

A Novel Approach for a Novel Pathogen: using a home assessment team to evaluate patients for 2019 novel coronavirus (SARS-CoV-2)

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Abstract

Thousands of people in the United States have required testing for SARS-CoV-2. Evaluation for a special pathogen is resource intensive. We report an innovative approach to home assessment that, in collaboration with public health, enables safe evaluation and specimen collection outside the healthcare setting, avoiding unnecessary exposures and resource utilization.

Key Words: novel coronavirus, COVID-19, SARS-CoV-2, home assessment

Introduction

The 2019 novel coronavirus (SARS-CoV-2), identified as the cause of an outbreak of respiratory infection in Wuhan, China, is rapidly spreading around the globe. The first case in the United States was identified on January 20th, 2020.¹ As of March 6, 2020, 164 additional cases in the United States have been diagnosed, though thousands of people have been tested for SARS-CoV-2.² We anticipate many more will require testing in the future. The transmission dynamics of SARS-CoV-2 remain under study, and conservative infection control processes and intensive contact tracing are required for confirmed or suspected cases of infection.

Public health agencies are charged to monitor persons with SARS-CoV-2 exposures and perform assessments if symptoms develop. Depending on the outcome of these assessments, testing for SARS-CoV-2 might be recommended.

Safe evaluation of persons for suspected infection with a special pathogen (including SARS-CoV-2) in the traditional healthcare environment is costly and resource intensive. It requires specialized rooms, use of personal protective equipment (PPE), monitored donning and doffing, logistically-complicated patient transportation from the community to the healthcare facility and back (typically through emergency medical services), and appropriate decontamination of transport and hospital environments. Additionally, evaluating a patient for emerging pathogens in a healthcare setting runs the risk of exposing patients and staff to infection. In a clinically stable patient with mild symptoms, alternative methods for special pathogen evaluation/testing are vital to preserve healthcare resources and prevent unnecessary exposures.

A home-assessment program was originally developed collaboratively by Harborview Medical Center and Public Health – Seattle & King County (Public Health) in 2014 in response to the potential need to test minimally symptomatic patients for Ebola infection at home quarantine locations. Several challenges, including lack of clarity around route of transmission to healthcare workers while doffing PPE, prohibited the program from being implemented at that time. However, when the number of people being monitored by Public Health for novel coronavirus disease (COVID-19) including contacts of the first U.S. case¹ and recent travelers from China who developed symptoms increased in King County, Washington, the Harborview

Home Assessment Team (HAT) was revised and launched in partnership with Public Health to provide real-time clinical assessments of patients in need of evaluation for COVID-19 who do not require emergency medical care or hospitalization.

Methods

Nurses and physicians at Harborview Medical Center, an urban county teaching hospital in Seattle, WA, have been engaged in continuous training in the care of patients with special pathogens since 2014 with biannual refresher courses. In January 2020, we received support from our hospital and Public Health to launch the HAT program, using trained personnel and our Infection Prevention & Control Program (IPC).

Patients with symptoms of illness and possible exposure to SARS-CoV-2 are identified either by Public Health or through a call to any part of the University of Washington healthcare system, with calls routed to the IPC team responsible for HAT activities. If the patient meets Center for Disease Control and Prevention (CDC) criteria for testing,³ Public Health determines appropriateness of a HAT visit and SARS-CoV-2 testing in the field.

Once Public Health determines that a HAT visit is indicated, a HAT member calls the patient to confirm that they are safe for a visit (breathing comfortably, able to eat and drink, mobilizing around their home), discuss details of the visit, determine locations for donning/doffing, and to register the patient within our system to allow for medical record documentation. Each HAT is made-up of 1 physician, 1 nurse, 1 or more trained PPE observers, and a site-commander, and uses one or two vehicles to transport personnel, PPE, and testing materials. The physician and nurse enter the patient's dwelling in appropriate PPE recommended by the CDC, using standard, contact, and airborne precautions with eye protection.⁴ The patient is evaluated by the physician, who gathers a focused history and performs a physical exam. Specimens are obtained (nasopharyngeal swab, oropharyngeal swab, and sputum if appropriate) for SARS-CoV-2 testing to be performed by the CDC or Washington State Department of Health laboratory. An additional nasopharyngeal swab is collected for viral respiratory pathogen testing, including influenza, at the University of Washington Virology Laboratory. All equipment used for assessment (e.g. disposable stethoscopes and

thermometers) are left with the patient. Documents requiring signatures (consent, HIPAA, etc.) are signed and photographed by the patient on their own phone and emailed to a secure University of Washington email address for uploading into the medical record.

After collection, nasopharyngeal swabs are placed in collection vials with universal viral transport media and into a biohazard bag with an absorbable pad. Each biohazard bag is cleaned with bleach (0.55% sodium hypochlorite) wipes with a 3 minute dwell time. Upon exit from the evaluation site, the specimen bags are placed directly into a sealable, autoclavable, transport box handled by a clean trained observer. This transport box is subsequently transported back to the laboratory.

Doffing procedures are performed one healthcare worker at a time, with assistance from the trained observer and monitoring by the site commander (Figure 1). Hand hygiene is performed with a 70% ethanol based sanitizer. Waste management is safely performed by the trained observer and overseen by the site commander in order to minimize contamination to the healthcare worker and leave waste that is not externally contaminated (Figure 2). Because of lack of licensing to transport Level B biohazard waste, all waste is left with the patient. Upon confirmation of negative results, the patient places waste into their usual waste removal process. For patients testing positive for SARS-CoV-2, a licensed company will be contacted for Level B biohazard waste removal.

Patients are instructed to self-isolate pending results of tests and to continue isolation if positive for SARS-CoV-2. Public Health performs at least every other day phone follow-up (more frequent for medically fragile patients) until results are obtained and thereafter for those with COVID-19, until resolution of symptoms to ensure no progression of illness and no need for medical care.

All involved HAT members complete a daily log including temperature and respiratory and gastrointestinal symptom reporting through employee health for 14 days or until SARS-CoV-2 testing returns negative from the index visit.

Results

To date, HAT has successfully conducted 15 community-based assessment visits, including in single-family homes and commercial properties where patients were isolated. All patients were deemed clinically stable and appropriate to remain out of the hospital; none have required subsequent hospitalization.

Approximate time from dispatch to return is 3 hours on average; including 10 minutes for donning, 30 minutes for face-to-face patient care, and 30 minutes for doffing/waste procedures.

To date, 2 patients have tested positive for SARS-CoV-2. Other evaluated patients have tested positive for human coronavirus, rhinovirus, parainfluenza, or had negative results. Patients have reported that evaluation in this setting is highly acceptable.

We noted no instances of contamination of healthcare worker PPE with visible blood or other body fluids and no instances of breach of PPE doffing protocol. . No HAT members have developed symptoms requiring evaluation.

Discussion

To our knowledge, this is the first hospital team-based COVID-19 assessment program in the United States to evaluate patients outside of the traditional healthcare setting. This model benefits both the public health and clinical healthcare systems by increasing safety and efficiency while reducing the costs and complexity of SARS-CoV-2 testing for patients who do not require emergency evaluation or hospitalization. Given concerns with healthcare exposures and healthcare-associated outbreaks with SARS-CoV-2, as well as historical experiences with SARS-CoV and MERS-CoV transmission in healthcare settings, minimizing the exposure risk to clinics, emergency departments, and hospitals is crucial.^{5,6}

As healthcare workers are known to be at risk of contamination during doffing of PPE, even when caring for patients with routine respiratory infections,⁷ the importance of well monitored appropriate PPE doffing for special pathogens cannot be over-emphasized. Given the novel nature of this pathogen, that the exact mechanisms of transmission have yet to be

defined and unclear morbidity and mortality, this is an important yet often overlooked step in keeping our healthcare workers safe.

Following initiation of our protocols, the CDC has released new guidance for COVID-19 assessment in residential settings⁸ with waste management recommendations that differ from ours. For future novel pathogen assessments prior to release of national guidance, especially for pathogens with a greater risk of transmission, our protocol regarding secure PPE waste control remains pertinent.

The HAT program is a scalable, cost-saving model that cuts-down on resources required to isolate and care for patients. Importantly, this model can likely be used for other novel outbreaks and potentially in unconventional settings like ships, planes, and airports that can be served by scaling-up HAT size to allow large scale screening of individuals.

Our hospital has a long history of collaborating closely with Public Health on routinely occurring and emerging infectious disease responses. The use of home assessment teams in the setting of novel infectious disease epidemics demonstrates the value of integrated and coordinated public health and healthcare systems and corresponding benefits to our patients and the public.

Acknowledgments:

We thank the leadership of Harborview Medical Center, UW Medicine, and Washington State Department of Health for supporting this project.

Funding:

Dr. Lynch reports funding for the program from Washington State Department of Health, during the conduct of the study.

None of the authors has potential conflicts to disclose.

Citations

1. Holshue ML, DeBolt C, Lindquist S, et al. First Case of 2019 Novel Coronavirus in the United States. *N Engl J Med*. January 2020. doi:10.1056/NEJMoa2001191
2. Centers for Disease Control and Prevention. 2019 Novel Coronavirus (2019-nCoV) in the U.S. <https://www.cdc.gov/coronavirus/2019-ncov/cases-in-us.html>. Accessed March 6, 2020.
3. Centers for Disease Control and Prevention. Evaluating and Reporting Persons Under Investigation (PUI). <https://www.cdc.gov/coronavirus/2019-nCoV/hcp/clinical-criteria.html>. Accessed March 6, 2020.
4. Centers for Disease Control and Prevention. Interim Infection Prevention and Control Recommendations for Patients with Confirmed 2019 Novel Coronavirus (2019-nCoV) or Persons Under Investigation for 2019-nCoV in Healthcare Settings. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control.html>. Accessed March 6, 2020.
5. Lau JTF, Fung KS, Wong TW, et al. SARS Transmission among Hospital Workers in Hong Kong. *Emerg Infect Dis*. 2004;10(2):280-286.
6. Wang D, Hu B, Hu C, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA*. February 2020.
7. Phan LT, Sweeney D, Maita D, Moritz DC, Bleasdale SC, Jones RM. Respiratory viruses on personal protective equipment and bodies of healthcare workers. *Infect Control Hosp Epidemiol*. 2019;40:1356-1360.
8. Centers for Disease Control and Prevention. Interim Guidance for Public Health Personnel Evaluating Persons Under Investigation (PUIs) and Asymptomatic Close Contacts of Confirmed Cases at Their Home or Non-Home Residential Settings. <https://www.cdc.gov/coronavirus/2019-ncov/php/guidance-evaluating-pui.html>. Accessed March 6, 2020.

FIGURE LEGENDS

Figure 1. Doffing Procedures for N95 mask, goggles, and gown

Step #	Action
1	Hot MD/RN wipes down inside door handle with bleach wipe and Trained Observer (TO) wipes down outside door handle with bleach wipe
2	TO positions in WARM zone and is donned in: Gown, Gloves, N95, Goggles/eye shield
3	Site Commander (SC) positions in COLD Zone and is donned in: Mask with eye shield and gloves
4	HOT MD/RN performs Hand Hygiene (HH) prior to exiting domicile over gloves.
5	HOT MD/RN knocks signaling TO to prepare for exit. TO will return the knock when ready and HOT MD/RN will open the door. HOT MD/RN remaining or patient will close the door.
6	TO gives HOT MD/RN HH over gloves.
7	HOT MD/RN turns towards the patient door to remove gown and gloves: <ul style="list-style-type: none"> <input type="checkbox"/> HCW removes GOWN and GLOVES by first pulling at the waist, then at the shoulders and rolling gown inside out and remove gloves last. Gloves should be bundled inside the gown. <input type="checkbox"/> HCW turns and disposes gown and gloves in red biohazard bag
8	TO gives HOT MD/RN HH
10	HOT MD/RN dons gloves
11	TO holds up mirror and HOT MD/RN removes EYE PROTECTION and disposes in red biohazard bag. <ul style="list-style-type: none"> <input type="checkbox"/> If using FACE SHEILD, pull straps to the side and while maintaining tension, pull strap over head to avoid snapping back of face shield.
12	HOT MD/RN removes gloves and disposes in red biohazard bin
13	HOT MD/RN performs HH and dons clean gloves
14	HOT MD/RN removes N95 mask. DO NOT TOUCH THE FRONT OF THE MASK. <ul style="list-style-type: none"> <input type="checkbox"/> Tilt head slightly forward <input type="checkbox"/> Grasping first the bottom strap, pull to the sides, then over your head. <input type="checkbox"/> PERFORM HH OVER GLOVES <input type="checkbox"/> Then grasp the upper strap with both hands, pull to the sides and then over your head. <input type="checkbox"/> Keep tension on the upper strap as you remove it, which will let the mask fall forward and dispose in red biohazard bag. <input type="checkbox"/> <u>Do not touch your face after you remove the mask.</u>
15	HOT MD/RN removes gloves and disposes in red biohazard bag and performs HH
16	HOT MD/RN prepares to leave HOT Doffing Zone through Warm Zone to Cold Zone. SC or TO to wipe down soles of shoes of HOT MD/RN prior to leaving doffing zone. Wait 3 minutes before leaving doffing zone.
17	Repeat checklist with remaining HOT MD/RN. After all HAT members have exited domicile, TO will perform Waste Management Checklist.

Note: MD, medical doctor; RN, registered nurse; TO, Trained Observer; HH, hand hygiene

Figure 2. Waste Management Checklist

Step #	Action
1	<p>Site Commander (SC) sets up:</p> <ul style="list-style-type: none"> <input type="checkbox"/> A line of 3 biohazard bags <input type="checkbox"/> Alcohol-based hand rub at Bag #1 and Bag #3 <input type="checkbox"/> Bleach wipes at Bag #3 <p>SC is donned in gloves and mask with eye shield *This step should occur while HCWs are in home and should be ready prior to HCWs leaving home</p>
2	After all Healthcare Worker (HCW) PPE is removed, Trained Observer (TO) ties/secures biohazard bag #1. Minimize air in bag and any burping of the bag should be done away from TO. Bunny ear bag tie is OK.
3	TO performs HH over gloves
4	TO will then take biohazard bag #1 and place into biohazard bag #2. Roll up the sides a bit.
5	TO performs HH over gloves
6	<p>TO doffs GOWN and GLOVES and places into biohazard bag #2</p> <ul style="list-style-type: none"> <input type="checkbox"/> TO removes GOWN and GLOVES by first pulling at the waist, then at the shoulders and rolling gown inside out and remove gloves last. Gloves should be bundled inside the gown. <input type="checkbox"/> TO turns and disposes gown and gloves in red biohazard bag #2.
7	SC gives TO HH and TO dons new gloves
8	SC holds up mirror and TO removes EYE PROTECTION and disposes in red biohazard bag #2
9	TO removes gloves and disposes in red biohazard bin #2
10	SC gives TO HH and dons clean gloves
11	<p>TO removes N95 mask. DO NOT TOUCH THE FRONT OF THE MASK.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Tilt head slightly forward <input type="checkbox"/> Grasping first the bottom strap, pull to the sides, then over your head. <input type="checkbox"/> PERFORM HH OVER GLOVES <input type="checkbox"/> Then grasp the upper strap with both hands, pull to the sides and then over your head. <input type="checkbox"/> Keep tension on the upper strap as you remove it, which will let the mask fall forward and dispose in red biohazard bag #2. <input type="checkbox"/> Do not touch your face after you remove the mask.
12	TO removes gloves and disposes in red biohazard bag #2 and performs HH
13	SC ties/secures biohazard bag #2. Minimize air in bag and any burping of the bag should be done away from SC. Bunny ear bag tie is OK.
14	SC removes gloves and disposes in biohazard bag #3 and performs HH.
15	SC removes mask with eye shield and disposes in biohazard bag #3 and performs HH.
16	Home Assessment Team (HAT) member dons clean gloves and ties biohazard bag #3.
17	HAT member removes gloves and places them on top of biohazard bag #3 and performs HH.

Note: SC, site commander; HCW, Health Care Worker; TO, Trained Observer; HAT, Home Assessment Team; HH, hand hygiene