on Epic EMR patient work flow.) Epic EMR provides functionalities and tools that

⁵ Epic EMR uses templates to implement feature sets to match user assigned functions.

correspond to Elmhurst HC's medical practice areas, including Emergency Medicine, Neurology, Pediatrics and Adult Primary Care. Overall, 18 Epic EMR modules (each representing a set of clinical specialty functions or features) were installed at Elmhurst HC for its various user departments. (See Appendix II for a listing of those modules and description of their functions.) As reflected in Table I below, between April 2016 and August 2017 Elmhurst HC's Epic EMR processed over 560,000 patient visits. During the same period, Epic EMR facilitated the exchange (send or receive) of patient medical records with over 100 medical facilities outside of H+H, including NYU Langone Medical Center, MediSys Health Network, Brookdale University Hospital and Medical Center, Mount Sinai Health System, and Weill Cornell Medicine, among others.

Table I Elmhurst HC Epic EMR Operational Statistics

April 1, 2016 – August 1, 2017

Total Number of Events	Description of Event			
562,598	Elmhurst HC patient encounters ⁶			
68,110	Patient medical records exchanged at Elmhurst HC			
9,279	Patient medical records sent			
58,831	Patient medical records received			
119	Medical facilities that participated in the records exchange			

H+H's EITS operates a centralized helpdesk to support Elmhurst HC's Epic EMR users. The centralized helpdesk addresses users' general support issues such as resolving access and printing problems. Moreover, the EITS helpdesk is responsible for resolving Epic EMR Service Restoration issues that either limit or interrupt functionality or work flow in accordance with its Service Level Agreement with Elmhurst HC.

Objectives

The objective of this audit was to determine whether the implemented Epic EMR at Elmhurst HC is performing as designed and planned.

Scope and Methodology Statement

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. This audit was conducted in accordance with the audit responsibilities of the City Comptroller as set forth in Chapter 5, §93, of the New York City Charter.

⁶ An interaction between a patient and healthcare provider(s) for the purpose of providing healthcare service(s) or assessing the health status of a patient.

The scope of this audit was the operational status of the EPIC EMR application at Elmhurst HC from April 2016 through March 2017. We conducted audit fieldwork from March 2017 through September 2017. Please refer to the Detailed Scope and Methodology at the end of this report for specific procedures and tests that were conducted.

Discussion of Audit Results

The matters covered in this report were discussed with H+H officials during and at the conclusion of this audit. A preliminary draft report was sent to H+H and discussed at an exit conference held on December 28, 2017. On January 12, 2018, we submitted a draft report to H+H with a request for comments. We received a written response from H+H on January 25, 2018. In its response, H+H agreed with the audit finding and reported that it has implemented the audit recommendation by adding skilled resources and training in the Epic helpdesk oversight.

The full text of H+H's response is included as an addendum to this report.

FINDINGS AND RECOMMENDATIONS

We determined that Elmhurst HC's Epic EMR, which became operational in April 2016, is generally performing as designed and planned. H+H's Enterprise Information Technology Services has a sufficiently strong computing environment (hardware, software, communications infrastructure) to run Epic EMR, as well as the technical resources to help maintain the Epic EMR for continued day-to-day operations. However, the audit revealed an area of concern: although EITS maintains a 24-hour, 7-days-per-week, agency-wide helpdesk facility to support users in need of technical assistance, its data indicated that the average time frames in which it resolved higher-priority service-restoration issues affecting the Epic EMR at Elmhurst HC significantly exceeded its own targets, a condition that, if not addressed, could potentially delay the delivery of services to patients.

Epic EMR at Elmhurst HC

Elmhurst HC's Epic EMR demonstrated good functional stability in operation over an 11-month period immediately following the April, 2016 implementation. That assessment is based on our review, analysis, and assessment of: (1) helpdesk-incidents data related to the Epic EMR during the 12-month period from April 2016 through March 2017; (2) the types of incidents logged by the helpdesk compared with incident resolution rates; and (3) data reflecting Epic EMR usage in correlation with incident trends in new system deployments.⁷

EITS Helpdesk Data

However, as indicated in Table III, our analysis of helpdesk statistics for the Elmhurst HC revealed that the actual turn-around times for resolved incidents that the helpdesk classified with priority levels of "medium," "high," or "critical" significantly exceeded EITS' target turnaround times established by its SLA.⁸ Repeated delays in addressing higher-priority incidents that affect system operations can result in significant interruptions and potentially delay the provision of services to patients. This matter is discussed in greater detail in the following section of the report.

EITS Helpdesk Delayed in Resolving Service Restoration Incidents

EITS' helpdesk's actual turnaround times for resolving reported Service Restoration incidents with the priority level of medium, high, or critical at Elmhurst HC significantly exceeded the turnaround times established in EITS' SLA with H+H client organizations.

EITS provides technical incident management services to all H+H users, including users of the Elmhurst HC's Epic EMR computing resources, based on its SLA agreement. The EITS helpdesk provides 24-hour, 7-days-per-week support and is reachable by users via email and/or telephone.

According to the terms of EITS' SLA, all user requests for technical assistance are initially reviewed by helpdesk technicians to determine the type of assistance required. Generally, the requests are categorized as: (1) *Service Requests*, which involve routine issues such as user password resets, connecting a printer, adding a new service, or changing a user screen, among

⁷ Organizations installing new systems or applications generally experience a high volume of requests for assistance from users during the initial periods of installation.

⁸ The three priority levels, in descending order, involve three types of service-restoration incidents, meaning specifically: (1) those that prevent multiple people from working; (2) issues that significantly impact users' ability to work; and (3) issues that do not completely interfere with users' work but require workarounds.

others; or (2) Service Restoration, which involves issues that impact the functionality or workflow of the system as experienced by the user, such as an application's ceasing to work or not working well.

In line with the SLA, EITS' helpdesk technicians triage Service Restoration incidents and classify them based on the urgency of the matter and its impact on Epic EMR's workflow. As shown in Table II below, EITS' helpdesk assigns one of four priority levels, each with its own target turnaround time specified in the SLA, to each Service Restoration incident, based on the reported conditions.

Table II Service Restoration Incident Priority Classification and SLA Target Turnaround Time

Priority Level	Definition	SLA Target Turnaround Time ⁹
Critical	Incidents preventing multiple people from working; loss of system functionality; or issues with no alternative workflows or workarounds are available.	4 Hours
High	Incidents that significantly impact users' ability to work.	2-Days
Medium	Incidents that do not completely interfere with users' work; there are workarounds, or that users can perform other tasks until the incidents are resolved.	7-Days
Low	Minor incidents.	30-Days

The priority level of a Service Restoration incident determines the time in which EITS should resolve the issue so that the user can continue normal workflow. 10

Our analysis of EITS helpdesk statistics for Epic EMR-related Service Restoration incidents at Elmhurst HC showed that a total of 16,922 issues were reported during the 12-month period April 2016 through March 2017. (See Appendix III for more detailed analysis of those statistics.) Each of those incidents was assigned a ticket number by the EITS helpdesk facility for tracking purposes. However, as reflected in Table III below, when we compared EITS's Average Actual times for resolving those Service Restoration issues with its target resolution times listed in the SLA, we found that EITS' actual resolution times significantly exceeded its SLA target times for resolving incidents it classified as medium, high, or critical priority. Conversely, for low-priority Service Resolution incidents, EITS' average actual resolution time of 6 days was far less than the allotted SLA target time of 30 days.

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⁹ The SLA Target times for tickets are measured on actual time 24/7/365. The SLA clock starts at the time of ticket creation and stops

once the ticket has been resolved, breached or has been marked as pending.

10 The allocated time, shown in the table as "SLA Target Turnaround Time," is used by the helpdesk facility as (1) a performance target for assisting users; and (2) a gauge for managing the volume of users' requests for assistance and allocating helpdesk resources accordingly—an effort to match helpdesk resources with user requirements. In addition, the time frames allocated for the resolution of "service restoration" incidents in each of the four designated incident priority levels form the basis of EITS' SLA with its agency users within H+H.

Table III

Elmhurst HC Service Restoration Incidents Average Actual Resolution Time versus SLA Target April 2016 – March 2017

	Priority Level				
	Low	Medium	High	Critical	
Average Actual Resolution Time	6-Days 👵	12.5-Days _ᢙ	5-Days 🕝	2.4-Days ¹¹ ♠	
SLA Target Resolution Time	30-Days	7-Days	2-Days	4-Hours	

Appendix III of this report details Elmhurst HC Service Restoration incidents during the above 12-month period, by month, priority categories, and age of the helpdesk tickets.

EITS is required to adhere to its SLA performance standards for incident management to support Elmhurst HC's Epic EMR users so that they can maintain proper patient care. Missing the SLA target times for high- and critical-priority tickets can significantly impact multiple user-workflows, especially when no alternatives or workarounds are available. Since Epic EMR is Elmhurst HC's primary, mission-critical EMR system, any incidents that are unresolved, or resolved in an untimely manner, may have a material impact on patient care and patient safety.

Recommendation

 EITS should assess its helpdesk operations with regard to the resolution of reported Service Restoration incidents to identify the probable causes for missing SLA targets, such as, if applicable, a lack of resources, inadequate training, or others, and develop solutions to improve the timeliness of its resolutions.

H+H Response: H+H agreed, stating, "EITS has implemented the recommendation and added Skilled Resources, and trained the Help Desk in the EPIC application and Enterprise Operation Center oversight."

¹¹ The "2.4-Days" average actual resolution time for critical incidents was skewed by one Service Restoration incident pertaining to transfer of pathology reports. The incident, which was resolved in 61 days, required outside technicians to resolve. See Appendix III, Figure 3, for monthly averages of Service Restoration incidents and resolution times.

DETAILED SCOPE AND METHODOLOGY

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. This audit was conducted in accordance with the audit responsibilities of the City Comptroller as set forth in Chapter 5, §93, of the New York City Charter.

The scope of this audit was the operational status of the Epic EMR application at Elmhurst HC from April 2016 through March 2017. We conducted audit fieldwork from March 2017 through September 2017.

Due to privacy restrictions associated with patient medical records governed by the Health Insurance Portability and Accountability Act of 1996 (HIPAA), we conducted functional reliability testing on Epic EMR through analyses of all recorded Epic EMR-related technical incident records of users' requests for fixes and other assistance in connection with Epic EMR usage during the 12-month period from April 1, 2016—representing the date of initial usage and availability—through March 31, 2017. We used the agency's EITS helpdesk Service Level Agreement as our main criteria to evaluate technical incidents. In addition, we performed functional testing on Epic modules in agency's test environment using the mock-up data designed for system testing. ¹³

To achieve the audit objectives, we reviewed pertinent documentation (listed under bullet-points below), conducted system walkthroughs, performed system testing, and analyzed 100 percent of the Elmhurst HC's Epic related helpdesk incidents logged in one year (from inception in April 2016 through March 2017).

To gain an understanding of the H+H, Elmhurst HC, and the Epic implementation project, we reviewed the Mayor's Management Report along with H+H's and Elmhurst HC's websites. We also reviewed minutes from monthly H+H IT board meetings and other related board meeting notes to understand H+H's IT strategy and planning.

To understand the rules, policies and guidelines for implementing an electronic medical health records system and agency information technology practices, we:

- Reviewed the IT portion of H+H's 2015 and 2016 Financial Integrity Statement (submitted under Comptroller's Directive #1) to understand the structure of the agency's information systems and the agency's IT controls.
- Reviewed the agency intranet web pages for an understanding of agency background information, its rules and policies, internal communication regarding Epic EMR project and user training.
- Reviewed HIPPA to understand the rules and policies in EMR system development and protecting health data.

¹² HIPAA is a federal statute that prescribes certain data-privacy and security standards for health care providers, plans, and business associates for safeguarding the privacy of individuals' medical records and health information.

¹³ Agency test environment is a facility where developed software can be tested prior to making it available to all users of the live system. The test environment is segregated from actual patient information in the production environment.

• We obtained pertinent contract information (relating to Epic Systems and other participating vendors) for the EMR implementation at H+H to evaluate the system development life cycle.

To understand IT governance and determine controls within the agency, and the Epic EMR development project, we:

- Obtained names and contact information for key personnel who participated in the Epic EMR implementation at Elmhurst HC to evaluate internal control and project management.
- Reviewed organization charts for H+H—the agency overall, Elmhurst HC, and agency unit(s) responsible for the Epic EMR implementation—to evaluate internal control and project management.
- Reviewed the H+H "Business Associates Agreement" with vendors to determine risk management and patient privacy control measures.
- Reviewed listings of Epic EMR users within H+H as well as listings of authorized external users and their user roles by H+H units and departments and by names of organizations associated with the external users to determine access controls and system functionalities. We also evaluated Epic user templates to evaluate security access control of the system based on user roles and responsibilities.
- Examined records of the system usage activities of authorized users to assess system performance and access control.
- Reviewed H+H's user-access requisition process for utilizing the Epic EMR system to determine agency practices on access controls.
- Reviewed the organization's business continuity plan (BCP), including alignment of the IT disaster recovery plan (DRP) with the BCP, and the agency's Downtime Procedure to determine the organization's ability to continue essential business operations during the period of an IT disruption.
- Reviewed the agency's security framework and security report types to determine whether the system is protected from internal and external risk and its contingency plans.

We also conducted walk-though exercises to better understand the agency's utilization of the Epic EMR system at Elmhurst HC. Specifically, we:

- Reviewed listing of clinics associated with the Elmhurst HC to evaluate Epic EMR utilization at the hospital.
- Conducted walk-throughs of four clinical departments in the Elmhurst HC for a better understanding of the work environment where the application is being used.

To determine whether the Epic application was functional, we reviewed the following technical documentations and contracts and performed testing on the system in a testing environment. Specifically, we:

- Evaluated the Epic modules installed at Elmhurst HC to determine the completeness of implementation. We also obtained and reviewed the Epic modules dictionary to familiarize ourselves with the Epic system components and their features.
- Reviewed Epic's application and integrated testing methodology to determine whether pertinent quality assurance procedures were followed to ensure system readiness.

- Evaluated change and release management practices to determine whether changes made to systems and applications are adequately controlled and documented.
- Reviewed purchase orders related to the EPIC implementation to determine EPIC functionalities and major vendors involved in the EPIC implementation project.
- Examined Epic EMR and other system architecture diagrams to evaluate EPIC system installation, infrastructure layout and system reliability.
- Reviewed detailed information on Epic EMR's single patient data movement workflow to determine data movement from one system to another system within the H+H IT environment.
- Performed testing of the Epic test environment to assess the Epic system's overall performance, usability, access control, and security features. Examined system transaction levels by extensively testing the Epic testing environment to evaluate its performance over time.
- Reviewed patient activation data of MyChart mobile application to determine patient interaction with Epic system. See Appendix IV for statistics from this applications.
- Reviewed user login logs to determine user activities on Epic EMR system based on user templates to determine user interaction with the system.
- Reviewed the exchange of health records with outside entities to and from Elmhurst HC to determine whether the implemented Epic system is capable of inter-operation with other hospitals and medical communities.
- Reviewed the agency's patient registration process workflow plans for the emergency and ambulatory care departments to determine Elmhurst HC's planning for daily business operation.
- Reviewed Epic Interface Architecture diagrams to understand how the Epic system works together with other agency systems such as financial, registration other thirdparty clinical systems.
- Interviewed H+H IT professionals regarding IT governance, the EMR project management, legacy data migration, system architecture, and integration with essential clinical systems.

To evaluate whether Epic EMR was performing as designed and planned, we conducted various tests. Specifically, we:

- Evaluated technical incident management practices to determine whether problems and incidents are prevented, detected, analyzed, reported and resolved in a timely manner to support the organization's goals and objectives.
- Reviewed the EITS helpdesk technical support Service Level Agreement to determine whether EITS is meeting its SLA requirements. In addition, we reviewed SLA agreement between H+H and the outside vendor to understand agency's incident management process.
- Reviewed and tested the full population of Elmhurst HC's Epic EMR-related helpdesk
 incident data for the 12-month period to determine whether the Epic EMR system
 users at Elmhurst HC are reporting usage difficulties, which may indicate problems in
 user training or in system performance.

- Called helpdesk and reported a technical incident to determine helpdesk effectiveness and efficiency on resolving the technical incident.
- Reviewed capital and operating budgets and expenditures of the Epic EMR implementation project to evaluate project expenses and financial planning.
- Reviewed all payments made by the agency on related Epic products and services from April 2016 to March 2017 to determine financial control of the implementation project.
- Reviewed Epic Go Sequencing Gantt charts to evaluate project timeline and scheduling.
- Determined whether a training program existed for training prospective users, and if ongoing training is available as needed for new users and for training refreshments.
- Reviewed the Epic User Web portal to evaluate training programs and documentation on the Epic EMR system.
- Interviewed the training director to understand agency planning on user training, availabilities of training practice ground and documentation.
- Reviewed agency newsletters and system maintenance notification alerts to gauge Epic system overall performances and service interruptions.

Patient Processing Workflow

Elmhurst HC uses Epic EMR to process the flow of patients seeking medical care at the hospital and at its clinics. The following is the Elmhurst HC patient workflow in processing a new patient using the new Epic EMR:

Registration and Financial System

- Patient Registration (Assigned EMPI number, visit number and bed)
- Verifies scheduled visits information
- Reconcile patient information with Epic EMR (in case of downtime or new patient unscheduled visit)

Registration, Admission, Transfer.

Discharge,

Visit Info.

Send and received patient and treatment information from Epic EMR for billing and financial purposes

Translator System

Translate electronic health records into uniform HL7 message for data exchange between Epic EMR and Patient Registration and Financial System.

Registration, Admission, Transfer, Discharge, Visit Info

Send and received patient and treatment information from Epic EMR for billing and financial purposes

EPIC EMR

- Accepts patient and visit information from Registration System.
- Manages patient schedules, bed assignment and patient movement.
- Shows historical patient health records stores records created by clinical professionals

- 1. Patient Registration (via a third-party system) process:
 - Registers incoming patients and passes information onto Epic EMR.
 - Each patient is assigned an EMPI¹⁴ number, and each patient visit is assigned a visit number as well as a bed if necessary.
 - Verifies scheduled patient visits, and passes information onto Epic EMR.
 - Receives frequent information updates from Epic EMR such as patient location, clinical service, level of care, attending provider, and bed type.
 - For any patient who calls for an appointment and does not have a record in Epic EMR,
 Patient Registration receives the new patient's information directly registered in Epic

¹⁴ An enterprise master patient index or enterprise-wide master patient index is a database that is used across a healthcare organization to maintain consistent, accurate and current demographic and essential medical data on the patients seen and managed within its various departments.

APPENDIX I

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 EMR upon calling, and assigns a unique patient identification number (EMPI) for each patient upon their check in—and Patient Registration updates Epic EMR with the PIN information.

2. HL7 Health Data Translator

 Translate electronic health records into uniform HL7 message for data exchange between Epic EMR and Patient Registration and Financial System and other third party clinical systems.¹⁵

3. Epic EMR process

- Accepts patient information from the Patient Registration system.
- Accepts verified patient visit information.
- Manages patient bed assignments.
- Processes patient movements between various clinical areas within the hospital.
- Medical procedures performed on the patient are recorded in Epic EMR and updated into the patient registration system.
- Creates a record for a patient who calls for an appointment, and does not have a
 record in Epic EMR. Upon patient check in, the Patient Registration system receives
 Epic EMR record creation information and assigns a patient identification number
 (EMPI) for that patient—and sends the EMPI information back to Epic EMR.
- Discharges patients and sends patient visit details (such as medical provider services rendered, procedures performed, and laboratory tests conducted) to the patient registration and finance system.

¹⁵ Health Level-7 or HL7 refers to a set of international standards for transfer of clinical and administrative data between software applications used by various healthcare providers.

Epic System Modules and Definitions

- 1. EpicCare Ambulatory Epic EMR's primary module within which other individually authorized user features are made available through additional preinstalled modules. EpicCare Ambulatory functions include documentation of patient visits, placing medical procedure orders, viewing procedure results, and sending communications to patients.
- 2. Kaleidoscope Epic's ophthalmology application. It allows Ophthalmologists and Optometrists to document eye exams and related procedures and write contact lens and eyeglass prescriptions.
- 3. Anesthesia Epic's anesthesia information management application is designed to provide full ordering and clinical documentation tools wherever anesthesia services are needed in the organization.
- 4. ASAP Epic's emergency department information system application. ASAP displays and manages emergency room and bed availability and streamlines workflows in emergency medical care environments.
- 5. Beacon Epic's oncology application. Used by physicians to document cancer stages and manage chemotherapy by creating and personalizing treatment plans based on standard oncology protocols—the plan tracks inpatient stays and follows patients across outpatient visits.
- 6. ADT Short for Admission, Discharge, and Transfer—a patient registration system. An Epic tool used to track inpatients from their arrivals (admissions) to movements (transfers) inside the facility, through to their departures (discharges). Recently renamed to Grand Central, it includes BedTime sub-functions for bed management.
- 7. Cadence Epic's scheduling application that is used to schedule and track patient appointments.
- 8. Care Everywhere An information (data) exchange application to facilitate authorized sharing of Epic patient records with other healthcare providers. The information can come from or go to another Epic system, or a non-Epic EMR that complies with health industry information exchange standards.
- 9. Orders & Infection Control Epic systems for laboratory orders management and mandatory government reporting.
- 10. ClinDoc/Stork The Epic application for documenting patient information in the hospital setting. Stork The Epic obstetrics application for managing pregnancy episodes, workflows during labor, documenting deliveries in the hospital.
- 11. Cupid Epic's cardiology application. It provides specialized order entry, procedures documentation, and structured reporting for the cardiology medical practice.
- 12. OpTime Epic's operating room management application.

APPENDIX II

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- 13. EpicCare Link An Epic web-based application that allows authorized medical providers at an affiliate organization to view a patient's clinical data from H+H's EMR via the Internet. EpicCare Link allows those providers to be given access to a web-based portal for limited use of the EMR to view activity on their patients who have received care at H+H.
- 14. Willow Epic's pharmacy application. It supports Ophthalmologists and Optometrists during eye examinations in documenting eye related procedures, and write contact lens and eyeglass prescriptions.
- 15. HIM Stands for Health Information Management, and tools to simplify medical records management tasks, including charting and film tracking, coding and abstracting.
- 16. Radiant Epic's radiology application for documenting, film tracking and viewing of radiology images.
- 17. Meaningful Use/Core Measures Meaningful Use is using certified electronic health record technology primarily to: improve quality, safety, efficiency, and reduce health disparities; engage patients and family; Improve care coordination, and population and public health; and, maintain privacy and security of patient health information. Core Measures pertain to quantifiable quality measurements of the healthcare processes, outcomes, patient perceptions, and organizational structure and/or systems that are associated with the ability to provide high-quality health care.
- 18. MyChart Epic's web-based and mobile application—a patient portal allowing patients to view test results, contact their healthcare providers, schedule appointments, and submit medical questions.

Figure 1: Elmhurst HC Service Restoration Incident Tickets Trend

Monthly Trend April 1, 2016 through March 31, 2017

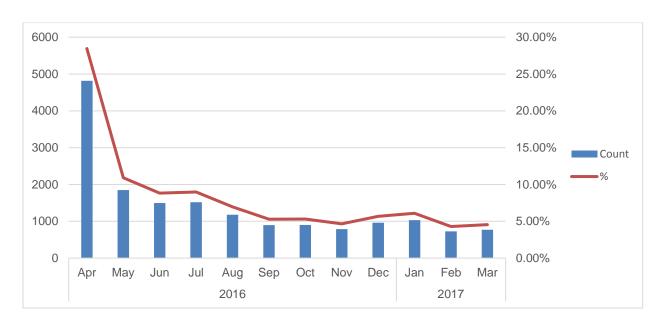


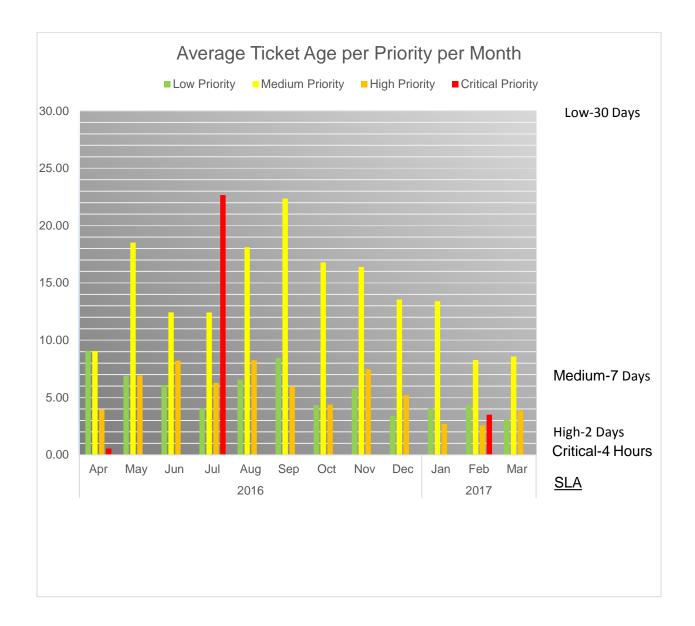
Figure 2: Elmhurst HC Epic EMR Helpdesk Statistics

Elmhurst HC Service Restoration Incident Tickets Monthly Total by Priority April 1, 2016 through March 31, 2017

Time Period	Low Priority	Medium Priority	High Priority	Critical Priority	Total Tickets
2016					
Apr	1,812	2,141	832	31	4,816
May	1,328	421	98		1,847
Jun	1,015	383	96		1,494
Jul	1,022	345	149	3	1,519
Aug	673	330	175	1	1,179
Sep	567	224	102	1	894
Oct	571	212	116		899
Nov	511	193	82		786
Dec	642	224	94		960
2017					
Jan	738	209	85		1,032
Feb	478	166	80	2	726
Mar	467	202	101		770
Total Tickets	9,824	5,050	2,010	38	16,922

Figure 3: Elmhurst HC Service Restoration Incident Tickets Resolution Trend

Monthly Total by Priority
Average Resolution Rate (in Days)
April 1, 2016 through March 31, 2017



Note: The spike in July's critical priority incident data was skewed by one Service Restoration incident pertaining to transfer of pathology reports. The incident, which resolved in 61 days, required outside technicians to resolve.

Figure 4: Elmhurst HC Service Restoration Incident Tickets Resolution

Monthly Total by Priority
Average Resolution Rate (in Days)
April 1, 2016 through March 31, 2017

Time Period	Low Priority	Medium Priority	High Priority	Critical Priority	Avg. for Month
2016					
Apr	9.08	9.04	3.94	0.55	8.12
May	6.92	18.51	6.94		9.56
Jun	6.10	12.43	8.22		7.86
Jul	4.03	12.42	6.28	22.67	6.19
Aug	6.56	18.12	8.26	0.00	10.04
Sep	8.45	22.36	5.98	0.00	11.64
Oct	4.35	16.79	4.40		7.29
Nov	5.79	16.39	7.46		8.57
Dec	3.42	13.54	5.21		5.96
2017					
Jan	4.03	13.42	2.71		5.82
Feb	4.38	8.28	2.58	3.50	5.07
Mar	3.10	8.58	3.87		4.64
Avg. in Days	6.04	12.45	5.07	2.42	7.83
SLA					
Agreement	30 Days	7 Days	2 Days	4 Hours	

MyChart Mobile and Web-based Patient Portal for Elmhurst HC patients

The Epic EMR MyChart module allows patients to view test results, medical history and immunizations, contact their healthcare providers and submit medical questions via online portal or mobile apps. ¹⁶ An average of 87 percent of Elmhurst HC's patients are offered the MyChart feature—of those offered, an average of 12 percent are actively using the application.

Figure 5: Elmhurst HC MyCHART Activation data

April 1, 2016 through March 31, 2017

	Unique Patients Total	Currently Offered My Chart		Currently MyChart Active	
Month	Total	Total	%	Total	%
Apr-16	26,555	24,176	91%	2,576	10%
May-16	32,133	28,955	90%	3,441	11%
Jun-16	31,768	28,803	91%	3,616	11%
Jul-16	29,926	27,631	92%	3,588	12%
Aug-16	31,640	28,127	89%	3,830	12%
Sep-16	30,483	25,984	85%	3,772	12%
Oct-16	30,113	25,493	85%	3,608	12%
Nov-16	29,463	24,853	84%	3,475	12%
Dec-16	31,019	25,454	82%	3,647	12%
Jan-17	30,863	25,330	82%	3,784	12%
Feb-17	26,111	21,878	84%	3,506	13%
Mar-17	28,240	23,769	84%	3,740	13%
Total	358,314	310,453		42,583	
Average			87%		12%

¹⁶ Currently available for both iOS and Android. Applications features may varies based on mobile OS.



January 25, 2018

Mitchell Katz President and CEO NYC Health + Hospitals 125 Worth Street 5th Floor New York, NY 10013 Tel: 212-788-3321 Mitchell.Katz@nychhc.org

Marjorie Landa Deputy Comptroller for Audit Municipal Building 1 Centre Street, Room 1100 New York, NY 10007

RE: Audit Report on the EPIC Electronic Medical Record System that NYC Health + Hospital Implemented at the Elmhurst Hospital (SI17-079A)

Dear Ms. Landa:

We are delighted that you have concluded the comprehensive review of the Epic Installation at NYC Health + Hospitals/ Elmhurst and found the EPIC Electronical Medical Record (EMR) to be performing as designed and planned.

We are proud that you found NYC Health + Hospitals Enterprise Information Technology Services (EITS) to have had a sufficient strong computing environment (hardware, software, and communications structure) to run the EPIC EMR.

We also appreciate that you provided a recommendation in an area in which we can improve. EITS has implemented the recommendation and added Skilled Resources, and trained the Help Desk in the EPIC application and Enterprise Operation Center oversight. Our current incident statistics and Service Level Agreements (SLA) reports have met EITS SLA requirements over the last three months. As we continue the effort to install EPIC EMR throughout the NYC Health + Hospitals system, the added resources suggested in the recommendation will be useful.

Thank you and if you have any questions regarding the response, please contact Christopher Telano, Chief Internal Auditor/Senior AVP at 646.458.5623.

Best Regards,

C:

Mitchell Katz, MD

Andre DaSilva, IT Audit Manager