Giving Your EHR a Checkup after COVID-19: A Practical Framework for Reviewing Clinical Decision Support in Light of the Telemedicine Expansion

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Submitted to: JMIR Medical Informatics
on: July 10, 2020

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Abstract

The transformation of healthcare during COVID-19 presents clinical decision support (CDS) programs with substantial opportunities for growth, but also risks that come with dramatic change. In this viewpoint we share our experience at NYU Langone Health, in New York at the epicenter of the pandemic. Early on we recognized the potential impact of the shift to telemedicine on our ambulatory CDS program and devised a simple framework for an intra-pandemic ambulatory CDS checkup. We discuss our initial findings and lessons learned. We believe our approach is generalizable to other organizations, easy to replicate, and realistic to implement even for an already overcommitted clinical informatics team.

(JMIR Preprints 10/07/2020:21712)
DOI: https://doi.org/10.2196/preprints.21712

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Viewpoint

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Authors

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Abstract

The transformation of healthcare during COVID-19 presents clinical decision support (CDS) programs with substantial opportunities for growth, but also risks that come with dramatic change. In this viewpoint we share our experience at NYU Langone Health, in New York at the epicenter of the pandemic. Early on we recognized the potential impact of the shift to telemedicine on our ambulatory CDS program and devised a simple framework for an intra-pandemic ambulatory CDS checkup. We discuss our initial findings and lessons learned. We believe our approach is generalizable to other organizations, easy to replicate, and realistic to implement even for an already overcommitted clinical informatics team.

Keywords: COVID-19; EHR; clinical decision support; telemedicine; ambulatory care

Introduction

The Covid-19 pandemic has ushered in seismic changes in the delivery of care where telemedicine has revolutionized and likely permanently altered the manner in which outpatient care is delivered [1, 2]. Telemedicine is not just office medicine virtualized, but there are dramatic differences in workflows [3], differences in the composition of and interaction between members of the care team, and differences in the type and quality of clinical data available to clinicians at the time of the telemedicine encounter. With this shift, some unintended consequences for the provision of preventive and chronic care have been documented [4-7]. This report details the first, to our knowledge, description of how the expansion of telemedicine in response to COVID-19 impacted ambulatory clinical decision support (CDS) and suggests a simple framework for assessing the fitness of a CDS program to navigate this transformation.

Ongoing evaluation of an organization's CDS program is critical to advance patient safety, quality, and experience of care [8-9]. During typical time periods, 2/3 of CMIOs report at least 1 CDS malfunction annually [10], and a study of EHR alerts at a leading academic medical center revealed that 22% of active alerts were broken [11]. Extraordinary circumstances like the pandemic magnify these challenges.

As stewards of hard-earned successes in CDS driven healthcare improvement informaticists have the responsibility to remain vigilant in the support of CDS driven general health, wellbeing, and management of chronic conditions. This is perhaps even more important now during the pandemic when our CDS is at higher risk of malfunctioning, and when these aspects of care are at risk of being neglected [12]. Practicing at the epicenter of the pandemic significant competing priorities have by necessity forced us to develop a practical and time sparing approach to evaluate the health of our outpatient CDS program in the context of COVID-19. Below we discuss our initial findings and lessons learned. We believe our approach is generalizable to other organizations, easy to replicate, and realistic to implement even for an already overcommitted clinical informatics team.

Organizational History and Clinical Context for the Decision Support Checkup

NYU Langone Health (NYULH) is a large academic health care system in New York, consisting of over 5,000 health care providers across 4 hospitals and 500+ ambulatory locations. Since 2011, NYULH has grown its ambulatory care network across Manhattan, Brooklyn, Queens, Staten Island, Long Island, and Florida, and has maintained its position as a national leader in the highest-quality outpatient care receiving the Ambulatory Care Quality and Accountability Award from Vizient, Inc. in each of the past 4 years. In numerous ways, NYULH's implementation of a single electronic health record (Epic Systems, Verona, WI) and integration of ancillary systems, help to facilitate ongoing excellence in ambulatory quality by connecting the vast network of locations, supporting best practice with electronic decision support, and presenting dashboards that reinforce the NYULH culture of data-driven performance and accountability.

Since March 2020, NYULH has been at the epicenter of the national COVID-19 pandemic. Outpatient practices were consolidated and ambulatory providers were re-deployed to the inpatient setting. While in person office visits continued during the pandemic, patients were also given the option to schedule telemedicine video visits with their usual ambulatory care providers. From 3/19-5/31, 244,425 telemedicine video visits were completed by 2,100 providers. These video visits accounted for 59% (244,425/414,076) of the ambulatory visit volume during this time with in person office visits accounting for the other 41% (169,651/414,076).

Though tracking ambulatory CDS for chronic disease was not on the agenda in the very early days of the pandemic, it was important for us not to lose focus on how our clinical systems also support general health and care for chronic conditions even during difficult times. To this end we devised a simple framework for an intra-pandemic ambulatory CDS checkup that would include the following 4 steps:

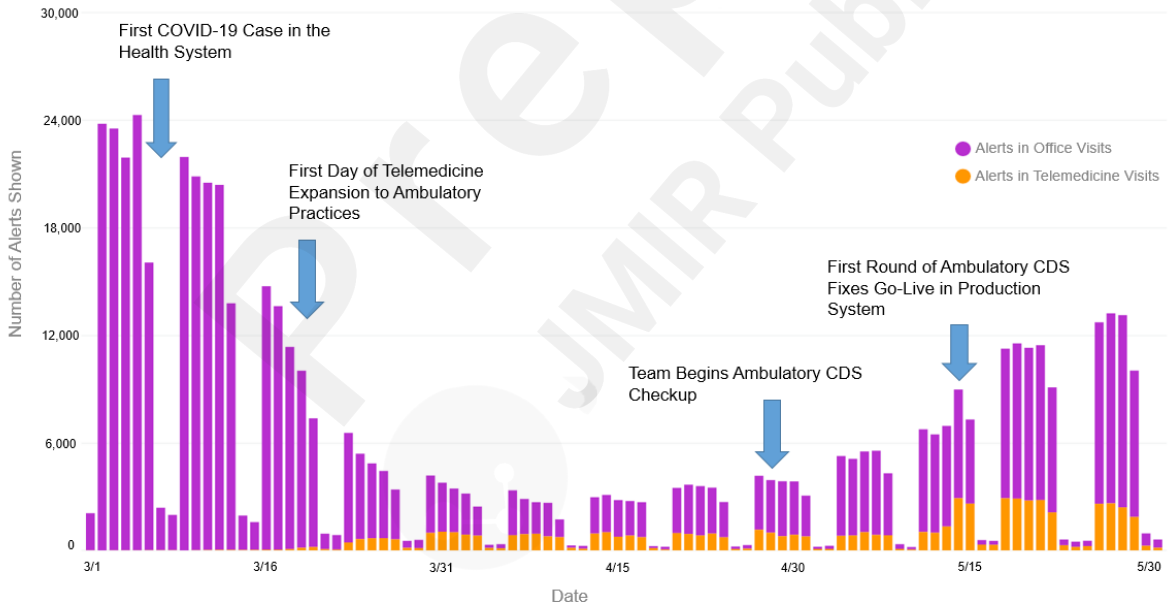
1. A basic comparative analysis of alert firing volumes and per encounter firing rates in telemedicine encounters and office visits.
2. A basic comparative analysis of action taken rates for the same alerts shown in telemedicine encounters and office visits.
3. Clinical informaticist review of alerts with significant discrepancies in firing volume or action taken rates using the 5 Rights of CDS to identify optimization opportunities.
4. Prioritize malfunctions and review optimization opportunities together with operational leadership through the existing CDS governance structures.

Step 1: Evaluating Ambulatory Alert Firing Volumes after the COVID-19 Telemedicine Expansion

Our framework builds upon previously published work [13] that describes alert malfunction as occurring across two major domains: (1) malfunction in alert display and (2) malfunction in provider response. We chose firing volumes and per encounter firing rates as our measures to asses for dysfunction in alert display. Firing rates for the same alert may vary significantly across clinical care settings [14], and we looked to understand if telemedicine as a care setting demonstrated significantly different firing volumes or firing rates when compared to office visits. Regular review of alert firing rates is a best practice for identifying alert display malfunctions[15] and many organizations like our own have adopted dashboards for ongoing monitoring of alert firing rates and firing volumes [16-18]. These measures allow for the ability to monitor alert performance over a wide range of alerts without having to do manual chart reviews.

We started with a high-level overview comparing cumulative firing volumes across all ambulatory alerts during the pandemic. This report considers 3/19-5/31 to be our study period representing the start of the telemedicine expansion up until the end of the month of May. (Figure 1) shows the overall trend in NYULH daily alert firing volumes at baseline and through this period of time.

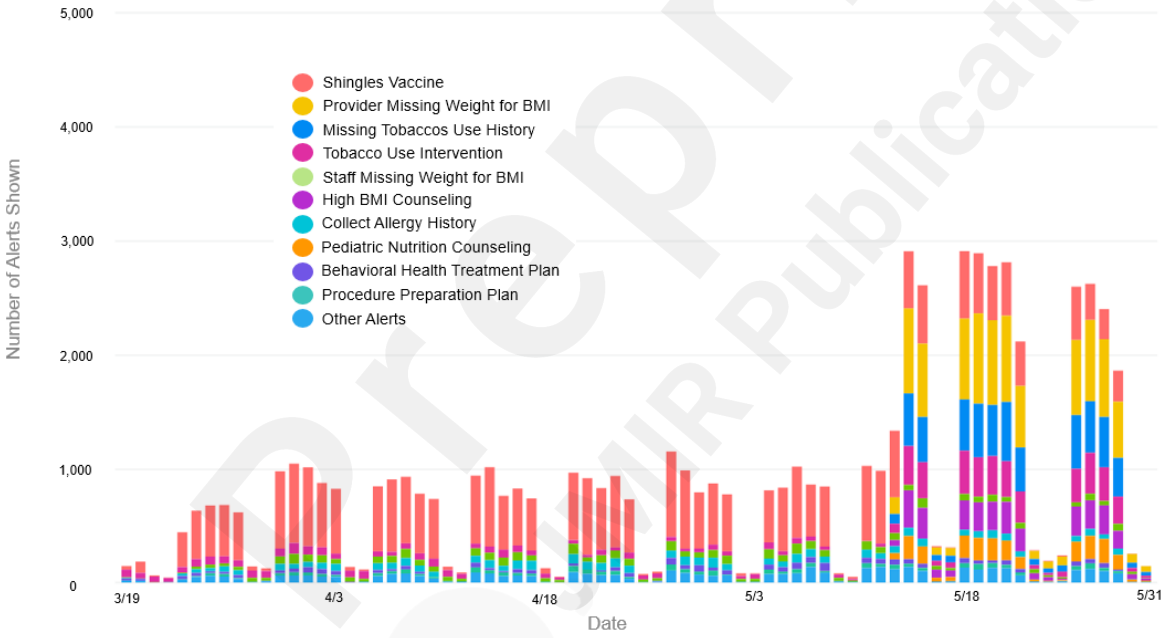
Figure 1. Ambulatory alert firing volumes during COVID-19 by date and visit type



In total and across ambulatory settings alert firing volumes were down during the pandemic study period (3/19-5/31), but far fewer alerts were found to be firing in telemedicine encounters (64,938) as compared to office visit (233,636). This in spite of the fact that providers completed more telemedicine visits during this time (244,425 vs 169,651). On a per encounter basis, during the pandemic, clinicians were shown more than 5 times as may alerts in office visits (1.37 alerts per encounter) as they were in telemedicine video visits (0.26 alerts per encounter). The relative paucity of alerts in telemedicine visits was an unexpected finding and we set out to understand why this was occurring.

For each individual alert we compared per encounter alert firing volumes for that alert in two contexts: telemedicine and office visits. Observing for differences in per encounter firing volumes in these two settings allowed us to quickly identify alerts that were malfunctioning by not firing in a telemedicine setting. We came to realize that 10 of our top 40 alerts by volume were not firing appropriately in telemedicine encounters. Further investigation revealed that ambulatory alerts restricted by encounter types were often not firing as expected, while other alerts restricted by practice location or provider specialty were performing well. Clinical informaticists and operational leaders reviewed the list of alerts that were not firing and validated that they were appropriate for the telemedicine encounters. The reconfiguration of these alerts to include telemedicine encounter types went live in the production system on May 14th. (Figure 2) shows the impact on the overall daily alert volume and diversity of clinical alerts in telemedicine.

Figure 2. Telemedicine alert firing volumes during COVID-19 by date and alert type



Step 2: Evaluating Ambulatory Alert Action Taken Rates after the COVID-19 Telemedicine Expansion

Provider response is the second major domain of alert malfunction [13]. Though there are many ways to measure alert performance in this domain [19, 20], we chose the action taken rate defined as the rate in which a clinician takes any action toward acknowledging a displayed alert. This measure allowed us to look for trends across many alerts with different action types.

To understand whether providers were interacting with alerts displayed in the context of telemedicine encounters at the same rates as during office visits, we looked at action taken rates in these two clinical contexts. (Table 1) contains the top 5 provider facing alerts by volume and

compares action taken rates for these same alerts displayed in telemedicine and in person office visits. It is important to note, that at NYULH providers experience the same user interface with the same activities and navigators in telemedicine and office visits. Differences in the alert action rates thus represent true disparities in the clinical decision support of a single alert presented in two different clinical contexts. We found that there were statistically significant differences in the action taken rate in 3 out of the top 5 alerts, and in these same 3 alerts providers were less likely to take action in telemedicine encounters when compared to office visits.

Table 1. Action taken rates for the top 5 provider facing alerts by volume (3/19-5/31)

	Telemedicine	Office Visit	*P* value
Shingles Vaccine	3.9% (1,032/26,458)	6.3% (1,576/25,011)	*P* <.001
High BMI Counseling	13.9% (431/3,102)	12.8% (9,618/75,144)	*P* = .07
Provider Missing Weight for BMI	0.3% (24/8,101)	0.2% (21/10,572)	*P* = .19
Tobacco Use Intervention	4.6% (296/6,441)	10.1% (1,543/15,281)	*P* < .001
Pediatric Nutrition Counseling	4.0% (85/2,139)	8.1% (517/6,381)	*P* < .001

Cumulatively from 3/19-5/31 64,938 alerts fired in telemedicine encounters with clinicians taking action on 3,257 of those alerts, for an action taken rate of 5.3% (3,257/64,938). By comparison 233,636 alerts fired in office visits with clinicians taking action on 19,427 alerts for an action taken rate of 8.3% (19,427/233,636). Although analyses of this type are subject to confounding factors the superior performance of alerts in office encounters is not surprising given that these alerts went through years of iterative improvements specifically for the office setting. Our clinical assessment was that opportunities exist to optimize at least some of these alerts to perform better during virtual visits.

Step 3: Clinical Evaluation of Ambulatory Alerts after the Telemedicine Expansion - The 5 Rights of CDS

Based upon analysis described above we were able to prioritize alerts for review using the following methodology. For each alert we calculated the difference in the per encounter firing rate between telemedicine and office encounters and the difference in the action taken rate in these two settings. Alerts with the greatest differentials in these rates between telemedicine and office encounters were prioritized for review.

During the clinical workflow review our informaticists reflected on the 5 rights of CDS (the right information, to the right person, in the right intervention format, through the right channel, at the right time in workflow) [21,22] to evaluate for each alert whether it was optimized for telemedicine video visits. As an example of our approach (Table 2) summarizes findings for 4 alerts prioritized for clinical review. Some common themes from informaticist review are also summarized in (Textbox 1)

Table 2. Clinical informaticist review of the five rights of CDS as applied to NYULH alerts firing in telemedicine visits.

	Time?	Information?	Person?	Format?	Channel ?
Shingles Vaccine	Vaccines can't be given virtually. Telemedicine is only the right time if guidance is for patient to go for follow up at pharmacy or office	Should include link to shingles vaccine administration locator for available locations that have vaccine in stock	Yes	Yes	Yes
High BMI Counseling	Yes, but alerts not firing without weight being entered.	Yes	Yes	Yes	Yes
Provider Missing Weight for BMI	No, once video encounter starts already too late. Weight should be collected before the encounter	Yes	Alert should go to patient or office staff	Yes	Consider patient facing alert through portal
Tobacco Use Intervention	No, not showing up at right time in workflow without staff documenting social history prior to provider	Yes	Support staff should be encouraged to virtually room the patient and collect history	Consider adding interruptive alert after provider enters tobacco use history	Yes

Textbox 1. Themes from clinical informaticist review of NYULH alerts with discrepant firing rates or action taken rates in telemedicine and office visits.

I. Telemedicine visits may have different workflows than office visits and some alerts developed for the office may not be appearing at the optimal time in the telemedicine workflow.

- Alerts which in the office appear to providers when they enter the encounter may not appear in a telemedicine encounter until later in the visit.
- These alert are triggered by clinical data (e.g. history, medical problems, vitals, medications etc) that is usually entered in the office by support staff prior to the provider seeing the patient.
- Without support staff rooming the patient during a telemedicine visit the alert does not appear until later in the visit when the provider enters this data.
- Non-interruptive alerts are especially likely to be missed at this later time.

II. Missing clinical data is a common reason for decreased alert firing rates seen in telemedicine visits.

- Data like vital signs and point of care testing may not be available at the time of the telemedicine visit and alerts dependent on this data may not fire.
- Without the full care team (medical assistant, nurse, nutritionist, physician extender etc.) contributing to the data collection, reason for visit, medical history, surgical history, social history, medications and problem list may not be as complete.

III. Remote patient monitoring (RPM) and patient reported clinical data entered through the portal should have a role in replacing data collection usually completed in the office by an MA or RN.

- The current RPM approach is to collect data between visits. Operational and technical changes will need to be made to optimize RPM for collection on the day of the encounter. This encounter level data is necessary clinically and would also be available to trigger alerts.
- As patients enter the video visit through the patient portal there is an opportunity to further engage and enter their own clinical data.

IV. When firing rates are down because clinical data is not available consider workflows where office staff collect data prior to the provider entering the virtual visit.

- Depending on the need, staff could outreach prior to or on the day of the visit.
- This strategy would be well paired with RPM and staff playing a role “virtually rooming” the patient and supporting patient adoption and proper use of remote monitoring.

Step 4: Review of Optimization Opportunities through Existing Governance Structures

At NYULH we have a multi-stakeholder CDS governance structure that plays an active role in the monitoring of alert performance. We are currently in the beginning stages of review, but as we lay the groundwork for success some early insights include: (1) Support from the executive leadership

of ambulatory care practices has been particularly important, even more so then in most CDS improvement initiatives as next steps involve new operational processes for RPM in virtual care, and the changing role of support staff in this context. (2) A first principal of our ambulatory CDS governance is to "avoid interruption of care whenever possible." 98.5% of our ambulatory alerts have historically been non-interruptive. Our CDS stakeholders requested a subgroup analysis of the 2.5% of interruptive ambulatory alerts that fired during the period of the pandemic, and we found that amongst interruptive ambulatory alerts the action taken rate was actually higher in telemedicine visits 40.5% (1,194/2,949) when compared with office visits 29.4% (691/2,370) [*P*<.001]. These findings were surprising and warrant further study and review; it is possible that in telemedicine encounters, with providers being more immersed in the system, modal alerts are actually comparatively more effective. The role of changing alert format for alerts not performing well in telemedicine will likely be an ongoing point of discussion at our CDS governance committees.

Conclusion

In this viewpoint we have reported on a framework to evaluate the impact of COVID-19 on our ambulatory CDS program and have advocated for other organizations to consider performing their own targeted ambulatory CDS check-up in light of the dramatic changes in the provision of care. Furthermore, we provide several key themes institutions can target when conducting their own evaluation. The strength of our approach is in its practical nature using data that is readily available to prioritize rapid clinical review of CDS most in need of intervention. The weakness maybe in its narrow focus. A review of published CDS malfunction taxonomies [23] reveals that the majority of described alert malfunction types may not be discovered using our methodology. We have focused exclusively on best practice advisory alerts, but medication alerts, order sets, documentation templates, and other CDS should also be re-examined with the shift to telemedicine. There is much work still to be done.

With limitations acknowledged, in a short amount of time we were able to identify and fix significant CDS malfunctions, recognize alerts in need of optimization, and generate ideas for how to improve the performance of those alerts. On July 1st, NCQA released "a sweeping set of adjustments to 40 of its widely-used Healthcare Effectiveness Data and Information Set (HEDIS) measures – in support of health plans, clinicians and patients who rely on telehealth services in record numbers as a result of the disruption brought on by the COVID-19 pandemic [24]." Changes in the HEDIS measures will surely promote further conversations about quality measurement in telehealth, and will soon lead to increased attention to the performance of CDS in this context. As physicians, we routinely counsel our patients to schedule regular check-ups because "an ounce of prevention is worth a pound of cure." As clinical informaticists, we must now be proactive in providing "check-ups" for our ambulatory EHR CDS. The health of our patients and wellbeing of our clinical colleagues is at stake.

Acknowledgements

The authors thank Nader Mherabi and Suzanne Howard for their leadership during the pandemic and their ongoing support of our clinical informatics and ambulatory CDS teams. We also thank the thousands of NYU Langone Health clinicians who have provided patients with exemplary acute and preventative care during these difficult times.

Conflicts of Interest

None declared.

Abbreviations

CDS: Clinical Decision Support
NYULH: NYU Langone Health
RPM: Remote Patient Monitoring

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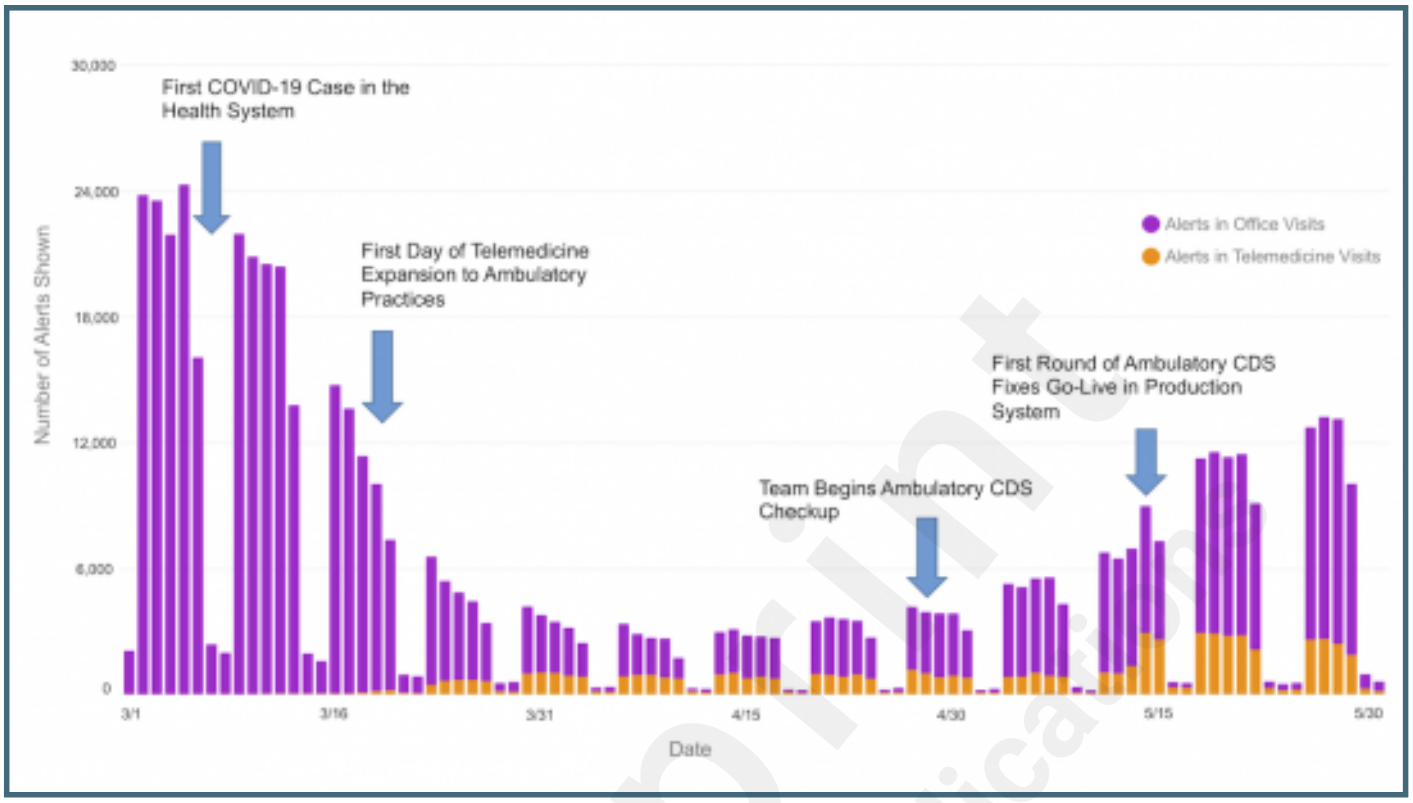
Supplementary Files

Figures

Ambulatory alert firing volumes during COVID-19 by date and visit type.



Telemedicine alert firing volumes during COVID-19 by date and alert type.

TOC/Feature image for homepages

Photo shoot of NYU Langone Health medical campus during Coronavirus pandemic. Pictured: Lynsey Holton, Patient Access. Photographed by Elliot Goldstein on April 20, 2020.