The usefulness of an ambulatory care pharmacy performance dashboard during the COVID-19 pandemic in a complex tertiary care system

Abdulrazaq S. Al-Jazairi, PharmD, MBA, FCCP, BCPS-AQ Cardiology, Pharmaceutical Care Division, King Faisal Specialist Hospital & Research Centre, Riyadh, Saudi Arabia

Bashar K. Horanieh, MSc Pharm, Health Information and Technology Affairs, King Faisal Specialist Hospital & Research Centre, Riyadh, Saudi Arabia

Osama A. Alswailem, MD, Health Information and Technology Affairs, King Faisal Specialist Hospital & Research Centre, Riyadh, Saudi Arabia

Address correspondence to Dr. Al-Jazairi (ajazairi@kfshrc.edu.sa).

Twitter: @AbdulrazaqAlJa3 (fax)

Purpose. To describe the usefulness of an innovative "semi–real-time" pharmacy dashboard in managing workload during the unpredictable coronavirus disease 2019 (COVID-19) pandemic.

Summary. We created a pharmacy dashboard to monitor workload and key performance indicators during the dynamic COVID-19 crisis. The dashboard accessed the prescribing workload from our clinical information system and filled prescriptions from robotic prescription dispensing systems. The aggregated data was visualized using modern tools. The dashboard presents performance data in near real time and is updated every 15 minutes. After validation during the early weeks of the COVID-19 crisis, the dashboard provided reliable data and served as a great decision support aid in calculating the backlog of prescribed but unfilled prescriptions. It also aided in adjusting manpower, identifying prescribing and dispensing patterns, identifying trends, and diverting staff resources to appropriate locations. The dashboard has been useful in clearing the backlog in a timely manner, staff planning, and predicting the next coming surge so that we can proactively minimize accumulation of backlogged prescriptions.

Conclusion. Developing a dynamic, semi–real-time pharmacy dashboard during unstable circumstances such as those that have arisen during the COVID-19 pandemic can be very useful in ambulatory care pharmacy workload management.

Keywords: ambulatory, COVID-19, dashboard, pharmacy, workload management innovation

King Faisal Specialist Hospital & Research Centre in Riyadh, Saudi Arabia, is a tertiary care hospital with a 1,300-bed capacity. The Division of Pharmaceutical Care is the first hospital pharmacy service to be accredited under the ASHP accreditation standard for international hospital and health-system pharmacy services.[1] The organization is also accredited by Joint Commission International Accreditation, is recognized by the American Nurses Credentialing Center's Magnet Recognition Program, and has earned the Healthcare Information and Management Systems Society's Stage 7 (HIMSS7) designation. The organization is well known regionally and internationally for providing specialized medical care focusing on its 5 core competency programs: solid organ transplantation, medical genetics, oncology, cardiovascular diseases, and neurosciences.

Background

Our medication formulary comprises 1,654 items. The formulary is managed through an evidence-based approach by the pharmacy and therapeutics committee. About 75% of total pharmaceutical spending is on the top 100 medications, and approximately 70% takes place in the ambulatory care pharmacy. On a daily basis, we typically serve 1,000 patients in the ambulatory care setting and provide 400 medication refills, with an average of 5.5 prescriptions per patient. The ambulatory care pharmacy is equipped with 8 robotic systems (ScriptPro, Mission, KS): 7 ScriptPro Workflow Management System 200 (SP200) units and 1 ScriptPro SP50 unit for the emergency pharmacy. The overall automated system, which includes the robots, data points, and an inventory management system, provides bar coding for all dispensed medications, inventory management, tracking to the patient level for each dispensed medication (including medication recall), and expiry checks. It performs about 1.9 million transactions per year. The division is staffed by 300 employees. Our staff is composed of 170 pharmacists, 92 pharmacy technicians, 22 clerks, and secretarial and support personnel. Almost 40% of staff members are allocated to the ambulatory care setting.

Dashboard implementation during initial pandemic response

In mid-March 2020, during the early weeks of the coronavirus disease 2019 (COVID-19) pandemic, there were many uncertainties regarding clinic operations due to a curfew, switching to use of virtual or phone clinics, and mass renewal of medication orders. Prescribing behavior and demand for medication were unpredictable. A confounding variable that could have paralyzed our operations at any time was the issue of pharmacy staff health, including work absences by infected staff and the potential for quarantining of additional staff after contact tracing.

During these unstable conditions, we needed a tool to provide timely and accurate information on the prescription workload and the pharmacy's ability to absorb it. Considering Riyadh's lockdown status, fragmented sources of prescriptions, and unexpected absences of infected staff, the availability of manpower to run the operation was unpredictable. A pharmacy dashboard is a modern analytics tool for monitoring key performance indicators (KPIs) in a dynamic way in order to measure, monitor, and manage performance more effectively.[2] Therefore, we created a pharmacy performance dashboard that accessed the prescribing workload from our integrated clinical information system (Cerner, North Kansas City, MO) and monitored prescription filling from robotic dispensing systems. The aggregated data can be visualized using modern tools (Table 1). The dashboard presents "semi–real-time" data, as it is updated every 15 minutes.

Our pharmacy dashboard provided enhanced workload management capabilities to help respond to a surge in prescriptions and pharmacy dispensing output during the early months of the COVID-19 pandemic. To validate the reliability of the tool, we analyzed several time segments and compared the tool-generated data with manually compiled data. Once we were assured of the consistent accuracy of dashboard-provided information, we went live with the tool, which has served as a great decision support aid.

Dashboard functionalities

The dashboard provides the following functionalities:

1. It performs semi–real-time monitoring of input data (prescriptions) and output data (dispensed prescriptions).

2. It calculates the backlog of prescriptions waiting to be prepared.

3. It aids in adjusting manpower to clear the backlog (eg, through scheduling of overtime, authorization of remote access, creation of a back-up pool or new shifts).

4. It identifies patterns of busy days and corresponding low output.

5. It identifies general trends in prescribing and dispensing of medications.

6. By identifying mismatches between prescriptions received in the pharmacy and those displayed on the dashboard, it alerts us to unaligned or uncaptured source data and/or services.

7. During a condition of decreased staff availability in a specific location, the dashboard helps us to make the decision to divert work to a different pharmacy location.

8. It stratifies workload as new prescriptions or medication refills.

The dashboard displays graphic information, as shown in Figures 1 and 2. (For each depicted data set, the x-axis of the dashboard figure represents time [in days], the left-hand y-axis represents the prescription count, and the right-hand y-axis represents the backlogged number of unfilled prescriptions.) The dashboard provides different views of the workload. It can present data on prescribing and the dispensing workload in a bar graph showing new prescriptions only cumulative dispensing data including refills (Figure 1). It can also show trends in prescribing and dispensing over a selected period of time (eg, from the start of the COVID-19 crisis through July 22, 2020, as in Figure 1). Most importantly, the dashboard can depict the number of undispensed prescriptions over time, which we refer to as the backlog, by calculating the difference between the numbers of written and filled prescriptions (Figure 2). The first peak in Figure 2 represents the period of unexpected

lockdown, curfew, and the switch to virtual or phone clinics. During that time staff struggled to make it to the hospital, and it took time to create remote access and enhance our telepharmacy operations. However, the tool was very helpful in estimating the number of staff needed in order to catch up with processing the backlog. Per pharmacy benchmarks, pharmacists are expected to dispense, on average, 150 to 180 prescriptions per 9-hour shift. Dividing the number of backlogged prescriptions by 180 helped us to estimate the number of staff needed to clear the backlog. As the first backlog peak was cleared, there was a second, less intense peak due to imposition of a 24-hour curfew and coinciding with Ramadan (the fasting month for Muslims), during which we worked shorter shifts. The dashboard also allowed us to visualize the performance of the pharmacy over the last 30 days, with all functionalities incorporated into one figure (data not shown); interestingly, the overall performance trends shown in the dashboard were reflected in the numbers of patient complaints posted on the organization's social media account, which diminished over time, with a corresponding increase in positive comments about the pharmacy service.

Current dashboard utility

Although the dashboard is updated every 15 minutes, we check it in the early morning, at midday, and at the end of the day. Checking the dashboard in the early morning helps in estimating the extra workforce needed to clear a dispensing backlog. It also provides insights on the performance of pharmacists who have worked overtime to clear the backlog the night before. It also helps us to assess the afterhours prescribing behavior at the phone clinics. The midday dashboard check usually shows a sharp influx of prescriptions in the morning (the dashboard provides data on both prescribing rate and volume), as many physicians prescribe medications through phone and virtual clinics. Once we realize that there is a big increase in the expected number of prescriptions, we optimize the use of our human resources. In many instances, we deploy our pharmacy backup pool, which includes members of the pharmacy health information technology, drug information, investigational drug services, and quality and safety teams. Despite the fact that these pharmacists

do not regularly work in the ambulatory care pharmacy, they are trained to provide pharmacy staffing coverage whenever there is a need. This extra help usually covers lunchtimes and breaks, helping to avoid further accumulation of backlogged prescriptions.

In addition to judiciously using limited remote access capabilities during the initial phase of the COVID-19 response, we expanded the numbers of pharmacists permitted to work from home and designated paired teams of pharmacists, with each team consisting of a home-based pharmacist assigned to work with a partner who was on-site.

Using the dashboard helped us in clearing the backlog in a timely manner through aiding the pharmacy administration in staff planning and predicting the next coming surge so that we could act proactively and prevent prescription accumulation. This ultimately may minimize therapy interruption, enhance patients' adherence to their medication regimens, and improve their patient care experience.

In the ASHP resource document "Patient Surge Management During a Pandemic: Toolkit for Hospital and Health System Pharmacy," it is clearly stated that there is a need to develop a process whereby staffing models can be quickly developed.[3] Our dashboard materialized that recommendation and extended our monitoring capabilities to the level of prescriptions workload, enabling us to be more proactive in responding to real-time changes. During the pandemic, the institutional leadership made strategic decisions to move patients from one campus to the other in order to better control the spread of the virus, yet the dashboard was able to capture the influx of prescriptions from different campuses and consolidate them in one view, which helped guide staffing decisions.

Planned modifications

Despite the dashboard's current usefulness, the tool could be enhanced in different aspects. Such modifications might include adding capabilities enabling us to further analyze data at a granular level for each location. Based on our benchmark data, the tool could be enhanced to better pinpoint the number of staff and shifts needed to clear a backlog of unfilled prescriptions.

Moreover, through monitoring of dashboard metrics we plan to reorganize and prioritize dispensing operations for critical clinics (eg, solid organ transplant, HIV care, and anticoagulation clinics). Checking the dashboard will give us an estimation of each clinic's prescription backlog, which will guide us on the number of staff needed to work an overtime shift in order to fulfill the clinic's medication needs.

Considering the anticipated "new normal" workflow for pharmacy, dynamic and near real-time data provided by a pharmacy dashboard can be very helpful in supporting ambulatory care pharmacy workload management, minimizing therapy interruptions, and improving the patient experience—all of which are becoming priorities for large-scale, complex organizations.

Conclusion

Developing a dynamic, semi–real-time pharmacy dashboard during unstable circumstances such as those that have arisen during the COVID-19 pandemic can be very useful in ambulatory care pharmacy workload management.

Disclosures

The authors have declared no potential conflicts of interest.

References

1. American Society of Health-System Pharmacists. ASHP accreditation standard for international hospital and health-system pharmacy services. Accessed July 22, 2020. https://www.ashp.org/-/media/assets/global/Docs/Standards-International-Pharmacy-Services-Accreditation-January-2019.ashx

2. Ghazisaeidi M, Safdari R, Torabi M, et al. Development of performance dashboards in healthcare sector: key practical issues. *Acta Inform Med*. 2015;23(5):317-321.

3. American Society of Health-System Pharmacists. Patient surge management during a pandemic: toolkit for hospital and health system pharmacy. Published June 2020. Accessed July 22, 2020. https://www.ashp.org/-/media/assets/pharmacy-practice/resource centers/Coronavirus/docs/Health-System-Pharmacy-Surge-Toolkit.ashx

Figure 1. Dashboard visualization of trends in prescribing and dispensing (both new prescription and refills) during the early months of the pandemic response. See Table 1 for definitions of performance metrics.

Figure 2. Dashboard visualization of unfilled medication backlog during the early months of the pandemic response. See Table 1 for definitions of performance metrics.

Key Points

- In the presence of unpredictable prescribing patterns during the COVID-19 pandemic, developing a near real-time pharmacy performance dashboard can be helpful in managing pharmacy workload.

- Members of an organization's pharmacy leadership can work hand-in-hand with health information technology personnel in developing and validating a dashboard tool to satisfy decision support needs.

- Continuous enhancement of a dashboard through a process driven by key decision makers is vital to optimize the tool's usefulness.

Table 1. Pharmacy Performance Dashboard Description, Build Technology, and Data Presentation

Definitions	Cerner: the organization's integrated clinical information system (Cerner Corporation, North Kansas City, MO), which uses a central Oracle Database server (Oracle Corporation, Austin, TX)
	ScriptPro: the organization's pharmacy retail system (ScriptPro LLC, Mission, KS) using Microsoft SQL Database (Microsoft Corporation, Redmond, WA); consists of 10 databases, one for each pharmacy dispensing area
Included pharmacy locations	Emergency, ambulatory care, discharge, and home health care medication orders with "ordered/completed" status
Excluded pharmacy locations	All orders from other locations such as inpatient orders or settings with order status not ordered/completed, e.g. future encounters
Data extraction and aggregation	1. Cerner and ScriptPro integrated through the Cloverleaf engine (Infor, New York, NY); medication orders sent to ScriptPro, and a message is sent back to Cerner after medication dispensing
	2. Medication orders satisfying inclusion criteria extracted from Cerner
	3. Orders aggregated by facility and prescribing date and stored in Visual FoxPro database (Microsoft Corporation)
	4. Orders dispensed from all ScriptPro databases extracted and added to same Visual FoxPro database, with data aggregated by facility, dispensing date, and prescription type (new or refill)
Patient privacy	Health Insurance Portability and Accountability Act (HIPPA) compliance assured at every step of data extraction, transfer, manipulation, and aggregation

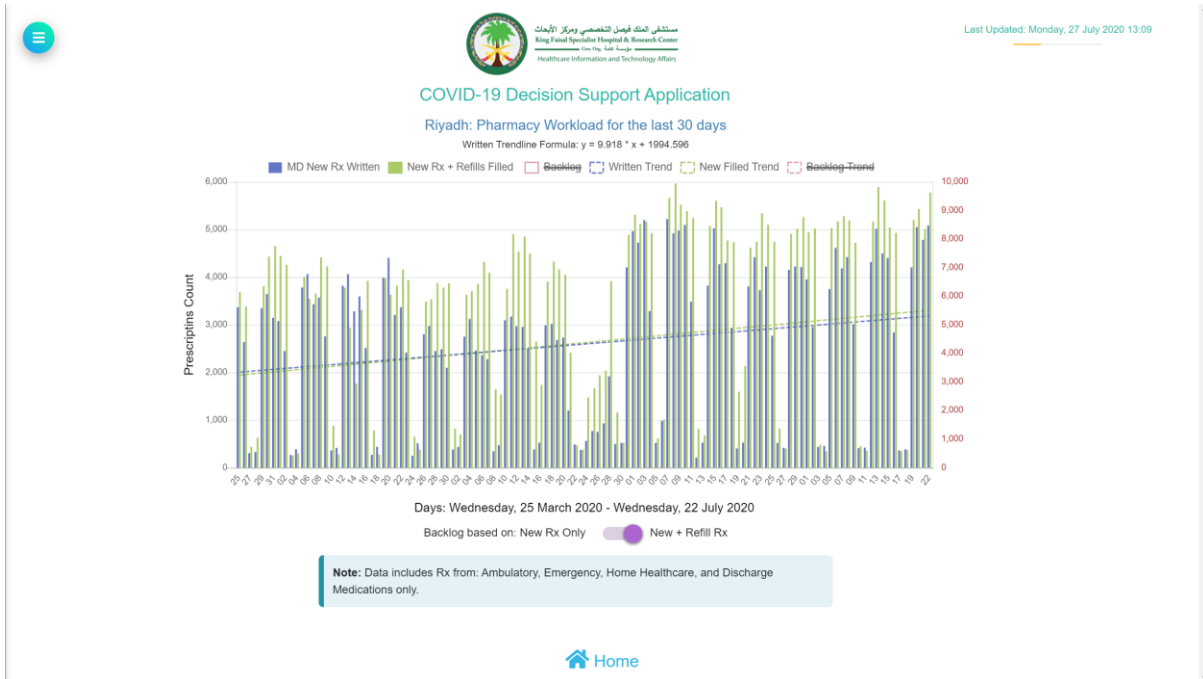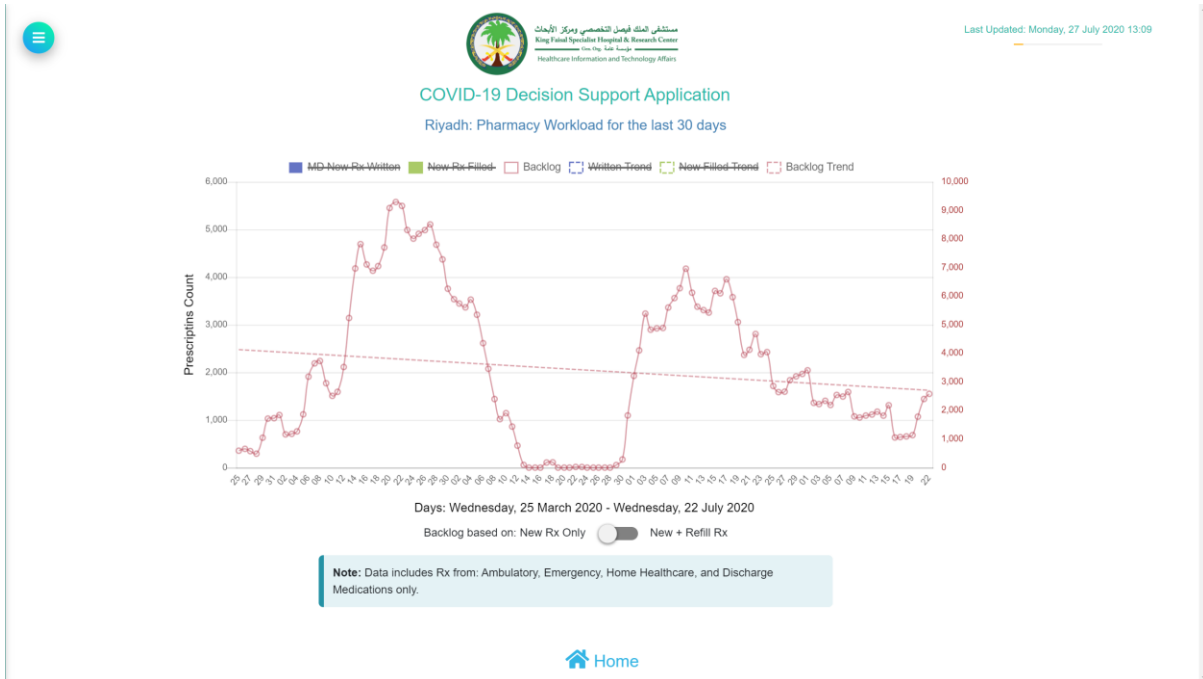|	
Build technology	Back-end tools: • Web server used was IIS on Windows Server platform (Microsoft Corporation) • Visual FoxPro used for data management Front-end tools: • For web publishing, common standards such as HTML, CSS, and Javascript (Oracle Corporation), JSON, Bootstrap, JQuery, Chart.js, and DataTables
Design	Switches considered as part of design to enable end users to select the view of their choice
Dashboard data definitions	• MD New Rx Written: new medications orders written on the calculation day • New Rx Filled: new prescriptions dispensed on the calculation day • New + Refill Rx: new and refill prescriptions dispensed on the calculation day • Backlog = MD New Rx Written – MD New Rx Filled (For all measures, trend lines calculated using simple linear regression equation.)

Figure 1

Figure 2