ORIGINAL RESEARCH

Implementation of an Opt-Out Outpatient HIV Screening Program

*Cameron T. Miller, BS, Kristin S. Alvarez, PharmD, BCPS,
Ank E. Nijhawan, MD, MPH, Virali Soni, BS Pharm, MBA, Lena Turknett, RN,
Raja Paspula, MD, and Helen L. King, MD*

Background: **Screening rates for Human Immunodeficiency Virus (HIV) remain low despite guidelines by both the CDC and USPSTF recommending that all adolescents and adults be screened at least once. The aim of this quality improvement study was to increase HIV screening among eligible patients.**

Methods: **This quality improvement study assessed the impact of interventions to increase HIV screening in an outpatient population at a large urban safety-net hospital. Outcomes were compared from the preintervention (December 2020 to November 2021) to postintervention years (December 2021 to November 2022). Stepwise electronic alerts to prompt HIV screening paired with provider financial incentives were implemented. The proportion of eligible individuals screened for HIV were compared after intervention implementation.**

Results: **Average monthly HIV screening increased from 506 ± 97 to 2484 ± 663 between the pre- and postintervention periods, correlating to a 5.1-fold increase in screening (7.8% to 39.8%, *P* < .01). Increases were seen across all ages, and those aged 55 to 64 and 65+ had the highest relative increase in screening at 7.5 and 9.3-fold, respectively (*P* < .01). Screening rates increased for Hispanics (7.9% preintervention vs 43.6% postintervention, *P* < .01). In the pre- and postintervention periods, 41 patients with new HIV diagnoses were identified (13 preintervention and 28 postintervention) and 85.4% were linked to care within 30 days.**

Conclusions: **Stepwise interventions targeted at primary care clinicians are an effective way to increase HIV screening rates, particularly in older demographics. Earlier HIV diagnosis coupled with linkage to care is an important strategy in ending the HIV epidemic. (J Am Board Fam Med 2024;37:650–659.)**

Keywords: **Electronic Medical Records, Health Care Disparities, HIV Testing, Primary Health Care, Public Health, Quality Improvement, Screening**

Background

The Human Immunodeficiency Virus (HIV) epidemic persists in the United States (US) despite advances in effective antiretroviral options for prevention and treatment. By the end of 2019, the Centers for Disease Control and Prevention (CDC) estimated that 12,00,000 people in the US are living with HIV (PWH), of whom 13% are unaware of their diagnosis.[1] PWH who are unaware of their status contribute significantly to new infections, with an estimated transmission rate 3 to 7 times higher than people with known HIV.[2]

This article was externally peer reviewed.
Submitted 27 September 2023; revised 1 February 2024; accepted 12 February 2024.
From the University of Texas Southwestern Medical Center, Dallas, Texas (CTM); Parkland Health, Center of Innovation and Value, Dallas, Texas (KSA); University of Texas Southwestern Medical Center, Department of Internal Medicine, Division of Infectious Diseases and Geographic Medicine, Dallas, Texas (AEN); Parkland Health, Center of Innovation and Value, Dallas, Texas (VS); Parkland Health, HIV Services, Dallas, Texas (LT); Medical Director COPC, Parkland Health, Dallas, Texas (RP); University of Texas Southwestern Medical Center, Department of Internal Medicine, Division of Infectious Diseases and Geographic Medicine, Dallas, Texas (HLK).
Funding: Gilead Sciences FOCUS Award. In the U.S., the FOCUS Program is a public health initiative that enables partners to develop and share best practices in routine blood-borne virus (HIV, HCV, HBV) screening, diagnosis, and linkage to care in accordance with screening guidelines promulgated by the U.S. Centers for Disease Control and Prevention (CDC), the U.S. Preventive Services Task Force (USPSTF), and state and local public health departments. FOCUS funding supports HIV screening and linkage to a first appointment. FOCUS partners do not use FOCUS awards for activities beyond linkage to a first appointment.
Conflict of interest: None.
Corresponding author: Helen L. King, MD, 5323 Harry Hines Boulevard, Dallas, TX 75390-9113 (E-mail: helen.king@utsouthwestern.edu).

The federal Ending the HIV Epidemic (EHE) initiative, launched in 2019, aims to reduce new HIV infections in the US by 90% by 2030.[3] The EHE identified 57 priority jurisdictions that account for >50% of all new HIV diagnoses to target testing, treatment and prevention efforts. Having knowledge of one's HIV status provides the foundation for informed decisions about treatment or Pre-exposure prophylaxis (PrEP). In addition to lowering morbidity and mortality, avoiding 1 HIV infection is estimated to save $229,800 in health care expenditure.[4]

The CDC recommends universal HIV screening at least once for persons aged 13 to 64 and the USPSTF recommends it for persons aged 15 to 65.[5,6] Annual or more frequent HIV testing is recommended for those who are at substantial risk or for those who live in a high-prevalence setting on an opt-out basis.[7] However, national HIV screening rates remain suboptimal. Among >500 million combined visits made to clinics and emergency departments in the US between 2009 to 2017, HIV screening was conducted at less than 3% of all visits.[8] Barriers to HIV screening exist on multiple levels. Patients may underestimate their risk of acquiring HIV, not know where to request care, and be concerned about costs, stigma and confidentiality.[9–11] Clinicians may face time constraints, not be aware of current screening guidelines, or feel uncomfortable counseling patients on HIV test results.[11,12]

Successful approaches for overcoming HIV screening barriers include using an opt-out testing approach, expanding testing to diverse settings including emergency departments, family planning clinics, and correctional facilities, providing incentives to patients or clinicians and incorporating passive and active clinical decision support tools into electronic health records (EHRs).[13–23] New and sustainable strategies are needed to implement evidence-based approaches in real-world settings, particularly those prioritized by EHE and serving highly impacted groups.

In this quality improvement study, we sought to evaluate implementation of expanded HIV screening in Dallas county's large safety-net hospital system, Parkland Health. Dallas County is a priority jurisdiction of the EHE given its high HIV incidence, and Parkland provides care to a predominantly uninsured and underserved population. Specifically, we aimed to assess the impact of stepwise escalation of electronic interventions and provider incentive including EHR reminders and clinical support tools on (1) the proportion of eligible individuals successfully screened for HIV in the outpatient clinic system, (2) the number of individuals newly diagnosed with HIV, and (3) the characteristics and linkage to care rates of individuals diagnosed with HIV during the implementation phase.

Methods

Context

Data for this quality improvement project was obtained from the electronic health record (EHR, Epic, Inc., Verrona, WI) at Parkland Health outpatient facilities, which conduct more than 1.2 million patient visits yearly. Outpatient locations were categorized as adult primary care, youth family centers (YFCs), and homeless outreach (HOMES). This project was approved by the institutional Human Research Protection Program as a nonregulated research quality improvement project.

Interventions

The preintervention period was December 1, 2020, through November 11, 2021; postintervention period was December 1, 2021, through November 30, 2022.

Given Dallas County's EHE priority jurisdiction status, annual opt-out HIV screening was utilized for those in the CDC-recommended age range and a once per lifetime screening for all other adults. Our annual screening criteria included: Aged 13 to 64 years; no previous known diagnosis of HIV or previous positive confirmatory test within the EHR; and a scheduled outpatient clinic visit.

The first intervention was a passive EHR reminder for opt-out HIV screening enacted in December 2021 to prompt a once in a lifetime screen for all patients 13 years or older. This reminder is in a discrete health care maintenance section of the EHR patient face page that does not require active provider interaction. To further motivate clinicians, a performance-based financial incentive was initiated in January 2021 for primary care clinicians meeting health maintenance screening thresholds as defined by clinical leadership. The incentive quality metrics are selected annually, targets are set, and a pay for performance model employed. Lastly, an active EHR reminder, or best practice alert (BPA), was implemented February 2022 to prompt annual opt-out HIV screening for all patients aged 13 to 64. The BPA requires provider interaction to proceed with the patient encounter in which clinicians may opt to order the test or dismiss the alert with explanation. After their individual implementations, all 3 interventions remained in effect for the duration of the study.

HIV screening in the outpatient clinics was completed using a fourth generation HIV antigen/antibody (Ag/Ab) combination immunoassay. Reactive screens were followed by a reflex HIV-1/HIV-2 antibody differentiation immunoassay, and subsequent indeterminant tests were resolved with an HIV-1 nucleic acid amplification test. Of note, the EHR algorithm prompting screening alerts excluded patients who were known to have HIV in our EHR, however, patients who had been diagnosed externally would still be eligible for screening. We included those who had a known HIV diagnosis and were not in care to assess the impact of screening on linkage to care for these individuals. Patients with a known HIV diagnosis already receiving HIV care and those with no confirmatory testing within 180 days were excluded from analysis. For patients with a known diagnosis of HIV, we considered them out of care if they had been without antiretroviral therapy (ART) for >30 days. Linkage to care was defined as attending the medical intake visit.

Measures

We extracted data from the EHR for eligible patients and patients screened for HIV during the pre- and post periods and performed manual chart review for those with positive test results. Demographics characteristics were recorded for both pre- and post periods. To determine the proportion of eligible patients screened over time, screening rates for unique patients $\geq$ 13 years old eligible for a lifetime screen were calculated from the total eligible population who completed clinic visits during that period.

Analysis

A control chart was used to assess the impact of our interventions over time on lifetime HIV screening rates in the eligible population. Descriptive analysis of patient demographics was performed for both pre- and postintervention periods with statistical comparisons using Chi-square testing in SAS (SAS studio, SAS, Cary, NC). Patients were included only once in each period if they had multiple HIV tests. For those who tested positive, pre- and postintervention, outcomes were compared with Chi-square tests.

Results

Overall, the yearly average screening rate for those eligible for a once in a lifetime HIV screen increased from 7.8% to 39.8%, which represents a 5.1-fold increase in screening ($P < .01$) between the pre- and postintervention periods. The preintervention eligible population ($n = 68{,}879$) and postintervention eligible population ($n = 71{,}697$) are described in Table 1. The eligible populations from both periods were characterized with respect to age, sex, gender identity, race, ethnicity, and payor status. Most (>85%) of the eligible population was 35 or older for both pre- and postintervention. More than 60% of eligible patients were females for both periods. White individuals accounted for approximately 67.5% of eligible patients, followed by Blacks at approximately 27.5%. Approximately 60% reported Hispanic ethnicity.

Figure 1 depicts a control chart demonstrating the trends with HIV screening events for the eligible population over the 2-year period captured in this project. On average, there were 506 ± 97 HIV screenings per month preintervention and 2484 ± 663 screenings per month postintervention. In the initial months of the postintervention year, the monthly screening events exceeded the upper control limit ($+3\ \sigma$) for this process. Subsequently, they fluctuated within the control limits for 3 months before ultimately falling below the lower control limit ($-3\ \sigma$) by the year's end.

A total of 5,363 unique individuals were screened for HIV in the preintervention period and 28,542 in the postintervention period. There were 22 individuals excluded from analysis: 2 for lack of confirmatory testing and 20 due to having HIV screening despite already being diagnosed with HIV and in care. Screening results included 41 new diagnoses as well as 18 patients previously diagnosed with HIV who were not receiving ART (Figure 2).

Most HIV screenings took place in adult primary care clinics (90.3%) in both time periods, with 5.4% in HOMES, and 4.3% in YFCs. Of the 59 patients who tested positive and were identified as either a new HIV diagnosis or known HIV diagnosis out of care, 47 (79.7%) were tested in the

Table 1. **Demographics of the Eligible Population and the Population of Those Screened**

	Pre-Intervention Eligible Population ($n = 68,879$)	Pre-Intervention Screenings ($n = 5,363$)	Post-Intervention Eligible Population ($n = 71,697$)	Post-Intervention Screenings ($n = 28,542$)	Screenings *P*-value
Age					
13 to 24	4,082	896 (22.0)	4,600	1,933 (42.0)	<0.01
25 to 34	5,102	637 (12.5)	5,461	1,983 (36.3)	
35 to 44	11,243	1,108 (9.9)	11,531	4,880 (42.3)	
45 to 54	16,480	1,280 (7.8)	17,087	7,936 (46.4)	
55 to 64	17,377	1,091 (6.3)	17,742	8,395 (47.3)	
65+	14,595	351 (2.4)	15,276	3,415 (22.4)	
Legal Sex					
Woman	43,366	3,136 (7.2)	4,176	17,881 (40.5)	<0.01
Man	25,513	2,227 (8.7)	27,521	10,661 (38.7)	
Gender Identity					
Woman	43,286	3,133 (7.2)	44,080	17,856 (40.5)	<0.01
Man	25,447	2,217 (8.7)	27,453	10,646 (38.8)	
Transgender Woman	55	7 (12.7)	59	14 (23.7)	
Transgender Man	58	2 (3.4)	57	12 (21.1)	
Other	21	4 (19.0)	22	6 (27.3)	
Choose not to disclose	12	0	26	8 (30.8)	
Race					
American Indian	150	18 (12.0)	149	59 (39.6)	<0.01
Asian	2,281	81 (3.6)	2,189	678 (31.0)	
Black	18,891	1,552 (8.2)	19,715	6,888 (34.9)	
Other Pacific Islander	191	10 (5.2)	228	79 (34.6)	
Patient declines to respond	5	0	10	6 (60.0)	
Unknown	884	81 (9.2)	1,089	465 (42.7)	
White	46,477	3,621 (7.8)	48,317	20,367 (42.2)	
Ethnicity					
Hispanic	41,168	3,236 (7.9)	42,301	18,432 (43.6)	<0.01
Non Hispanic	2,7261	2,083 (7.6)	28,672	9,819 (34.2)	
Patient declines to respond	10	0	10	2 (20.0)	
Unknown	440	44 (10.0)	714	289 (40.5)	
Payor Status					
Commercial	3,333	345 (10.4)	3,423	1,477 (43.1)	<0.01
Medicare/Medicaid	18,204	1,067 (5.9)	18,209	5,602 (30.8)	
Charity	43,755	3,840 (8.8)	47,494	19,694 (41.5)	
Self-Pay	3,578	111 (3.1)	2,561	1,765 (68.9)	
Other (Tricare/Champva/ Worker's Comp)	9	0	10	4 (40.0)	

Note. The values in parentheses represent the percentage screened out of the eligible population for a given characteristic.

adult primary care clinics11 (18.6%) at HOMES clinics, and 1 (1.7%) at YFC clinics.

In the preintervention period, 35 (0.7%) of individuals tested for HIV had a positive result compared with 94 (0.3%) in the postintervention group. Of patients with a positive test result, 13 (37.1%) preintervention and 28 (29.8%) postintervention were identified with new HIV diagnoses. The proportion of patients with positive HIV tests that were known to have HIV and out of care decreased from 7 (20.0%) in the preintervention group to 11 (11.7%) in the postintervention group. In addition, the proportion of false positive screening tests determined on confirmatory testing increased in the postintervention period to 40 (42.6%) post intervention from 8 (22.9%) in the preintervention period.

Demographics for the pre- and postintervention population screened for HIV are described in

Figure 1. Lifetime HIV screenings before and after interventions to increase HIV screening. The control chart demonstrates the completion of lifetime HIV screening for the eligible population in the pre- and postintervention periods. Implementation of each intervention is illustrated over time. Intervention 1: Health care maintenance HIV screening alert implemented; Intervention 2: provider performance-based incentive for HIV screening initiated; Intervention 3: HIV screening BPA implemented. The red dotted lines represent the upper and lower control limits beyond 3 standard deviations from the mean. These values were recalculated after initiating interventions after 12/1/2021. The center blue line represents the average values before and after interventions. Colors of individual data points represent data stability (blue) and instability (red) per QI Macro rules. The pentagons numbered 1 to 3 represent the start point of the 3 interventions in order.

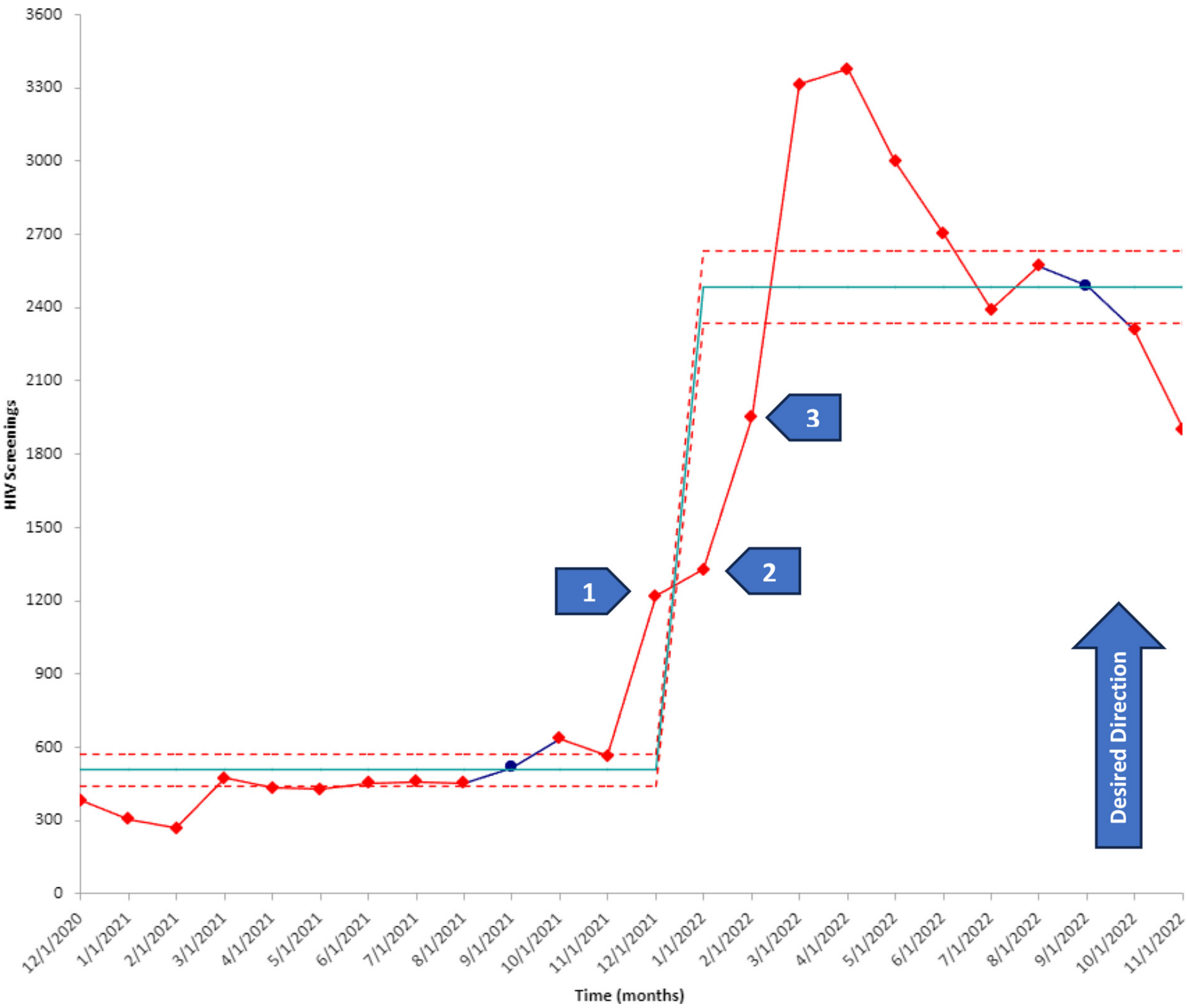
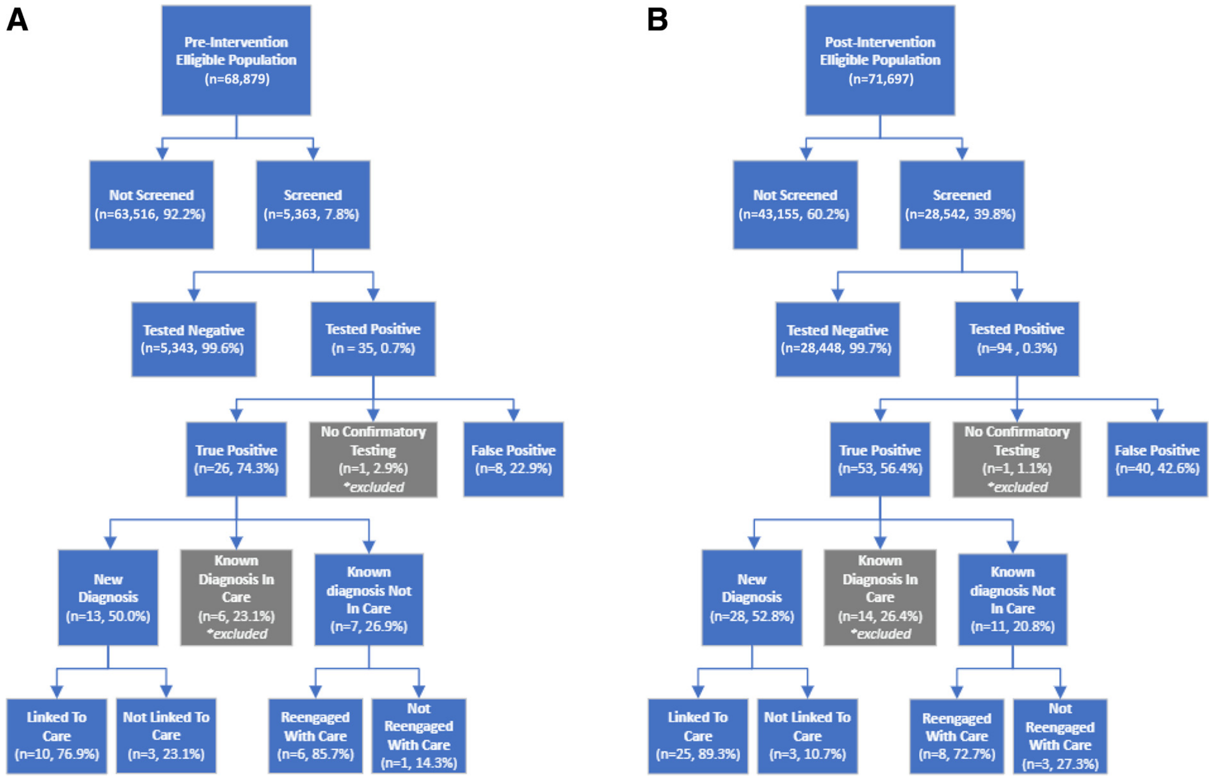


Table 1. Adults ≥ 35 were tested more frequently than adolescents and young adults in both periods. For the preintervention eligible population, the overall percentage of eligible individuals screened decreased as age increased as demonstrated with the youngest (13 to 24) bracket having the highest percentage of screening (22.0%) down to 6.3% for those aged 55 to 64. Of note, only 2.4% of those aged 65+, who were outside of the age 13 to 64 criteria, were screened. After the initiation of interventions, the proportion of eligible individuals who were screened within each age bracket between 13 to 64 rose significantly with 36% to 47% of eligible patients screened within each age bracket ($P < .01$); furthermore, even the screening of patients aged 65+ increased to 22.4%. Females were screened more frequently than males in both pre- and postintervention periods. Most patients did not have

Figure 2. Flowchart of patients screened for HIV in the pre- and postintervention periods. Figure 2A and 2B describe the number and portion of the eligible population screened, screening results, and subsequent linkage (or reengagement) to care for the pre- and postintervention timeframes, respectively.



answers related to sexual orientation recorded in the EHR, so this demographic variable could not be reliably assessed. Most patients screened for HIV in both study periods were Hispanic with a larger proportion of the population screened post-intervention being Hispanic (7.9% vs 43.6%, $P < .01$). Among non-Hispanic Black individuals, the portion of this population screened increased from 8.2% to 35.2% during pre- and postintervention periods. Most patients screened for HIV received charity care (71.6% and 69.0% in pre- and post period, respectively) or Medicare/Medicaid (19.9% and 19.6%).

Most patients identified with HIV through screening were linked or reengaged in care within 30 days. Overall, 81.3% in the preintervention group vs 80.8% in the postintervention group were linked to or reengaged in care within 30 days of positive screening result. Among new diagnoses, 76.9% vs 89.3% were linked to care within 30 days compared with those with known diagnoses out of care, 85.7% vs 72.7%, in the pre- and postintervention groups respectively.

Discussion

Implementation of an outpatient opt-out HIV screening program in a large, county, safety-net health system through stepwise provider electronic alerts led to a 5.1-fold increase in the lifetime HIV screening rate from 7.8% to 39.8%. In addition, 28 patients newly diagnosed with HIV and 11 patients with known HIV who were out of care were identified after the screening interventions. Similar quality improvement initiatives focusing on EHR reminders showed approximately 2-fold increases in screening rates with varying postintervention rates ranging from 3.34% to 30.7%.[14,19,22,23] The larger increase in screening in our study may be related to our approach of using multiple stepwise interventions as well as an institutional commitment to increasing HIV and STI screening which was identified as a priority through the Parkland Health and Dallas County Community Health Needs Assessment (CHNA).[24] Key stakeholder engagement and support on the institutional and county level through the CHNA initiative was critical to the success of our HIV screening program.

Although the number of individuals screened for HIV each month remained significantly higher throughout the postintervention compared with the preintervention year, there is a clear downward trajectory depicted in the control chart (Figure 1). Because our active EHR reminder is triggered annually, future investigation will determine if screening rates are both sustained and renewed beyond the first year. Although a large increase in screening was observed, 60.2% of eligible postintervention patients have not yet been screened for HIV. One of the potential constraints to further improvement in screening rates is provider alert fatigue.[25,26] Identifying provider attitude to currently implemented EHR reminders will allow for needed adjustments in interventions.

By transitioning to a standardized population-level screening approach rather than a targeted screening approach that varied by provider and setting, we were able to screen populations that previously were underscreened. For instance, we saw a larger proportion of HIV screening tests performed in adults over 55. In addition, the majority of the population screened for HIV were female and Hispanic in both study periods, though these groups did represent a larger proportion screened after the interventions, which is more aligned with our eligible population. More than 25% of patients did not have a recorded gender identity and more than 85% were not asked about their sexual orientation. By not documenting sexual orientation or gender identity, clinicians may make assumptions that can preclude appropriate risk-based follow-up discussion and testing.[27] Efforts should be made to increase sexual history documentation in routine clinic visits.

Notably, the CDC and USPSTF HIV screening recommendations differ in the recommended age for initiation of routine opt-out HIV screening (ie, 13 years for the CDC and 15 years for the USPSTF).[5,6] We adopted the CDC criteria for routine screening to cast a wider net and diagnose HIV earlier in adolescents and young adults, who account for 20% of new HIV diagnoses made in the U.S and 18% in Dallas County.[1]

HIV testing in locations outside of traditional medical settings is also an important component of a comprehensive screening program.[7] The scope of our study only included primary care visits, which excluded important testing locations outside of the traditional medical setting such as community outreach point-of-care (POC) screening events. Parallel to the time of our quality improvement project, there were 556 individuals screened at community outreach events that resulted in 21 true positive tests (16 new diagnoses and 5 known diagnoses not in care). Testing outside of the traditional clinical setting may reach a different population altogether, including people who do not seek medical care on a regular basis due to issues such as limited access to care or medical mistrust.[28,29] These complementary approaches to HIV screening are critically important to achieving EHE goals.

False positive HIV screening results can cause undue psychological stress to patients and medical providers.[30] With expansion to a population-based HIV screening approach, we saw an increase in the proportion of false positive results from 22.9% to 42.6% postintervention. The most likely explanation is that population-based screening expands to a lower prevalence population leading to higher false positive rates.[31] Although the risks of false positives can impact patients negatively, expansion of screening to a broader population led to increases in the number of patients with untreated HIV who were diagnosed and engaged in care. Without population-based screening, many of these patients may not have been diagnosed until much later leading to disease advancement and forward transmission of HIV. Medical providers must be aware of the potential for increases in false positive rates with population-based screening and plan approaches to discussing inconclusive or false positive results with patients that minimize undue psychological harm.

For those identified with a new HIV diagnosis or known HIV diagnosis out of care, there were high rates of linkage to care both before and after implementation of HIV screening interventions. Earlier ART initiation has been associated with improved viral suppression and decreases and HIV-associated morbidity and mortality.[32–34] Increasing linkage to care and decreasing time to ART initiation is an opportunity for continuous improvement with streamlining same day testing and appointments to this process. In addition, alternative techniques may be required to better engage, link, and retain patients in care who are previously known to have HIV and are out of care.

Clinical decision support tools, such as those implemented in this study, are commonly deployed in support of achieving public health goals. In contrast to these tools, the adoption of performance-based incentives represents a comparatively novel approach aimed at enhancing provider motivation. Other studies that use financial incentives in this manner show mixed success.[16,35–38] At the time of the EHR implementations, institutional leadership added HIV screening to a bundle of other quality metrics, providing an opportunity to include this as part of the stepwise intervention. There was a large increase in total screenings after the first month using the passive EHR reminder (1219 screened), a modest increase in the second month when the financial incentive began (1326 screened), and finally another large increase after the active BPA reminder (1951 screened).

Limitations

This study took place during the COVID-19 pandemic which may have impacted otherwise normal clinical operations. In addition, this study is rooted in the primary care setting of a large safety-net hospital system with most health care expenditures funded through charity. The results of this study may not generalize to health care systems which serve significantly different patient populations. Given the 1-month intervals between the introduction of successive interventions, we are unable to definitively ascertain their relative contributions to the observed increase in screening. Lastly, given the downward trajectory of screening rates over the course of the postintervention year, it is unclear if the increase in screening will remain sustained in subsequent years.

Conclusion

Using a combination of passive and active EHR reminders, as well as using a value-based care approach to incentivize clinicians, significantly increased HIV screening rates, particularly for older populations. Future continuous improvement measures should streamline these processes to support improvements to linkage to care, earlier ART initiation, and viral suppression for individuals identified with HIV through population-based opt-out HIV screening programs.

The authors thank Dr. Noel Santini and Parkland Health leadership for supporting implementation of routine opt-out HIV screening and the associate provider financial incentive. In addition, the team would like to thank the ACCESS Prevention and Testing Team and Parkland Community Health Workers, ACCESS Clinic leadership, the Community Health Needs Assessment (CHNA) Initiative leadership, and all Parkland Health primary care provider for supporting and sustaining this HIV screening initiative.

To see this article online, please go to: http://jabfm.org/content/37/4/650.full.

References

1. Centers for Disease Control and Prevention. HIV surveillance report, 2021; vol. 34. Available at: http://www.cdc.gov/hiv/library/reports/hiv-surveillance.html. Published May 2023. Accessed [June 28, 2023].
2. Burns DN, DeGruttola V, Pilcher CD, on behalf of the NIH-BMGF Finding Persons Unaware of Their HIV Infection Workshop, et al. Toward an endgame: finding and engaging people unaware of their HIV-1 infection in treatment and prevention. AIDS Res Hum Retroviruses. 2014;30:217–24.
3. Center for Disease Control and Prevention. Ending the HIV Epidemic in the U.S. (EHE). Available at: www.cdc.gov. Accessed May 15 2023. Available at: https://www.cdc.gov/endhiv/index.html.
4. Schackman BR, Fleishman JA, Su AE, et al. The lifetime medical cost savings from preventing HIV in the United States. Med Care 2015;53:293–301.
5. Center for Disease Control and Prevention. Implementing HIV testing in nonclinical settings: a guide for HIV testing providers. Accessed August 25, 2023. Available at: https://www.cdc.gov/hiv/pdf/testing/CDC_HIV_Implementing_HIV_Testing_in_Nonclinical_Settings.pdf.
6. Owens DK, Davidson KW, US Preventive Services Task Force, et al. Screening for HIV infection: US Preventive Services Task Force recommendation statement. JAMA 2019;321:2326–36.
7. Branson BM, Handsfield HH, Lampe MA, et al. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. MMWR Recomm Rep 2006;55:1–CE4.
8. Hoover KW, Huang YA, Tanner ML, et al. HIV testing trends at visits to physician offices, community health centers, and emergency departments—United States, 2009–2017. MMWR Morb Mortal Wkly Rep 2020;69:776–80.
9. Wise JM, Ott C, Azuero A, et al. Barriers to HIV testing: patient and provider perspectives in the Deep South. AIDS Behav 2019;23:1062–72.
10. Hutchinson AB, Corbie-Smith G, Thomas SB, Mohanan S, del Rio C. Understanding the patient's perspective on rapid and routine HIV testing in an inner-city urgent care center. AIDS Educ Prev 2004;16:101–14.
11. Leblanc NM, Flores DD, Barroso J. Facilitators and barriers to HIV screening: a qualitative meta-synthesis. Qual Health Res 2016;26:294–306.
12. Mohajer MA, Lyons M, King E, Pratt J, Fichtenbaum CJ. Internal medicine and emergency medicine physicians lack accurate knowledge of current CDC HIV testing recommendations and infrequently offer HIV

testing. J Int Assoc Physicians AIDS Care (Chic) 2012; 11:101–8.
13. DeMarco RF, Gallagher D, Bradley-Springer L, Jones SG, Visk J. Recommendations and reality: perceived patient, provider, and policy barriers to implementing routine HIV screening and proposed solutions. Nurs Outlook 2012;60:72–80.
14. Ford JS, Rouleau SG, Voong S, et al. Universal HIV screening in the emergency department: an interrupted time series analysis. AIDS 2022;36:1605–7.
15. Montoy JCC, Dow WH, Kaplan BC. Cash incentives versus defaults for HIV testing: a randomized clinical trial. PLoS One 2018;13:e0199833. Published 2018 Jul 6.
16. de Walque D, Gertler PJ, Bautista-Arredondo S, et al. Using provider performance incentives to increase HIV testing and counseling services in Rwanda. Journal of Health Economics 2015;40:1–9.
17. Luu MN, Wada PY, Levine-Hall T, et al. Using a report card to increase HIV screening in a large primary care group practice. BMJ Open Qual 2021;10:e000988.
18. Avery AK, Del Toro M, Caron A. Increases in HIV screening in primary care clinics through an electronic reminder: an interrupted time series. BMJ Qual Saf 2014;23:250–6.
19. Marcelin JR, Tan EM, Marcelin A, et al. Assessment and improvement of HIV screening rates in a Midwest primary care practice using an electronic clinical decision support system: a quality improvement study. BMC Med Inform Decis Mak 2016;16:76. Published 2016 Jul 4.
20. Vallée A, Sveltlane D, Trichereau J, et al. Electronic medical record alert increases HIV screening rates: the Foch hospital pilot POP-up project. BMC Health Serv Res 2022 Jun 16;22(1):784.
21. Tapp H, Ludden T, Shade L, Thomas J, Mohanan S, Leonard M. Electronic medical record alert activation increases hepatitis C and HIV screening rates in primary care practices within a large healthcare system. Prev Med Rep 2020;17:101036. Published 2020 Jan 7.
22. Kershaw C, Taylor JL, Horowitz G, et al. Use of an electronic medical record reminder improves HIV screening. BMC Health Serv Res 2018;18:14. Published 2018 Jan 10.
23. Goetz MB, Hoang T, Bowman C, The QUERI-HIV/Hepatitis Program, et al. A system-wide intervention to improve HIV testing in the Veterans Health Administration. J Gen Intern MED 2008; 23:1200–7.
24. Parkland Health and Dallas County Health and Human Services. Dallas County Community Health Needs Assessment 2022. Accessed August 25, 2023. Available at: https://www.parklandhealth.org/dallas-community-health.
25. Ancker JS, Edwards A, Nosal S, with the HITEC Investigators, et al. Effects of workload, work complexity, and repeated alerts on alert fatigue in a clinical decision support system [published correction appears in BMC Med Inform Decis Mak. 2019 Nov 18;19(1):227]. BMC Med Inform Decis Mak 2017;17:36. Published 2017 Apr 10.
26. Kawamanto K, Flynn MC, Kukhareva P, et al. A pragmatic guide to establishing clinical decision support governance and addressing decision support fatigue: a case study. AMIA Annual Symposium proceedings AMIA Symposium 2018;2018:624–33. Accessed June 30, 2023. Available at: https://europepmc.org/article/med/30815104.
27. Dichter ME, Ogden SN, Scheffey KL. Provider perspectives on the application of patient sexual orientation and gender identity in clinical care: a qualitative study. J Gen Intern Med 2018;33: 1359–65.
28. Bowles KE, Clark HA, Tai E, et al. Implementing rapid HIV testing in outreach and community settings: results from an advancing HIV prevention demonstration project conducted in seven U.S. cities. Public Health Rep 2008;123 Suppl 3: 78–85.
29. Delaney KP, DiNenno EA. HIV testing strategies for health departments to end the epidemic in the U.S. Am J Prev Med 2021;61:S6–S15.
30. Bhattacharya R, Barton S, Catalan J. When good news is bad news: psychological impact of false positive diagnosis of HIV. AIDS Care 2008;20:560–4.
31. Wiredja D, Ritchie TA, Tam G, Hogan CA, Pinsky B, Shi RZ. Performance evaluation and optimized reporting workflow for HIV diagnostic screening and confirmatory tests in a low prevalence setting. J Clin Virol 2021;145:105020.
32. Lundgren JD, Babiker AG, INSIGHT START Study Group, et al. Initiation of antiretroviral therapy in early asymptomatic HIV infection. N Engl J Med 2015;373:795–807.
33. Danel C, Moh R, TEMPRANO ANRS 12136 Study Group, et al. A trial of early antiretrovirals and isoniazid preventive therapy in Africa. N Engl J Med 2015;373:808–22.
34. Coffey S, Bacchetti P, Sachdev D, et al. RAPID antiretroviral therapy: high virologic suppression rates with immediate antiretroviral therapy initiation in a vulnerable urban clinic population [published correction appears in AIDS. 2019 Nov 1;33 (13):2113]. AIDS 2019;33:825–32.
35. Asch DA, Troxel AB, Stewart WF, et al. Effect of financial incentives to physicians, patients, or both on lipid levels: a randomized clinical trial. JAMA 2015;314:1926–35.
36. Bilardi JE, Fairley CK, Temple-Smith MJ, et al. Incentive payments to general practitioners aimed at increasing opportunistic testing of young women for chlamydia: a pilot cluster randomised controlled trial. BMC Public Health 2010;10:70. Published 2010 Feb 17.

37. Kalwij S, French S, Mugezi R, Baraitser P. Using educational outreach and a financial incentive to increase general practices' contribution to chlamydia screening in South-East London 2003-2011. BMC Public Health 2012;12:802. Published 2012 Sep 18.

38. Houle SK, McAlister FA, Jackevicius CA, Chuck AW, Tsuyuki RT. Does performance-based remuneration for individual health care practitioners affect patient care?: a systematic review. Ann Intern Med 2012;157:889–99.