A Comprehensive Outpatient Approach to COVID-19 in an Integrated Health System : Universal Screening, Virtual Assessment, Drive-Through Testing, Respiratory Clinics and Home Monitoring

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Abstract:

In this article we describe the COVID-19 patient management system of a large integrated health care organization. The process is multi-tiered and includes the following components: (1) Patients access screening for COVID-19 via telephone, online portal, or public-facing websites; (2) Patients who screen positive are assessed by e-visits or video visits by a team of primary care and emergency providers; (3) Providers direct patients who meet testing criteria to a network of drive-thru COVID-19 testing sites while patients requiring in-person evaluation or more extensive testing are sent to dedicated respiratory evaluation clinics; (4) Patients tested for COVID-19 are enrolled in a daily symptom and vital sign home monitoring program. This comprehensive approach to screening, diagnosis, and management ensures patients are able to access needed care while reducing unnecessary emergency room and inpatient utilization.

The COVID-19 pandemic has led to rapid and substantial changes in the delivery of healthcare in the United States. The increased demand for healthcare services by high acuity patients has put significant strain on emergency rooms and inpatient units. There is a pressing need for effective outpatient systems for screening, diagnosis, triage and management of COVID-19 patients to reduce the burden on our emergency, inpatient and critical care resources. In this article, we describe our multi-tiered approach for COVID-19 in the ambulatory setting.

BJC Medical Group (BJCMG) is a large multi-specialty medical group with more than 400 physicians and 200 advanced practice providers across 120 locations in Missouri and southern Illinois. BJCMG is a part of BJC Healthcare, a large not-for-profit integrated health system with 15 hospitals in Missouri and Illinois. Washington University Physicians are the primary care and specialist faculty at Washington University School of Medicine in St. Louis (WUSM). Through its affiliations with Barnes-Jewish and St. Louis Children's hospitals, the School of Medicine is linked to BJC. The WUSM clinical practice group includes more than 1,700 physicians at 50 clinical sites in the St. Louis area. BJC and WUSM share an integrated electronic health record (Epic Systems). An integrated team of BJC and WUSM clinicians and administrators developed and operationalized this program.

COVID-19 Screening and Assessment

To ensure prompt clinical assessment of patients reporting symptoms while also protecting healthcare workers from possible exposure, we developed a "virtual first" model of care.

Mirroring the physical screening that patients complete at all medical facility entrances, we implemented screening at all our virtual points-of-entry—telephone calls, the online patient portal (Epic MyChart), and public-facing web sites.

We leveraged our pre-existing centralized scheduling and nurse triage programs to create telephone screening questions for COVID-19 symptoms and risk factors (Figure 1) for all patients calling our practices. Patients who screen positive are transferred to a triage nurse who performs a basic clinical assessment and determines if the patient meets COVID-19 testing criteria (Figure 2). Unstable patients are directed to a local emergency department. Patients who require additional evaluation with a clinician are scheduled for a video visit with the centralized Virtual Care Center (described below) or connected with their primary care provider for a video visit for management.

Patients can also access a virtual risk assessment using Epic's "COVID-19 Symptom Checker" on Epic MyChart. The "Symptom Checker" is an interactive, click-through tool utilizing basic branching logic to direct patients to the appropriate level of care. Asymptomatic patients requesting COVID-19 information are provided social-distancing instructions and links to local and CDC educational resources. Patients with concerns regarding an exposure who have not developed symptoms, those who require work notes or other clinician documentation, or who report very mild symptoms are directed to an e-visit (an asynchronous message-based assessment and treatment). Symptomatic patients and those at high risk for complicated disease (elderly patients or those with specified comorbidities) are offered on-demand video visits with a Virtual Care Center clinician.

We added similar interactive click-through and new interactive voice recognition (IVR) functionality on our public-facing websites for basic clinical risk assessment and to front-end our RN triage, respectively. Patients complete questions on symptoms, co-morbidities, travel, and healthcare contacts. Based on branching logic, the patients are either connected to a RN to review testing criteria and order the test,

given instructions to proceed to an ED for emergent symptoms, connected to the MyChart portal for virtual care, or given written instructions regarding social distancing and self-isolation.

COVID-19 Virtual Care Center

To support our "virtual first" screening program, we assembled a team of primary care and emergency medicine physicians, nurse practitioners and physician assistants. These clinicians provide virtual visits for patients undergoing initial screening and those enrolled in the home monitoring program.

Primary care clinicians work on-site at the Virtual Care Center and focus on visits scheduled by the triage team; these visits are scheduled when (i) the triage RN is not sure if the patient meets testing criteria, (ii) feels the patient would benefit from a visit with a provider before being tested, or (iii) feels that one of our home monitoring patients needs further clinical assessment. These clinicians also manage e-visits and some on-demand video visits. Emergency medicine clinicians integrate virtual visits into their ED shifts in addition to staffing a dedicated ED telehealth provider, and are available for "on demand" e-visits and video visits, which are completed using videoconference technology or by telephone if technology issues arise. If the clinician feels that the patient needs an in-person examination or other testing (i.e., chest X-ray, flu swab, etc.), they schedule the patients with a respiratory care clinic or send to an ED.

E-visits are asynchronous, patient-initiated, text-based communications with a provider. Patients are given an expectation of a two hour response time between 7 a.m. and 7 p.m. Providers are able to address patient concerns, provide documentation for school or employers, and identify patients that should be escalated to video or in-person assessments. The asynchronous nature of e-visits enables the Virtual Provider Team to efficiently manage their workload by providing both e-visits and video visits during their sessions.

Drive-Through Testing Sites

To complement the virtual assessments, we worked to design COVID-19 specimen collection sites that were orderly, minimized healthcare worker exposure, conserved PPE, and could be operationalized quickly, which led to a drive-through tent model.

We have opened five drive-through testing sites in Missouri and Illinois urban, suburban and rural areas to date. Each site was designed near a trailer or building where staff at our Virtual Care Center print testing requisitions and labels. A runner puts the matched requisition/labels in the inner bag and the discharge instructions in the outer bag of a double bagged specimen collection kit and takes it to the site entrance. The security guard matches the bag to the patient using their driver's license and the patient takes the bag with them to the testing tent. The swabber removes the inner bag with the requisition/labels, swabs the patient for COVID-19 testing, and provides discharge instructions to the patients, who then drive out of the testing site.

The collection sites are staffed primarily by RNs, who wear gowns, gloves, isolation masks, and face shields. Security guards wear gloves, isolation masks, and face shields.

COVID-19 testing orders for all collection sites are generated from one Virtual Care Center in the EMR so all results flow back to a single department. We created a standardized, centralized process to notify patients of results, quarantine guidelines, and back to work guidelines, as well as to provide work notes or a referral to our home monitoring program.

Home Monitoring

Patients who have been diagnosed with or tested for COVID-19 are enrolled in a home monitoring program to proactively detect any worsening in their clinical condition. A staff RN or MA contacts patients discharged from the hospital or emergency room, or those who have been tested in our drive-through test sites or respiratory clinics to offer enrollment in the program. Patients have the choice of using the Care Companion tool within Epic's MyChart phone app, or receiving daily phone calls from a staff member. Each day the patient is asked about their symptoms and vital signs (Figure 3a, 3b). Based on pre-determined triggers, patients with worsening symptoms and/or vital signs receive a call from an RN for further evaluation. The RN completes a full assessment and can schedule the patient within 2 hours for a video visit with the Virtual Care Center if necessary. The daily questionnaire and escalation triggers were adapted from Northwestern University's home monitoring program as well as the COVID-19 Care Companion tool developed by the Cleveland Clinic and Epic Systems.

We partnered with our home health team to provide patients with pulse oximeters (due to known hypoxia without breathlessness) and thermometers. Due to limited supplies, we worked with our clinics to re-deploy oximeters and thermometers when able.

Patients "graduate" from the home monitoring program when they have been afebrile with only mild symptoms for three days, and more than 7 days have passed since symptom onset. Patients are then scheduled for a telemedicine visit with their PCP within 3 days, and given information about convalescent plasma donation.

This program has the potential for very large patient volumes. To staff our phone outreach and enrollment lines, we have utilized re-deployed nurses, medical assistants and medical students.

Respiratory Clinics

We created designated "Respiratory Clinics" to assess patients with respiratory symptoms and/or fever. Due to concern for exposure, shortages of PPE and testing supplies, many outpatient clinic sites are re-directing patients with respiratory symptoms to stay at home or, if additional evaluation is required, to go to the ED. We wanted to provide an option for evaluation for patients outside of the ED setting. Additionally, to best utilize our resources, including PPE, space and providers, we wanted to concentrate efforts at specific clinical sites.

We repurposed nine of our clinics and established these as dedicated respiratory evaluation clinics, using a model adapted from Vanderbilt University and Hospital Sisters Health System in Illinois. Patients with acute or subacute cough, dyspnea, or fever can be seen only in the respiratory clinics rather than in our primary care or convenient care sites; referral protocols are listed in Figure 4. These clinics are staffed by volunteer internal medicine and family medicine providers. The clinics have appropriate PPE, chest X-ray, and lab capabilities including COVID-19 testing.

To minimize exposure patients are met in their car by a medical assistant. The MA provides the patient with a mask, checks oxygen saturation and temperature, and gives the patient a brief medical history questionnaire to fill out. When the provider is ready, the patient enters through a separate entrance and immediately goes into the exam room. The provider completes a focused history and examination with the patient and collects any indicated point of care testing, including COVID-19, flu, respiratory viral panel or strep. Typically, the provider-patient interaction is done in 8 minutes or less. The provider then informs the MA if any radiology or blood work needs to be done and the patient is taken for further testing; if not, the patient leaves the clinic and returns to their car. If indicated, the provider will prescribe

antibiotics, steroids, inhalers, or other treatments. Exam rooms and common areas are cleaned between patients.

Because symptoms of COVID-19 are common to many illnesses, the respiratory clinic allows us to evaluate patients for a variety of conditions in a setting other than the ED. We commonly diagnose and treat bacterial pneumonia, bronchitis, asthma/COPD exacerbations, seasonal allergies, and sinusitis. Less than 5% of the patients seen in the respiratory clinics are sent to the ED. Patients are referred to the home monitoring program if appropriate for further management.

Lessons Learned

The COVID-19 pandemic has put the health care delivery system under immense stress as we adapt to rapidly evolving circumstances. We strive to provide the best care possible to patients while protecting our providers and staff and conserving our finite resources—PPE, testing supplies and hospital beds. Our multi-tiered approach has quickly evolved, expanding from basic screening and patient education to targeted in-person assessments and home monitoring. We anticipate further changes and additions as we continue to assess and respond to the changing COVID-19 landscape. Throughout this process, we have learned that perfect truly is the enemy of the good. Pre-COVID, we had the luxury of time to dissect each process, identify concerns and optimize workflows before putting them into practice. Now, we must take action, learn and adjust as we go. We cannot be paralyzed by waiting for "perfect," we have to move forward with "good enough", constantly evaluating and improving as we go. Health systems are evolving a variety of outpatient approaches to COVID-19 and it will be critical in the coming months to continually assess these systems to determine optimal ways to care for patients in these trying times.

Figures:

Figure 1. COVID-19 Signs & Symptoms Screening Questionnaire

Figure 2. COVID-19 Testing Criteria

Figure 3. Daily Home Monitoring Symptom Survey and RN Escalation Criteria

Figure 4. Respiratory Clinic Referral Guidance

Figure 1. COVID-19 Symptom Screening Questionnaire

1. Do you have any of the following symptoms:

   New or worsening cough?

   New or worsening shortness of breath?

   Fever (≥ 100° F)?

   Body aches?

   Loss of taste or smell?

   Diarrhea or Vomiting?

2. Have you had any cruise ship travel, international travel, or domestic travel in the last two weeks?

3. Have you had exposure to patients with COVID-19, isolated for COVID-19, or in contract with someone tested or isolated for COVID-19 or COVID-19 expsoures?

Figure 2. COVID-19 Testing Criteria

Symptoms		**High-Risk Groups**
Fever (subjective OR confirmed) **AND** Cough OR Shortness of breath	**PLUS**	Live in nursing home, skilled nursing facility or other group home setting
		Age ≥65
		Diabetes with complications (ex. nephropathy, neuropathy, retinopathy)
OR		Congestive Heart Failure
Sudden loss of taste or smell		Immunosuppression (ex. bone marrow or organ transplant, poorly-controlled HIV)
		Cancer (currently receiving treatment)
		Chronic lung disease (includes COPD, asthma)
		Chronic kidney disease
		Pregnancy

Figure 3a. Daily Home Monitoring Symptom Survey

questions in the current Foundation System are:

- **Enter Temperature Reading**
  - If you have a thermometer, enter your highest temperature since last recording (in Fahrenheit).
- **Enter Oxygen Saturation Reading**
  - If you have a portable oxygen sensor, enter your lowest oxygen percentage since last recording.
- **Enter information about your condition**
  - (Takes the patient to a questionnaire)
  - When did you first start experiencing symptoms related to COVID-19?
    - They give a date.
  - Are you feeling short of breath today? Y/N
  - (If yes) Is the shortness of breath better, the same, or worse than yesterday?
    - New
    - Better
    - Same
    - Worse
  - Are you having a cough today? Y/N
  - (If yes) Is the cough better, the same, or worse than yesterday?
    - New
    - Better
    - Same
    - Worse
  - Are you experiencing weakness today? Y/N
  - (If yes) Is the weakness better, the same, or worse than yesterday?
    - New
    - Better
    - Same
    - Worse
  - How is your appetite compared to yesterday?
    - Better
    - Same
    - Worse
  - Are you vomiting? Y/N
  - Are you experiencing diarrhea? Y/N
  - (If yes) Is the diarrhea new today, better, the same, or worse than yesterday?
    - New
    - Better
    - Same
    - Worse

Figure 3b. Home Monitoring RN Escalation Criteria

Respiratory Distress Evaluation:	
Continue to Monitor	MILD: • No SOB at rest • mild SOB with walking • speaks normally in sentences • Can lay flat without developing SOB • No retractions
Escalate to video visit or in person evaluation	MODERATE: • SOB at rest that is new or worsening • SOB with minimal exertion and prefers to sit that is new or worsened • Becomes SOB when lying down flat • speaks in phrases (too SOB or coughing too much to speak in sentences) • mild retractions • audible wheezing • Pulse ox decrease of 4% or <92% (check multiple fingers)
911/Send pt to ED	SEVERE • Very SOB at rest o speaks in single words o struggling to breathe o sitting hunched forward o retractions o pulse > 120 • Bluish lips or face • Pulse ox <88% on prescribed oxygen (or on room air if not prescribed oxygen)

Vomiting/Diarrhea Evaluation (dehydration):	
Continue to Monitor	• No significant dehydration (see below) • Mild vomiting (1-2x/day), no symptoms of dehydration • Mild to moderate diarrhea (<6x/day), no symptoms of dehydration
Escalate to video visit or in person evaluation	• Moderate vomiting (3-5x/day) • Moderate diarrhea (4-6x/day) and present >2days • Severe diarrhea (7x/day) >1 day w/ dehydration sx's • Dehydration symptoms such as: - thirsty - yellow or dark yellow urine - slightly light-headed when changing from seated to standing - slightly dry mucous membranes (mouth, not just lips)

911/Send pt to ED	• Red blood/coffee ground emesis • Vomiting with Insulin dependent diabetes and glucose >240 • Severe dehydration (below) - Urine Production: minimal or absent, last > 12 hrs ago - Urine Color: dark yellow-brown - Mucous Membranes: very dry inside of mouth - Heart rate > 130 beats / minute - Very thirsty, very weak and lightheaded; fainting may occur • Confused, difficult to awaken, or unresponsive • Too weak to stand or very dizzy when tries to stand

Fever Evaluation:	
Continue to Monitor	• Fever <102 • Able to stay hydrated
Escalate to video visit or in person evaluation	• Fever 102-105 • New fever (>101) after improvement for 2 days (without change in antipyretic use) • Pt sounds very sick or weak to the triager • Drinking very little and signs of dehydration (see *Dehydration*)
911/Send pt to ED	• Fever >105 • Fever with - Difficult to awaken or acting confused (e.g., disoriented, slurred speech) - Severe weakness (unable to stand), pale cold skin - New onset rash with purple (or blood-colored) spots/dots

Chest Pain Evaluation:	
Continue to Monitor	• Chest Pain that is at baseline (no change from recent chest pain) • New onset of chest pain only with coughing • New intermittent mild chest pain lasting only a few seconds
Escalate to video visit or in person evaluation	• Increasing severity or frequency of chest discomfort • New chest pain that lasts longer than a few seconds and is NOT associated with cough
911/Send pt to ED	• Crushing, pressure, like, or heavy chest pain • (If prior cardiac history) Chest pain similar to prior angina that has not improved • New chest pain associated with syncope or new light-headedness

Figure 4. Respiratory Clinic Referral Guidance

Patients who have completed a video or telephone visit with the virtual triage team and qualify for COVID testing, can be scheduled for respiratory clinic: a. Patients who need to be assessed to see if they are stable at home (i.e. needs vitals checked) b. Patients who need testing other than COVID (i.e. chest xray, CMP, flu swab)
Patients who have been screened by the virtual COVID triage team and do NOT qualify for COVID testing, but need an **in-person** evaluation, vitals checked, and/or testing other than COVID (i.e., chest xray) • Ideally these patients would complete a telemedicine visit with PCP first to determine if a respiratory clinic evaluation is needed. • Appropriate for respiratory clinic referral: cough/fever for 1 week. • Not appropriate for respiratory clinic referral: COPD patient with cough for 6 months.
Patients who have been tested for COVID (either positive or pending) who have developed worsening symptoms • Ideally these patients would be evaluated by phone or video to make sure they are appropriate for respiratory clinic rather than ED
Patients who present to the office with respiratory symptoms
COVID positive patients in the recovery phase with persistent or recurrent symptoms