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Leveraging an Electronic Health Record Note Template to Standardize Screening and Testing for COVID-19.

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Keywords: Electronic Health Records, COVID-19, Ambulatory Care, Outpatients, Primary Care, Veterans

Word Count: 2143
HIGHLIGHTS:

- The coronavirus disease 2019 (COVID-19) pandemic challenged health care organizations to provide patient care with rapidly changing guidelines and scarce resources.
- To screen Veterans at Veterans Affairs (VA) Puget Sound we developed a novel electronic health record (EHR) note template and integrated it into primary care workflows.
- The template allowed for categorization of patient stability as a discrete data element that could be used for tracking suspected cases and provided standard triaging advice.
- In response to the COVID-19 pandemic, a brief, practical EHR note template can be quickly adopted to inform guideline-based screening, direct patient care, and conserve resources.

ABSTRACT

The coronavirus disease 2019 (COVID-19) pandemic challenged health care organizations to develop ways to provide patient care with rapidly changing guidelines and scarce resources. Clinical leaders and informatics specialists partnered to rapidly develop an electronic health record (EHR) template for primary care staff to screen Veterans at Veterans Affairs (VA) Puget Sound. The template prompts categorization of patients by stability and suspicion for COVID-19, and provides just-in-time triaging advice for clinic staff. Each category is a discrete data element and this information was used by leadership to track screening and testing volumes. We found that a brief, practical EHR note template can be quickly adopted to inform guideline-based screening, direct patient care, and conserve resources.
1. BACKGROUND:

The initial epicenter of the US outbreak of coronavirus disease 2019 (COVID-19) was in Washington state with the first confirmed case in January 2020 [1] and the first recognized US death in late February. These events prompted immediate preparation from regional health care systems. As part of the response of the Veterans Affairs (VA) Puget Sound Health Care System, we integrated an electronic health record (EHR) note template into primary care workflows to screen patients for COVID-19 symptoms, track cases, and guide outpatient care.

2. ORGANIZATIONAL CONTEXT:

The Veterans Health Administration (VHA) is a large integrated health system that provides care for 9 million Veterans. VA Puget Sound Health Care System provides care for over 70,000 Veterans in western Washington. Primary care services at VA are delivered in a patient-centered medical home model called the Patient Aligned Care Team (PACT) [2]. Each PACT consists of core members: an administrative clerk, a clinical associate (licensed practice nurse or medical assistant), a registered nurse and a provider. Nationally, VA uses a home grown EHR, the Computerized Patient Record System (CPRS), for ordering, documentation, results review, and consult management. The EHR can be customized at the facility-level to adopt to local workflows and services.

3. PERSONAL CONTEXT:

Clinical application coordinators, a team of experts who build notes and order sets in the EHR, have partnered for years with clinical leaders and frontline providers to create EHR-based solutions for care delivery. However, it often takes several months to develop and implement EHR changes due to high demand and a need to prioritize several different projects. During the COVID-19 pandemic, a leadership team from health informatics, data analytics, primary care, and facility incident command formed a working group to rapidly develop EHR solutions,
including a COVID-19 screening note template. Members of this group frequently reviewed CDC recommendations and facility testing capacity in planning changes.

4. PROBLEM:

Puget Sound was the first major U.S. region to experience an outbreak of COVID-19. The Centers for Disease Control released recommendations for screening patients on February 28th, 2020 [3] based on epidemiologic risk and symptoms.

Primary care leadership at VA Puget anticipated a high volume of COVID-19 related encounters and primary care teams would lead these efforts. Timely new protocols were needed for screening, tracking, and triaging primary care patients in response to the crisis. This information needed to reach clinical leadership and front-line staff and providers. Trends in case volume could inform surge planning such as potential workforce re-assignment, management of personal protective equipment resources, and prioritizing testing resources.

Early challenges included frequent changes in screening protocols and availability of testing. In addition, isolation precaution counseling and infection control reporting requirements were novel concepts for staff, requiring just-in-time education. We needed a way for teams to quickly access and apply up-to-date information and provide consistent, high-quality care to accurately screen and test patients.

5. SOLUTION:

5.1 Screening Template

Clinical leadership and clinical application specialists created a new COVID-19 Screening Note template. The EHR template allows for documentation and contains structured data entry fields.
The note template requires authors to input patient symptoms and epidemiologic risk factors for COVID-19 according to the Centers for Disease Control (CDC) criteria and to document clinical stability (Text Box 1). The template used generally accepted clinical criteria for stability that have been used in patients with pneumonia. [4] The template categorizes the patient into one of four options: suspect COVID-19 and stable, suspect COVID-19 and unstable, do not suspect COVID-19 and stable, do not suspect COVID-19 and unstable. Each category included clinical recommendations, including whether to test the patient for COVID-19 and the appropriate care setting. Each option is a discrete data element, enabling population health tracking.

The note template also gives clinical staff guidance on safe patient disposition, self-isolation guidelines, and reporting guidelines. We embedded Washington Department of Health and CDC guidelines within the EHR template to reduce the need for staff and clinicians to repeatedly search external clinical resources during the encounter. Finally, a standard note title, “COVID-19 Screening Note,” created visibility within the patient’s chart for subsequent patient encounters.

The screening template was updated over time as understanding of epidemiologic risk and symptoms evolved (Figure 3). Changes included removing locations of travel risk, incorporation of patient counseling, expanded plan of care recommendations, updating quarantine recommendations to align with Washington state’s home isolation guidance, and the addition of CDC priority groups for COVID-19 testing.[5]

5.2 Implementation of Template in Screening Workflow

Primary care staff performed primary screening on incoming patient calls and prior to face-to-face appointments (Figure 1). The primary screen consists of questions about viral symptoms
and potential exposure to persons with COVID-19. Patients who screened positive either for symptoms or an exposure underwent a secondary telephone screening by a primary care nurse or provider using the COVID-19 Screening Note. Facility-wide, each clinical service could choose to incorporate the note template into their workflow, and it could be used ad hoc, though most screening was performed by primary care.

The note template was introduced at a daily COVID briefing for primary care management, and this information was distributed to staff at their primary clinical site through pre-existing channels including staff meetings and email. Informal feedback or issues with use of the template raised by staff were discussed with leadership and the template creators during the daily COVID briefings. When possible, minor changes to the template were made in a way to minimize impact on workflow or need for training. Primary care leadership communicated more substantial changes to the template through the same means as above.

5.3 Tracking

The data elements from the note template were used to create a dashboard to provide daily clinical reports of the volume of stable and unstable patients suspected to have COVID-19 screened across the facility, in addition to the results from testing of these patient cohorts.

5.4 Screening and Testing Results

1,338 patients were screened using the COVID-19 Screening Note from March 5th – April 8th (Figure 2). Thirty-one percent (n=412) of screened patients were suspected to have COVID-19 with 88% deemed clinically stable. Of this stable suspected positive cohort, 139 were ultimately tested for COVID-19 with 12 positive results (8.6%). Less than four percent (n=51) of screened patients were suspected to have COVID-19 and deemed clinically unstable, of which 29 were
tested and 4 positive (13.8%). Sixty-nine percent (n=926) of screened patients were not suspected to have COVID-19. Among this group, 30 were tested with 1 positive result (3.3%).

This work was completed as part of operations and is not considered research per VA policy and was not subject to institutional review board review.

6. UNRESOLVED QUESTIONS AND LESSONS FOR THE FIELD:

The rapid implementation of our COVID screening template was supported by a few key factors. Using the Consolidated Framework for Implementation Research (CFIR) [6] framework, we identified 3 major elements that supported our implementation efforts including: priority and tension for change, leadership engagement, and access to resources and information. First, COVID-19 forced us to reimagine how to provide care to keep patients and staff safe. In the context of a new emerging pandemic there was a broad understanding that to minimize risk for everyone in our community there was a need to change how we cared for patients with suspected COVID symptoms. Second, our leadership team was engaged from the start, playing a key role in developing local screening efforts and creating a climate in which staff were supported and expected to use the new tool. Finally, we made use of available EHR resources and facility partnerships to build a practical, adaptable template containing up to date information.

Additionally, creating an EHR-based template provided just-in-time education to frontline staff and ensured quality screening that adhered to local and national guidance with minimal training. Documentation in a note is standard practice in primary care and thus it was easy to integrate this solution with minimal disruption. Use of the template not only standardized documentation, but also guided triage and disposition for COVID-19 patients in the face of rapidly changing national guidelines and local testing resources. This stands in contrast to typical EHR clinical
support interventions, which are often alert-based and perceived as burdensome and contribute to alert fatigue.[7]

Our local model was presented to the Veterans Health Administration (VHA) COVID-19 surveillance council and a similar screening note template was adopted nationally across VHA, a large integrated health system that provides care for 9 million Veterans. To date, COVID screening note templates have been used over 1.5 million times at 124 VA facilities nation-wide. Other VA departments also adopted EHR-based COVID note templates unique to their setting or care need (i.e. pre-procedure screening and testing).

We learned that through partnering with informatics, analytics, and clinical leadership in a time of crisis we could create rapid clinical tools within the EHR. One advantage of using a homegrown EHR is that it can be quickly customized at the local level. VHA is currently transitioning from CPRS to a commercial EHR. It is unknown how this transition will impact the ability of individual facilities to pioneer EHR-based solutions such as those needed in response to COVID-19 or to customize the EHR for local differences in clinical workflows. It will be important to maintain this capability after transitioning to a commercial EHR. Partnership between local, regional, and national VA leadership with the commercial vendor will be essential to ensure that the EHR will adapt appropriately to our health system’s needs.

7. DISCUSSION:

We successfully and rapidly leveraged our EHR to make a local, novel screening tool that produced population level data on emerging COVID-19 cases at VA Puget Sound.

We screened over 1300 patients in 5 weeks and approximately 31% of patients were suspected positive for COVID-19 based on symptoms and exposures. Initially, most stable patients
suspected COVID-19 positive were placed on 14-day home quarantine given lack of widely available testing. Unstable patients were triaged to the emergency department or other settings for assessment and testing. In late March, testing capacity increased and we added CDC priority groups to the screening note template to identify patients for a testing appointment. Roughly 2.5 times as many patients tested positive for COVID-19 from the screened suspect positive group than the suspect negative group (8.6% vs 3.3%).

Through the use of data elements in the template, we categorized patients into one of four conditions and used this data to track cases over time. Having Information on daily volume of screened and suspected positive patients allowed our facility to determine accurate staffing needs and smoothly implement risk-based patient testing as testing capacity expanded.

Limitations include that screening was conducted on a convenience sample of patients who called in or had upcoming appointments and is not representative of the total Veteran patient population. Low risk and less symptomatic patients would likely be missed in this real world sample, however, their exclusion reserved screening resources for higher risk and unstable patients. We are unable to calculate a formal sensitivity and specificity accurately due to the fact that not everyone screened received a COVID-19 test. Similarly, to measure predictive values we would need a more accurate prevalence of COVID-19, which was unavailable. However, despite these limitations the use of the template did help separate the population into suspect positive and suspect negative populations with differences in eventual detection of COVID.

Unfortunately, COVID-19 is unlikely to be the last pandemic of a novel pathogen. In this case it was vital to have a local team that identified a problem and solution early, and could implement it quickly. As VA nationally transitions to a commercial EHR, VA Puget Sound will be one of the initial implementation sites, and there will be a lot to learn about how local teams can best partner with a commercial vendor to develop solutions that meet the needs of Veterans. We
show that use of a brief, practical EHR note template can be rapidly implemented to guide nurses and providers through novel guideline-based care in primary care. This template allows providers to give patients up-to-date advice in the setting of rapid change, reserve emergency care for only those who truly need it and save valuable testing resources.

Acknowledgements:
The authors would like to thank Amanda Greathouse, Brian Hagel and Tolulope Isinkaye of the Clinical Application Coordinators team for building and modifying templates. Dr. Deeds and Dr. Hagan contributed equally as co-first authors. Data for this report were developed by the Analytics and Business Intelligence department, Veterans Affairs Puget Sound. Mr. Grandjean had full access to all the data in the study. Dr. Deeds and Dr. Hagan take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding: This work was supported by the VHA Office of Primary Care.

Competing Interests: The authors declare no conflicts of interest.

References:

1. Holshue ML, Debolt C, Lindquist S, et al. First Case of 2019 Novel Coronavirus in the United States. N Engl J Med. 2020;382(10):929-936.

2. Nelson KM, Helfrich C, Sun H, et al. Implementation of the patient-centered medical home in the Veterans Health Administration: associations with patient satisfaction, quality of care, staff burnout, and hospital and emergency department use. JAMA internal medicine. 2014;174(8):1350-8.

3. Centers for Disease Control and Prevention. 2020. Healthcare Facilities: Preparing for Community Transmission. [online] Available at: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-hcf.html> [Accessed 4 May 2020].

4. Halm EA, Fine MJ, Kapoor WN, Singer DE, Marrie TJ, Siu AL. Instability on Hospital Discharge and the Risk of Adverse Outcomes in Patients With Pneumonia. Arch Intern Med. 2002;162(11):1278–1284.

5. Centers for Disease Control and Prevention. 2020. Coronavirus Disease 2019 (COVID-19). [online] Available at: <https://www.cdc.gov/coronavirus/2019-nCoV/hcp/clinical-criteria.html> [Accessed 9 April 2020].

6. Qualitative Data. Consolidated Framework for Implementation Research. 2019. https://cfirguide.org/evaluation-design/qualitativedata/. Accessed June 2020.
van der Sijs H, Aarts J, Vulto A, Berg M. Overriding of drug safety alerts in computerized physician order entry. *J Am Med Inform Assoc.* 2006;13:138–47.
Text Box 1. COVID-19 Screening Note Template with Data Elements

Symptoms:
(A) Fever:
   Objective > 38 C or 100.4 F: [ ] yes [ ] no
   Subjective: [ ] yes [ ] no
(B) Lower Respiratory Symptoms:
   Cough   [ ] yes [ ] no
   Shortness of breath   [ ] yes [ ] no

Epidemiologic Risk:
(C) Close contact with COVID-19 + patient within 14 days of symptoms:   [ ] yes [ ] no
   If yes, date and details of contact:
(D) Travel from China, Iran, Europe, Japan, Hong Kong, or Kirkland LifeCare Center
   within 14 days of symptoms: [ ] yes [ ] no
   If yes, date and details of travel:

[ ] COVID-19 Suspected due to:
   [ ] {Fever OR Cough OR Shortness of Breath} – AND – {COVID-19 close contact
   within 14 days of symptoms}
   [ ] {Fever AND [Cough OR Shortness of Breath]} – AND – {High Risk Travel within 14
   days of symptoms}
   [ ] Does not meet criteria above, but clinician still has suspicion for COVID-19 EITHER
   due to presence of viral symptoms in a patient with high risk medical conditions OR
   due to patient’s high risk for exposure.

Stability:
[VITALS TODAY]
   Stable Vital Signs   [ ] yes [ ] no   [ ] N/A (phone)
   Normal Mental Status  [ ] yes [ ] no
   Adequate PO intake  [ ] yes [ ] no
   Adequate home support: [ ] yes [ ] no
   Stable for home (yes to all above):   [ ] yes [ ] no

Plan of Care:
[ ] Do NOT suspect COVID and stable:
   Stay at home until symptoms resolve, offer empiric oseltamivir (Tamiflu) if symptoms <
   48 hours
[ ] Do NOT suspect COVID and unstable:
   Send to ER and notify ER (ext xxxxx). Severe symptom patients without alternative
   diagnosis may
   still be considered for COVID in ER.
[ ] Suspect COVID and stable:
   Home Isolation (<click here for Washington DOH Guidance>) x 14 days.
[ ] Suspect COVID and unstable:
   Send to ER and notify ER (ext xxxxx) or EMS. Notify VA Infection Control.

Text box 1 Legend
Text box 1 shows the text of the COVID-19 screening note template from March 12th 2020. Using the template, the author determined if COVID was suspected, then assessed stability of the patient. Based on these assessments a plan of care and categorization was determined by the author. Data elements are embedded within the Plan of Care categories. The text below each data element option provided recommendations to the note’s author and was not included in the final note document.
Figure 1. Flow of Outpatient Screening at VA Puget Sound

Veteran requests evaluation of symptoms through call center, or veteran has upcoming face-to-face appointment.

Clinic associate or administrative clerk performs primary screen.

Screen Positive:
RN Care Manager conducts secondary screen. PACT PCP alerted to all secondary screen results.

Screen Negative:
MSA to reschedule face-to-face appointment to video or phone.

Stable/unsuspected:
MSA to reschedule face-to-face appointment to video or phone.

Stable/suspected:
Patient offered testing, and enters care management pathway. Symptoms and clinical stability monitored by RN telephone contact at day 2, 7, and 14 after initial secondary screen.

Unstable/unsuspected:
Warm handoff to acute care clinician, who facilitates transfer to ER.

Unstable/suspected:
Warm handoff to acute care clinician, who facilitates transfer to ER.

Primary screen is positive if patient has any of the following: recent contact with COVID-19+ person, recent high risk travel, fever, cough, or shortness of breath.
Figure 2. Trends for Patients Screened Positive with COVID-19 Screening Note

Screening began March 5th. Gray bar represents the total number of veterans screened that week.
January 21st: First confirmed US Case in Puget Sound.

February 29th: First COVID-19 death announced in WA State.

February 24th: Incident Command at VA Puget Sound.

March 3rd: Primary care leadership identified a need for screening process and partnered with informatics to develop screening note template with health factors for tracking cases.

March 5th: First iteration of local template and screening note ("COVID-19 Outpatient Screening Note") deployed. Dashboard created of daily trends in stable/unstable suspected/unsuspected patient screens.

March 9th: Primary screening note/template prior to all clinical encounters implemented.

March 10th: Data analytics presents primary and secondary screening templates with health factors to National COVID Surveillance Call. Template shared with all VIGNS.

March 12th: Changes made to criteria for suspicion and epidemiologic risk factors.

March 13th: National COVID-19 primary screening template created. Local note modified to integrate national template.

March 31st: CDC Priority Grouping for testing, and updated guidelines on isolation incorporated into template [3]. VA Puget Sound hosts inpatient testing.

April 1st: Sections added for pre-procedure or pre-imaging screening.

Figure 3. COVID Key Dates and Note Development Timeline.
All authors verify we have no conflicts of interest, financial or otherwise, to declare.

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