Received: 28 March 2021 | Revised: 28 April 2021 | Accepted: 12 May 2021

DOI: 10.1002/emp2.12468

JACEP OPEN
JOURNAL OF THE AMERICAN COLLEGE OF EMERGENCY PHYSICIANS OPEN
A GLOBAL JOURNAL OF EMERGENCY MEDICINE
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CONCEPTS

Infectious Disease

COVID-19 and beyond: Lessons learned from emergency department HIV screening for population-based screening in healthcare settings

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Funding and support: By *JACEP Open* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see www.icmje.org). The authors have stated that no such relationships exist.

Abstract

Emergency departments (EDs) have played a major role in the science and practice of HIV population screening. After decades of experience, EDs have demonstrated the capacity to provide testing and linkage to care to large volumes of patients, particularly those who do not otherwise engage the healthcare system. Efforts to expand ED HIV screening in the United States have been accelerated by a collaborative national network of emergency physicians and other stakeholders called EMTIDE (Emergency Medicine Transmissible Infectious Diseases and Epidemics). As the COVID-19 pandemic evolves, EDs nationwide are being tasked with diagnosing and managing COVID-19 in a myriad of capacities, adopting varied approaches based in part on know-how, local disease trends, and the supply chain. The objective of this article is to broadly summarize the lessons learned from decades of ED HIV screening and provide

Supervising Editor: Nathan Hoot, MD, PhD.

guidance for many analogous issues and challenges in population screening for COVID-19. Over time, and with the accumulated experience from other epidemics, ED screening should develop into an overarching discipline in which the disease in question may vary, but the efficiency of response is increased by prior knowledge and understanding.

KEYWORDS
COVID, emergency departments, HIV, population screening

1 | INTRODUCTION

Emergency departments (EDs) have played a major and ever-increasing role in the science and practice of population screening for HIV.[1,2] Knowledge gained during the past 2 decades is broad, spanning areas such as patient and physician engagement, patient selection strategies, linkage to care approaches, operational innovations, systems engineering approaches, and health economics.[1,3–9] Perhaps most important, EDs have demonstrated the capacity for providing testing and linkage to care for large numbers of people from all segments of the population, including those without other points of contact with the healthcare system.[10–12]

The ED also provides an opportunity to leverage its unique place within the healthcare system and play a significant role in supporting surveillance for emerging infectious disease outbreaks. For example, EDs have played an important role in monitoring trends for infectious diseases such as influenza, and most recently, severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), commonly known as COVID-19. COVID-19 continues to evolve and has emerged as one of the most historical pandemics of the world, with the United States leading the world in terms of total number of cases. EDs nationwide are being tasked with diagnosing and managing COVID-19 in a myriad of capacities adopting varied approaches based in part on know-how, local disease trends, and the supply chain. In the United States, EDs have, and will continue to be, called on to engage more broadly in public health strategies for purposes of surveillance, triage, case detection, and linkage to care to improve both individual patient care as well as the health of the population they serve.

Efforts to expand ED HIV screening in the United States have been accelerated by a collaborative national network of emergency physicians and other stakeholders from infectious diseases and public health, originally called the National ED HIV Testing Consortium, but more recently reorganized to address broad infectious disease challenges under the name EMTIDE (Emergency Medicine Transmissible Infectious Diseases and Epidemics). The objective of this article is to broadly summarize applicable lessons from over two decades of our collective experience with integrating ED HIV screening and linkage to care into ED practice. Selected experiences might be used to help plan, integrate, and optimize population-based screening approaches for COVID-19. The conceptual framework and specific lessons described herein should be informative for ED planning and practice but also have relevance for large-scale population screening in other clinical settings. This discussion is informed both by the published literature and the collective experiences of the EMTIDE investigators.

2 | LESSONS LEARNED

2.1 | Conceptual framework

As the body of research on HIV screening in EDs increased, there was recognition of the need for developing a conceptual framework[1,3] and nomenclature[4] to ensure the emerging evidence base would be interpretable and comparable. Many elements of that overall conceptual model should have enduring value for other population screening efforts (Figure 1). Regardless of the disease, within the ED there are specific considerations regarding how patients are selected, consented, tested, notified, and counseled. Taking these considerations into account will inform the operational plan, strategies for scalability, sustainability, and financial stability. Shared, common definitions ensure that researchers and policymakers can communicate effectively and compare and contrast outcomes across different settings to establish best practices.

In this article, we discuss 3 key themes surrounding our decades of experience with ED HIV screening programs and discuss relevant lessons that bear consideration in developing screening/testing approaches for COVID-19 and other infectious diseases in ED settings. The themes include the following: (1) diagnostic considerations (ie, type of diagnostic assay, test accuracy), (2) screening operations (ie, responsible staff, sample collection, patient selection) and post-testing considerations (ie, result notification, education, and counseling), and (3) public health surveillance and epidemiology (ie, population and sentinel surveillance).

2.2 | Diagnostic considerations

A primary issue in detecting HIV is the way in which virologic, immunologic, and clinical manifestations vary from person to person and change during the disease course. Non-specific symptoms, lack of symptoms, and ability to transmit unknowingly while asymptomatic are important challenges in both HIV and COVID-19 infection. These factors influence priorities in who should be screened, at what stage in the course of their illness, and with which assay technologies.

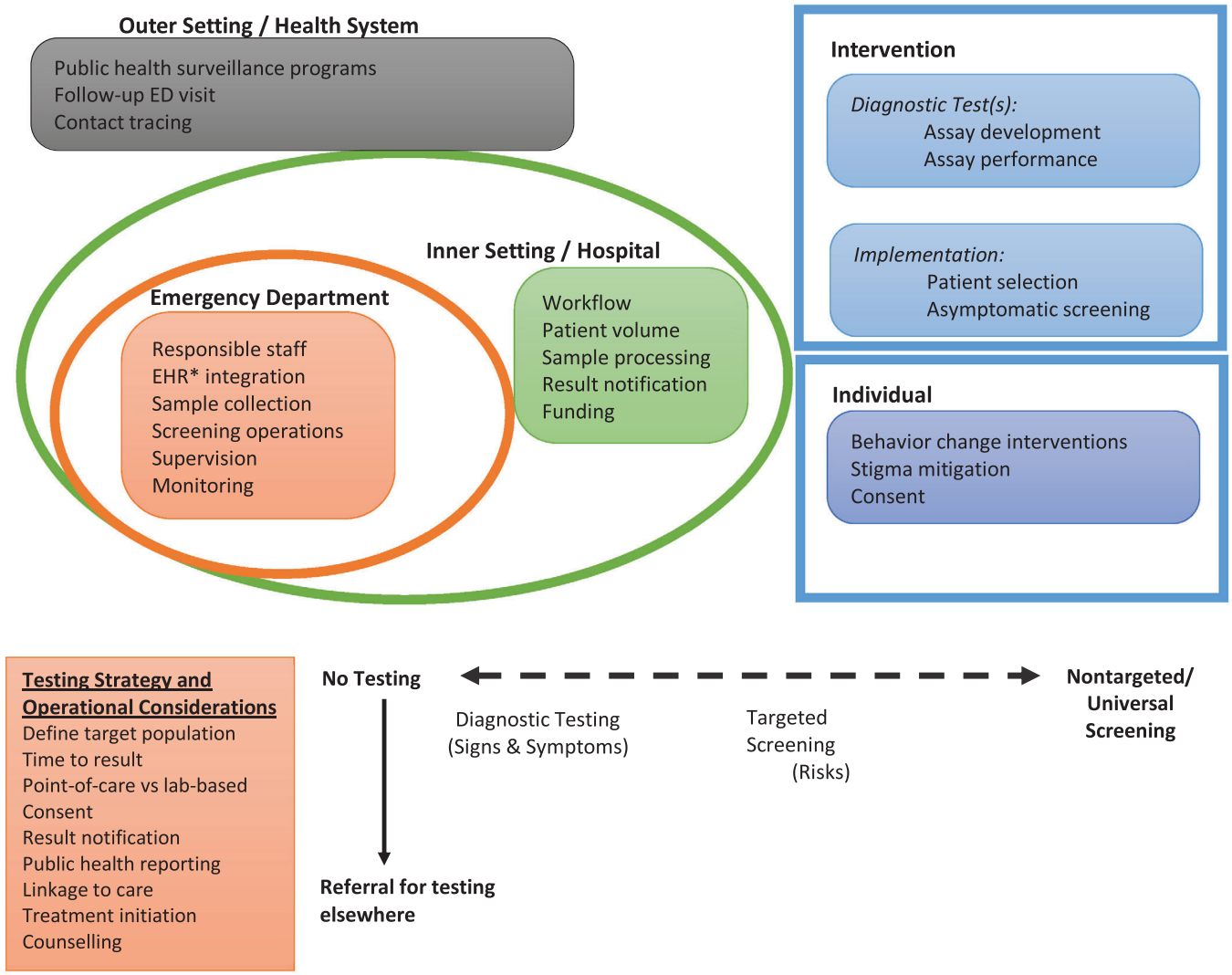

FIGURE 1 Conceptual framework of population-based screening in healthcare settings. This figure depicts the conceptual model of ED population-based screening for any current or future infectious disease, with operational considerations applicable to any healthcare setting. Adapted from HIV screening models and the Consolidated Framework for Implementation Research (CFIR). ED, emergency department; EHR, electronic health record

2.2.1 | Pathogenesis and asymptomatic infection

HIV progresses through a typical pattern in which replication of virus precedes, and is eventually attenuated by, immune response. Patients with acute symptomatic infection typically develop symptoms 2 to 4 weeks after HIV exposure, just before peak viremia.[13] However, an estimated 10%–60% of individuals with early HIV infection will not experience symptoms.[13] If patients do experience symptoms, they may be so mild that the patient does not seek medical attention. Even if the symptoms are severe or lead to a medical encounter, the presentation is typically non-specific and often undiagnosed.[13] The person then remains infectious despite the resolution of symptoms. Approximately 30% of HIV transmissions occur from persons with undiagnosed infection.[14] Screening patients who are unaware of their HIV status, or even their risk for infection, is recommended as the only way to detect infection that is otherwise invisible to both patient and healthcare staff.[1,5,15] As we learn more about COVID-19 transmission after acute symptoms wane (including but not limited to the magnitude, duration, and protection of antibody response), we understand from ED HIV screening the importance of screening asymptomatic patients for COVID-19 to minimize transmission. Developing best practice for doing this remains a challenge.

2.2.2 | Benefits of earlier diagnosis

Benefits of earlier HIV diagnosis for reduced transmission are clearly demonstrated, although they depend on individual behavior change, notification and testing of known contacts, and treatment to reduce infectiousness.[5,16] Earlier diagnosis improves individual health outcomes if treatment is available and taken.[1,5,6,15,16] The effectiveness of treatment options such as monoclonal antibodies for early mild to moderate COVID-19 infection is promising but remains under investigation

at the time of writing this article. However, early diagnosis of COVID-19 can result in reduced disease transmission from individual behavior change (self-quarantine) and notification and testing of known contacts (contact tracing performed by both patient and local health departments), similar to HIV.

2.2.3 | Assay technologies

The utility of available assays varies by disease stage. Nucleic acid testing (NAT) identifies HIV genetic material and can detect disease earlier than other methods.[17] HIV NAT is now widely available but remains expensive and does not provide rapid results. Combining multiple patient samples ("pooling") enables NAT to be used for mass screening,[18] but this is contingent on a low disease prevalence and the ability to combine many samples without loss of test sensitivity or increased contamination. Antigen assays have the advantage of detecting most infections that would be found by NAT with more rapid result availability and reduced cost, but because of decreased specificity, requires confirmation with NAT for diagnosis.[19] Antibody assays indicate infection, but are not sensitive in the earliest stages of disease (before antibodies have been formed) and do not indicate current viral load and the corresponding degree to which the person is infectious. Because HIV does not lead to immunity or halt pathogenesis, population prevalence of the antibody is always a marker of the proportion with ongoing infection and is not a marker of the proportion no longer infectious and no longer susceptible to disease. Although a detailed description of COVID-19 assay technologies is beyond the scope of this article, EDs will need to continue to be at the cutting edge in terms of integration of optimal assay selection for our setting. Issues to be attentive to include the need for educating both administrators and clinicians regarding selection of approaches for mass screening (versus individual testing), potential utility of different assays for different stages of disease, and the need for regular clinician training regarding the decision making associated with specific assays based on the performance characteristics of the assay being used.

2.2.4 | Assay accuracy

Test accuracy was a primary concern in the beginning of the HIV epidemic. The availability of a highly accurate HIV assay has been fundamental to screening acceptability and epidemic control. False negative tests could lead to inappropriate reassurance and prevent the benefits that occur with earlier diagnosis. False positive tests could lead to psychosocial consequences, additional unnecessary testing, and even treatment that is both unnecessary and potentially harmful. The combination of these factors creates a paradigm in which preliminary assays are used initially and then followed with additional confirmatory testing if positive. Initial "screening" assays are desirable if easier to perform, have quicker results, and are less costly, but also sufficiently sensitive to be acceptable. However, if inadequately specific, then significant frustration with false positive results can occur. Confirmatory testing often entails additional cost and delay, which is considered acceptable given the need for near perfect specificity. A key operational question in HIV screening has been how to capture the biologic sample for confirmatory testing at the same time as initial screening to avoid the inefficiency and lack of compliance with repeat sample collection after a positive screening test. Currently, balancing test accuracy with the convenience of testing represents a primary diagnostic consideration for any infectious disease, including both HIV and COVID-19. Given the enormous advances that have been made in assay development during the past several decades, since the beginning of the HIV epidemic, bringing rapid testing to EDs for SAR-CoV-2 was possible in the earliest phases of the pandemic. Rapid polymerase chain reaction (PCR) assays have permitted some EDs to develop more effective rapid approaches to evaluating patients with suspected COVID-19. Unfortunately, supply chain issues were and continue to be a major challenge for many medical centers across the United States with major impacts on ED workflows and patient care.

2.3 | Screening operations

Perhaps the most important lesson from the ED HIV screening experience is that there are multiple approaches, and in the absence of a comparative study demonstrating one best approach, variation between centers is acceptable and leads to innovation. In this section, we present the system-level innovations that have allowed for operationalizing and integrating HIV testing into EDs.

2.3.1 | Responsible staff

A first question when adding any new activity to clinical practice is who will accomplish that activity. Some EDs have delegated HIV testing actions to adjunct staff that function in parallel with usual ED staff and are funded by outside sources separate from the usual healthcare revenue cycle.[3] This has the benefit of ensuring the testing occurs without interfering with other ED clinical care. Disadvantages include the cost and difficulty in bringing the process to scale, a potential delay in implementation by usual ED staff as they instead become accustomed to thinking of HIV testing as separate from their roles and responsibilities, and the lack of sustainability as seen when externally funded.

Integrating HIV screening into the usual activities of ED staff has been associated with much larger testing volumes and capitalizes on usual healthcare workflows that are already established (eg, use of the hospital laboratory as would be the case for any other test). This raises the question of how to make the activity acceptable to ED staff. To date, implementation efforts have largely focused on staff education, avoidance of new or burdensome tasks, and integration of prompts to act within electronic health records systems[7,20] often within triage nurse[21,22] or patient registration[8,23] workflows. During the COVID-19 pandemic, most EDs screened for SARS-CoV-2 at the onset of the ED encounter (immediately before or during triage) as a result of isolation and transmission concerns, rather than trying to intentionally increase

screening rates. In addition, screening often occurred in geographically isolated areas, such as medical tents, separate from the main ED, which further limited widespread screening efforts. However, as healthcare and public health pushed to increase screening among key populations, routine triage COVID-19 screening and automated testing practices became standard practice in some EDs. Of note, even in systems where testing (either HIV or COVID-19) is accomplished by usual ED staff, most programs have delegated result notification and linkage-to-care activities to external program staff or, less commonly, social work or health services staff employed by the ED. Furthermore, EDs often have partnered with local public entities, such as local health departments for notification of both HIV and COVID-19 results.

2.3.2 | Sample collection and assay processes

Large-scale systematic screening is more efficient when result turnaround time (TAT) is sufficiently short to act on the test result while the patient is still present within the same clinical encounter in which the sample was collected. When this is possible, the volume of work in contacting patients to notify them of results and encourage appropriate action according to the test result is greatly reduced. Short TATs can be achieved in 1 of 2 ways. The first is a 'rapid' bedside assay for which results are quickly available (ie, minutes) and there is no need to transport the specimen to a central laboratory.[4,24] In general, this approach has not resulted in the largest possible testing volumes because of the time required for parallel program staff or ED staff to process the assay, the logistical challenges to process many assays simultaneously, and the inability in most cases for rapid test kits to detect very early infection using p24 antigen testing. The alternative is to send the sample to a central lab in a rapid way such that usual processes and assays are completed sufficiently quickly. This functionally approximates (ie, 1–2 hours) that rapid assay TAT (ie, still available before most patients are discharged).[24] This approach has resulted in larger testing volumes because it leverages the usual processes and samples can be batched and processed on automated platforms.[5] SARS-CoV-2 assay processes and TATs vary nationwide based on the availability of resources; however, the concepts of how samples are processed and subsequent patient result notification have significant downstream consequences for EDs, health systems, and local public health. It is important to recognize that the health system decision making around epidemic and pandemic response may not always be in line with what seems logical or in the best interest of the ED. It is of ever-increasing importance that ED administrators and clinician thought leaders have a seat at the table when addressing decisions for individual healthcare systems around best approaches to testing.

2.3.3 | Approaches to patient selection

HIV screening approaches include diagnostic testing when there are signs or symptoms of illness, targeted (or risk-based) screening, and non-targeted (commonly referred to as 'routine' or 'universal' despite falling short in practice) screening without consideration of risk.[3,25] Complicating this classification scheme is the fact that this refers to the intent of the person ordering the test and not patient characteristics. For example, a person might order a diagnostic test when the patient was also eligible for targeted screening or a person screened under a non-targeted strategy might also have had signs or symptoms of illness as indications for diagnostic testing.

Applicable to both HIV and COVID-19, local disease prevalence, symptomatology of the disease, site-specific testing capacity, and availability of funding influence which screening approach is preferable. Diagnostic testing has been suggested as a minimum level of specialty engagement, as the pursuit of a diagnosis for a patient's presenting complaint is fairly consistent with the medical mission of emergency medicine.[26] Even if this was fully implemented, it would be insufficient to capture most patients who have either no symptoms or highly non-specific symptoms.[2,25]

Screening of patients without symptoms requires an embrace of a public health mission and more of a departure from the core specialty mission of emergent stabilization of individual patients. Screening also requires a more systematic, scaled, and streamlined operational focus that considers a process for massive numbers of patients rather than standard medical care for an individual patient.[21,22] Because population health and mass screening are relatively new to emergency medicine, EDs are already overwhelmed,[27] and healthcare financing is even more complicated for new initiatives than for long-standing initiatives, the issue of screening remains controversial.[28]

Once a center has embraced HIV screening, there is the decision about the degree to which the screening will be limited. To some degree, the volume of tests is limited simply because of imperfect implementation fidelity. To date, even with successful large-scale testing of thousands of patients, no center has succeeded in truly universal HIV screening.

It is also possible to limit screening only to those with recognized risk above that of the baseline population (as witnessed in the beginning of the COVID-19 pandemic). This too remains controversial. Non-targeted HIV screening is recommended by health authorities in most cases.[29] Also, non-targeted HIV screening in many urban EDs could be considered a form of risk-targeted screening simply because of overall ED population characteristics. Targeted screening is, at least theoretically, a means to capture a reasonable number of positive cases with a reduced number of required tests. Moreover, the yield of targeted HIV testing has been low, even if exceeding recommended thresholds of non-targeted screening.[6] Nonetheless, targeted strategies are criticized for being stigmatizing and missing persons without known or reported risk. In practical terms, the best approaches for operationalizing both HIV and COVID-19 risk assessments (which questions and how asked) have yet to be elucidated. ED-based research will be important in guiding the best approaches for COVID-19 patient selection, which will evolve over time as the epidemiology of the disease, clinical presentation, and testing supply chains evolve.

2.4 | Post-testing considerations

2.4.1 | Result notification

Result notification is imperfect for many diseases. The importance of reliable result notification arguably increases proportionally to the severity of the illness, risk of community transmission, and local and regional resources dedicated to finding and delivering test results. HIV result notification has varied by center and over time, with similar variation anecdotally seen in COVID-19. Investment in communicating negative test results has waned over time, as many patients receive negative results in real time, and there has been more acceptance of the idea that "no news is good news." Communication of positive results is paramount because there is a need for action that cannot occur until the knowledge is shared. This also applies when testing is inconclusive because the patient's status is still unknown and potentially positive. The process for communication of positive results is much easier when the patient is still present when the result becomes available. When this is not the case, many dedicated ED testing programs have found a way to notify patients using either existing workflow for calling patients with results, social workers, or parallel program staff. In some cases, result notification has been delegated to health departments.

2.4.2 | Education and counseling

Although counseling is the most commonly used term in standard discourse, an advance in HIV screening practices has been distinguishing between education (knowledge transfer necessary but not sufficient for behavior change) and counseling (behavioral interventions specifically intended to motivate change).[4] Counseling interventions have been described for HIV, but have rarely been implemented in the ED setting.[30,31] Counseling is no longer a required adjunct to testing and is resource intensive. The degree to which HIV education or counseling improves or reduces risk behavior is not well characterized.

Education and counseling procedures vary greatly in ED HIV screening. At one extreme, and especially when test results are negative, there may be no education. Undefined (ie, at provider discretion) education, paper handouts, and printed discharge instructions are all minimally resource intensive. More advanced efforts include video presentation[32,33] or structured in-person education often provided in conjunction with formal counseling. It could be argued that education and counseling for individuals who test negative (whether for HIV or COVID-19) is equally important for disease prevention.

Regardless of modality used or disease, there is the question of who will provide the service, how it will be accomplished, and with what fidelity. In general, there is always the balance between the opportunity to provide education or counseling to a high-risk population not otherwise receiving intervention versus feasibility challenges and expected efficacy of the intervention. The priority currently remains with increasing testing volumes, even if that entails missed opportunities for either HIV or COVID-19 educational or counseling intervention.

2.4.3 | Patient follow-up

The success of HIV linkage to care is highly dependent on obtaining accurate patient contact information during the index visit, identifying secondary contacts, immediate patient-centered contact in the ED to maintain a follow-up relationship, re-engaging with patients during subsequent visits, and re-linkage to care when patients have fallen out of care.[34,35] Although the notion of patient follow-up is not intuitive in the ED setting, the additional necessity of COVID-19 source control, contact tracing, and result notification makes reliable follow-up information essential. The intensity and reliability of processes to ensure accurate contact information and secure follow-up are highly variable but tend to be more robust when there is dedicated staff to focus on these issues and the patient is found to be positive. With any current (COVID-19) or future infectious disease, the degree to which healthcare systems engage in patient follow-up is essential to the screening cascade.

2.4.4 | Contact tracing

Contact tracing is a standard component of epidemic control and is one of the many reasons why diagnosis has value for public health.[36] Once a person is diagnosed, it becomes possible to interview that person to identify known contacts who may have been exposed or are unknowingly infected. Those contacts can then be notified of their need for testing. EDs have been diligent about communicating positive results to public health partners to facilitate contact tracing.[9] Lessons from HIV and sexually transmitted infection contact tracing can be used in COVID-19, specifically i) the use of an existing and/or functional contact tracing or disease intervention specialist network (local versus central system, local is preferred[37]), ii) the use of Health Insurance Portability and Accountability Act of 1996[49]–compliant technology to interact with and inform contacts,[37,38] iii) the importance of patient privacy in order for patients to be complaint with contact tracing procedures,[38] iv) the principle that certain thresholds of contact success and behavioral change must be met for contact tracing to be successful,[36] and v) an understanding that partnership with public health is critical.

2.4.5 | Stigma

For both HIV and COVID-19, social stigma and discrimination among affected patients, social contacts, and healthcare workers is real and can be emotionally crippling.[39,40] Both verbal and physical violence toward infected patients and the healthcare staff who treat them is a reality. Families have shunned infected members and healthcare workers because of fear of transmission. Stigma held or even expressed by healthcare workers and administrators can be a key barrier to patient engagement and process improvement. On the other hand, efforts such

as the routinization of HIV testing in the ED and other settings have contributed to the destigmatization of HIV and HIV testing.[41]

2.5 | Public health surveillance and epidemiology

2.5.1 | Seroprevalence estimates

EDs have conducted a variety of seroprevalence studies in which samples are tested for HIV on a non-clinical basis.[6,31] These studies provide a valuable characterization of the ED population and trends over time. To the degree EDs access a broad segment of the surrounding population, these studies have broad public health relevance. They have also been helpful in motivating changes in ED practice, including the adoption of universal personal protective equipment recommendations and HIV screening. Finally, seroprevalence assessments provide a baseline epidemiologic measure against which screening program success can be measured. Seroprevalence studies have most often been conducted using discarded sample remnants in central laboratories[6] but have also involved biobanking approaches with prospective systematic sample collection from ED patients with later testing on a non-clinical basis. As an example, multiple HIV seroprevalence studies among populations seeking healthcare have indicated that HIV prevalence may be higher here than in the general population.[42,43] These estimates have been critical to HIV surveillance and are anticipated to be critical in COVID-19 surveillance and guide clinical and public health testing and linkage strategies.

2.5.2 | Aggregate data for population and sentinel surveillance

EDs also contribute to surveillance systems simply by virtue of aggregating and reporting their clinical testing data. With the advent of testing algorithms capable of detecting acute HIV, this role has now expanded to the detection of both acute and chronic infection,[5] with similar processes pertinent to ED-based COVID-19 detection. In addition to contributing data to existing systems for population surveillance, EDs may have an expanding role in sentinel surveillance. As HIV outbreaks increasingly occur[44–48, 50], EDs could play a role in either early identification of those outbreaks or guiding response as they evolve.

2.6 | Application of lessons learned

Although this synthesis of ED HIV experience should provide useful context and conceptual framework for any healthcare screening initiative, each new disease process will involve variations in technology, operations, and societal views. A review of COVID-19 detection is outside the scope of this article, however we note several important differences between HIV and COVID-19 that would influence screening approach. First and foremost, the importance of screening itself will differ from HIV and vary over time based on factors such as COVID-19 disease prevalence, increased COVID-19 vaccination, and the importance of early diagnosis in terms of improving treatment outcomes or limiting transmission. The benefit of screening may paradoxically be limited when COVID-19 prevalence is exceedingly high if the number of positives exceeds result notification and contact tracing capabilities. In that circumstance, extra support or efficiencies are required. We enumerated lessons learned from HIV screening to provide guidance for managing ED screening during COVID-19 peaks. Examples include increased reliance on health department resources such as disease intervention specialists, use of parallel but separate ED staff for result notification and contact tracing (ie, prevention staff, student workers, social work), and decreased investment in communicating negative results (ie, encouraging a "no news is good news" approach). As seen with HIV, potential options for funding include separately funding program support or incorporating healthcare financing either through additional payment for services rendered or recognition of downstream cost savings from health events prevented.

Differences in mode of transmission and time course of disease influence who is at risk, which in turn alters decisions about whether and how to target screening based on risk. Routine screening for COVID-19 could mirror universal HIV screening. The resource bur-

TABLE 1 Summary points of lessons learned from emergency department (ED) HIV screening

Background	EDs have played a major role in the science and practice of population screening for HIV and have demonstrated the capacity for providing testing and linkage to care for large numbers of people, including those without other points of contact with the healthcare system.
Objective	To broadly summarize applicable lessons from > 2 decades of collective EMTIDE[a] experience with integrating ED HIV screening and linkage to care into ED practice.
Diagnostic considerations	Virologic, immunologic, and clinical manifestations vary by person and change during the disease course, which influences factors such as who should be screened, at what stage in the course of their illness, and with which assay technologies.
Screening operations Post-testing considerations	Decades of ED HIV screening have proven that there are multiple approaches to screening operations, variations between centers are acceptable, variation leads to innovation, and operational approaches can and should be iterative. EDs, in collaboration with their healthcare systems and health departments, should identify and implement best practices in patient notification, education and counseling, and patient follow-up as part of their population screening process.
Public health	EDs contribute to surveillance systems by aggregating and reporting their clinical testing data. In addition to playing a role in populational surveillance, EDs may have an expanded role in sentinel surveillance.

EMTIDE, Emergency Medicine Transmissible Infectious Diseases and Epidemics.

den for routine (or repeated) COVID-19 screening promises to be even greater than HIV because of concerns for reinfection or infection after vaccination. If limiting screening to those with known exposure or symptoms (a risk-based approach), the number of people meeting this criterion remains quite high. Lastly, policy frameworks lead to differences in payment for testing, documentation of risk at the time of testing, and consent requirements. Even in these areas of difference, the need to systematically address such questions is highlighted by the framework provided.

In summary, this synthesis of lessons learned from decades of ED HIV screening (Table 1) should provide guidance for many analogous issues and challenges in population screening for COVID-19. Over time, and with accumulated experience from other epidemics, ED screening should develop into an overarching discipline in which the disease in question may vary, but the efficiency of response is increased by prior knowledge and understanding.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

Kiran Ann Faryar, Heather Henderson, Jason W. Wilson, and Michael S. Lyons conceived the idea and drafted the manuscript. All authors contributed to the design, reviewed the manuscript, and revised it critically for important intellectual content. All authors gave final approval of the version to be published.

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How to cite this article: Faryar KA, Henderson H, Wilson JW, et al. COVID-19 and beyond: Lessons learned from emergency department HIV screening for population-based screening in healthcare settings. *JACEP Open*. 2021;2:e12468. https://doi.org/10.1002/emp2.12468