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An emergency department registration kiosk can increase HIV screening in high risk patients

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Summary

We evaluated the feasibility and the patient acceptability of integrating a kiosk into routine emergency department (ED) practice for offering HIV testing. The work was conducted in four phases: phase 1 was a baseline, in which external testing staff offered testing at the bedside; phase 2 was a pilot assessment of a prototype kiosk; phase 3 was a pilot implementation and phase 4 was the full implementation with automated login. Feasibility was assessed by the proportion of offering HIV tests, acceptance, completion and result reporting. During the study period, the number of ED patients and eligible patients for screening were similar in the three main phases. However, the number and proportion of patients offered testing of those eligible for screening increased significantly from phase 1 (32%) to phase 3 (37%) and phase 4 (40%). There were slightly higher prevalences of newly diagnosed HIV with kiosk versus bedside testing (phase 1, 0%; phase 3, 0.2%; phase 4, 0.5%). Compared to patients tested at the bedside, patients tested via the kiosk were significantly younger, more likely to be female, to be black, and to report high risk behaviours. ED-based HIV screening via a registration-based kiosk was feasible, yielded similar proportions of testing, and increased the proportion of engagement of higher-risk patients in testing.

Introduction

Emergency Departments (EDs) are important in offering HIV screening in the US.¹ Over the past few years, they have adopted different methods of providing HIV tests, including diagnostic, targeted, non-targeted and universal screening.² This has resulted in successful identification and linkage to care, of many people with unrecognized HIV.³

Most ED screening programmes employ external staff to perform testing, although this is relatively expensive. The proportion of ED patients who are offered a test is also rather low (about 20%).⁴ Interactive computerized kiosks have recently been used in healthcare

delivery to improve registration efficiency⁵ and to promote various public health initiatives in EDs.^{6–12} Pilot studies in a walk-in clinic in Los Angeles demonstrated that an educational kiosk module on rapid HIV testing was well accepted by patients. The kiosk increased patient's knowledge on HIV testing, although there was no change in the proportion of HIV screening.^{13,14}

There has been relatively little investigation of the utility of kiosks for streamlining ED-based HIV screening.¹⁵ Haukoos *et al.* evaluated the use of triage-based kiosks to obtain consent for HIV screening in an ED.¹⁶ The objective was to compare outcomes and comprehension of an opt-in versus an opt-out approach for consent for testing using the kiosk. We have previously reported findings from a pilot computerized tablet/kiosk usability study where HIV screening was coupled with other public health screening services using an electronic kiosk co-located at ED registration.¹⁷ We found high rates of patient willingness to engage with the kiosks, and favourable patient impressions regarding kiosks as a method for opt-in HIV testing, as well as self-entry of key demographic/ risk information which is a basic component of our HIV screening programme.

The aim of the present study was to evaluate the feasibility and the patient acceptability of integrating a kiosk into routine ED practice for offering HIV testing.

Methods

The study was conducted in an inner-city, adult ED. The ED is located in Baltimore and treats approximately 60,000 patients per year. The patients are socioeconomically disadvantaged, with more than 75% African Americans, 15% prior or current injection drug users (IDUs) and up to a 2.2% prevalence of newly diagnosed HIV from an established ED rapid HIV screening programme.¹⁸

The rapid HIV screening programme had four phases:

1. Reference. Bedside facilitators offered the test and manually gathered patient demographic and risk information (August to early September 2011);
2. Pilot feasibility assessment. A prototype kiosk was used to offer the HIV test and gather patient demographic and risk information, and perceptions about the kiosk feasibility (October 2011);
3. Pilot kiosk implementation. Same as phase 2 with an optimized tablet computer (late October through early December 2011);
4. Full kiosk implementation. Same as phase 2 with an enhanced kiosk, which included automated log-in (early December 2011 to January 2012).

Phases 1, 3 and 4 were conducted during weekdays, 16 hours per day. The study was approved by the appropriate ethics committee.

Study protocol

A rapid, non-targeted HIV screening programme began operation in the ED in 2005. All ED patients aged 18–64 years were eligible to be offered free rapid HIV testing if they had no

previous diagnosis of HIV/AIDS, had no self-reported HIV test performed in the past 3 months, were able to provide informed consent, and were not critically ill (i.e. patients with Emergency Severity Index levels 2–5.¹⁹)

The kiosk system was based on a “front-end” (registration) kiosk and a “back-end” (testing) kiosk, which were modified based on the findings from a usability study.¹⁷

Phase 1. HIV testing staff (facilitators) reviewed electronic charts and approached patients, who were eligible for screening according to their age and triage level, to offer HIV testing. If patients accepted the test and were eligible for testing, they provided consent, were tested at the bedside by a rapid oral fluid method (OraQuick Advance, OraSure Technologies, Bethlehem, PA, USA) and interviewed by facilitators to gather demographic and risk factor information (which was a component of the department’s HIV testing programme). Facilitators provided the HIV test results at the bedside.

Phase 2. Patients were directed by registration staff to the prototype kiosk to answer the questions. These concerned general medical and public health information sharing in EDs by kiosk, and the patient’s interest in HIV testing. Staff provided kiosk assistance when requested. Patients were then directed to the back-end kiosk where facilitators provided verbal consent for HIV testing, performed the HIV testing and provided results to the patient.

The prototype front-end kiosk (Creoso, Phoenix AZ, USA) was placed immediately adjacent to registration and first ED triage. The back-end kiosk (Creoso) was designed for patient self-entry of demographic and risk factor information and was installed adjacent to ED triage (Figure 1). The front-end kiosk was intended to simulate kiosk-based questions as part of ED registration (since at the time of the study, kiosk based registration had not been introduced in the ED). The front-end kiosk provided five screens: (1) a login screen; (2) a question about the patient’s interest in public health screening services; (3) a question about the patient’s willingness to use the kiosk to update their health information; (4) a question about the patient’s interest in having an HIV test done in the ED that day; and (5) instructions and information regarding obtaining an HIV test in the ED, for those who expressed an interest in HIV testing. The back-end kiosk included a risk assessment module intended to replace the staff-administered risk assessment survey and demographic data collection for patients who provided verbal consent to test at that location. The risk assessment module contained up to 21 screens, but the exact number of screens encountered by any patient varied depending on their responses.

Phase 3. Same as phase 2, with modifications to the software, hardware and flow, based on feedback from phase 2.

Phase 4. Same as phase 3 except the front-end kiosk was replaced by a touchscreen computerized kiosk (Vecna Technologies, Inc., Cambridge, MA, USA) which allowed patients to login via a wristband scanner.¹⁷

Data collection

Demographic and behavioural risk information was collected using a standardized data collection instrument which was part of the HIV testing programme. During phase 1, the facilitators interviewed patients, recorded data on a data collection instrument, and stored the data on a departmental server. During phases 3 and 4, patients completed the standardized data collection instrument on the kiosk which transmitted the information to a database on the departmental server.

Data analysis

The feasibility of kiosk-based screening was assessed by: (1) the proportion of patients who were offered HIV testing among those eligible for screening; (2) the proportion of patients who were eligible for testing among those who were offered it; (3) the proportion of patients who were tested among those who were offered and eligible for testing; (4) the proportion of patients who had newly diagnosed HIV infection among those who were tested.

Chi-squared tests were performed to assess differences in percentages of patients offered testing as well as differences in patients tested between study phases. The differences in percentages of patients offered testing, and tested across the study phases were assessed by the Cochran- Armitage trend test. Differences in distribution of key demographic and risk factor characteristics of patients tested for HIV between study phases were assessed by chi-squared tests. Analysis of the risk factor characteristics of patients during phase 3 and 4 was limited to those patients who responded the risk behaviour questions on the kiosk.

High risk sexual behaviour was defined as any of the following: men who have sex with men (MSM), sex with MSM, sex for money, paid sex, sex with HIV-positive individual, sex with injection drug users, sex under the influence of drugs or alcohol, sexual assault victim, or having being diagnosed with a sexually transmitted disease. The statistical analyses were performed using a standard package (SAS version 9.3, SAS Institute Inc., Cary, NC, USA).

Results

Kiosk feasibility was evaluated for 8 days in October 2011. A total of 217 ED patients used the front-end kiosk; 91 patients expressed interest in HIV testing and proceeded to the back-end kiosk for HIV testing. During this time, 57/67 patients (85%) reported that the software was easy to use and 4/67 (6%) reported that the software was not easy to use. Most of them (54/66, 82%) reported that they answered the questions without help while 8/66 (12%) reported needing help. Most of them (47/66, 71%) reported that they preferred HIV test-offering and risk assessment on the kiosk rather than in-person, while 11/66 (17%) reported that they preferred the offer of HIV testing to be made by a person. The location of the kiosk was adjusted in both the registration and triage area to conform better with ED patient flow. Feedback from clinical staff was taken into account. Tablet-computer problems, such as system non-responsiveness, were attended to before the start of phase 3.

Comparison between phases

HIV screening and testing data during three of the phases are summarized in Table 1. The number of ED patients in each phase was similar, approximately 4900 patients per 24-day period. Approximately 2500–3000 patients were eligible for screening in each phase. There were no significant differences in age, gender or race in the patients eligible for screening between the three phases (Table 2). The number of patients offered HIV testing among those eligible for screening increased significantly between phases (Table 1). In addition, the proportion of patients offered HIV testing among those eligible for screening increased from 21% in phase 1 to 27% in phase 3, and to 28% in phase 4 ($P < 0.05$). However, the acceptance rate declined from over 80% to approximately 60% ($P < 0.05$). Nevertheless, the percentage of patients eligible for screening who were tested was similar in all study phases ($P > 0.05$). Three newly diagnosed HIV-infected patients were identified during the kiosk phases (prevalence: phase 3: 0.3%, phase 4: 0.5%). On the other hand, none were identified during the reference phase (i.e. phase 1).

Demographics, risk factors and kiosk engagement

In total, 1443 ED patients were tested for HIV. There were significant differences in demographics and HIV risk factors between the two kiosk phases (phases 3 and 4) and the reference phase (Table 3). Patients tested in phases 3 and 4 were younger and were more likely to be female and black. A significantly higher proportion of patients reported having high risk sexual behaviours and using injection drugs in kiosk phases 3 and 4, than in the reference phase. However, the percentage of men who have sex with men was similar between phases. Prior kiosk experience, including the use of bank automated teller machines, airport, supermarket or health care setting kiosks, was reported in approximately 55% of patients in phases 3 and 4.

Patient acceptability and perceptions of kiosk

During phases 3 and 4, approximately 77% of the 905 patients tested for HIV completed the kiosk risk assessment, and perception questions regarding use of kiosks for administering HIV screening in the ED. Most of them rated the kiosk as easy to use (87%), and most reported that they did not need help to use the kiosk (82%). Compared to human face-to-face interaction for offering an HIV test, 71% patients preferred the kiosk and only 18% preferred a human.

Discussion

Our findings regarding the feasibility and acceptability of kiosks for offering non-targeted HIV screening in a busy academic ED are similar to those previously reported in Denver.¹⁶ Relative to phase 1, in which bedside testing was performed, the number of patients offered a rapid HIV test significantly increased by using the kiosk, with up to 40% of those eligible tested. Although percentages of acceptance with the kiosk were lower than with the bedside offers, the kiosk approach provides promise.

Use of the kiosk resulted in testing a higher proportion of ED patients with self-reported high risk sexual and IDU behaviours, than conventional bedside testing. Furthermore, three

previously undiagnosed HIV-infected patients were identified during kiosk phases 3 and 4, compared with none in the reference bedside testing phase. A major obstacle in identifying undiagnosed high risk, HIV-infected patients in EDs is that a significant number of them decline ED-based routine HIV screening, particularly using an opt-in approach;¹⁶ a significant proportion of those people may have undiagnosed HIV infection. For example, one recent study in an inner city ED in Washington, DC found that in patients who declined testing, there were approximately three-times as many with undiagnosed HIV than in those who accepted testing.²⁰

In recent years, kiosks have become more common for patient registration in order to improve patient flow in medical care settings.²¹ Previous studies have demonstrated that kiosks or similar computer-assisted self-interview methods can increase people's engagement in public health interventions (e.g. HIV,¹⁵ smoking cessation²² and healthy food²³). They also increase the proportion of reporting of sensitive high risk behaviours for HIV. The systematization and anonymity afforded by kiosks may explain patient preference for kiosks.

During phase 2 of the programme, patient and clinical staff perspectives were considered. Modifications included the development of a pen-based touch screen tablet prototype and the evaluation of the tablet to maximize its usability, manoeuvrability and acceptability.¹⁷ We also received helpful suggestions from ED registration, administration, clinical staff and information technology professionals and made various changes including, replacing the front-end tablet with a free-standing kiosk, adding automated login using a wristband scanner and fine-tuning the screen contents and displays. Further adjustment and enhancement of the kiosk systems, as well as a flexible quality improvement programme, will probably allow full integration with the ED kiosk registration system, the ED electronic tracking board and the hospital medical record.

Limitations

The study had several limitations. First, our findings were based on a single, inner-city ED and may not be easily generalizable to other EDs. Second, the kiosk we designed did not allow an offer to be made to all ED patients, since it excluded the opportunity to test patients who arrived by ambulance and bypassed standard registration, patients who could not consent at triage (e.g. those under the influence of alcohol or drugs), non-English-speaking patients and those who were not comfortable about using a kiosk and/or were illiterate. At the same time, the acceptance rate dropped during the kiosk phases compared to the bed-side testing phase. One explanation is that a computerized kiosk might reduce a patient's interest in HIV testing if he or she was not computer literate. Further enhancements of kiosk features and accessories may help address some, but not all of these matters.

Third, our findings were based on a simulated ED registration kiosk which was directly adjacent to ED short registration and first triage, since a true kiosk system for registration had not been implemented in the ED. Fourth, it is possible that our finding of increased engagement of high-risk patients during the kiosk phase might be due to the increased disclosure of high risk behaviours by patients via the kiosk, compared to face-to-face interview, rather than more high risk patients participating in the screening programme.

However, our data demonstrated that a higher proportion of younger patients engaged in our kiosk-facilitated programme compared to the conventional bed-side testing, suggesting that the kiosk did increase engagement with the HIV screening programme. Finally, the feasibility study did not assess the clinical effectiveness of the kiosks.

Conclusions

In summary, the present study found increased proportions of offering HIV tests, and similar proportions of HIV test completion, relative to conventional bedside testing methods. The kiosk resulted in testing a significantly greater portion of patients with high risk sexual and IDU behaviours, and yielded more newly diagnosed HIV-positive patients than bedside offer and testing. In addition, ED patients rated the kiosk-based approach as highly acceptable. Further work will be required to determine the clinical effectiveness of a kiosk-based approach for ED-based HIV screening.

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Figure 1.
The front-end kiosk.

Table 1

Outcomes of HIV screening programme.

	Phase 1	Phase 3	Phase 4
Period	Aug – early Sep 2011	late Oct – early Dec 2011	early Dec 2011 –Jan 2012
Patients attending the ED per 24 days	4853	4830	4934
Number eligible for screening	2975	2605	2571
Number offered HIV testing, of those eligible for screening (%)	936 (32)	965 (37) [*]	1030 (40) ^{*†}
Number eligible for HIV testing, of those offered HIV testing (%)	638 (68)	702 (73) [*]	729 (71) ^{*†}
Number tested	538	475	430
% of those offered and eligible for HIV testing	84	68 [*]	59 ^{*†}
% of those eligible for screening	18	18	17
Number newly identified as HIV-positive of those tested (%)	0 (0)	1 (0.2)	2 (0.5)

Eligible for screening: a patient was eligible for screening if he or she was 18–64 years age and was not critically ill.

Eligible for testing: a patient who was eligible for screening and he or she had no self-reported HIV infection, no self-reported HIV test in the past 3 months, and was able to provide informed consent.

^{*} P<0.05 compared to phase 1.

[†] P<0.05 by Cochran-Armitage trend test.

Table 2

Demographics of patients who were eligible for screening.

	Phase 1	Phase 3	Phase 4
Number of patients	2975	2605	2571
Mean age, years (SD)	40.1 (13.1)	38.8 (13.0)	39.1 (13.2)
Number of females (%)	1622 (55)	1479 (57)	1486 (58)
Race			
African Americans (%)	2154 (72)	1897 (73)	1954 (76)
Whites (%)	645 (22)	527 (20)	488 (19)
other race (%)	176 (6)	181 (7)	129 (5)

Table 3

Socio-demographics and self-reported risk behaviours in patients who received a rapid HIV test in an ED-based rapid HIV screening programme.

	Phase 1	Phase 3	Phase 4
Mean age, years (SD)	39.1 (13.6)	35.1 (12.5) *	35.2 (13.0) *
Number of patients all ages	538	475	430
18–24 years (%)	99 (18)	142 (30) *	134 (31) *
25–54 years (%)	343 (64)	294 (62)	258 (60)
55–64 years (%)	96 (18)	39 (8)	38 (9)
Number of females (%)	296 (55)	299 (63) *	267 (62) *
Race			
African Americans (%)	362 (67)	354 (75) *	334 (78) *
Whites (%)	122 (23)	60 (13)	35 (8)
other race (%)	54 (6)	61 (13)	61 (14)
Previous kiosk experience			
yes (%)	Not available	209 (57)	193 (53)
no (%)	Not available	159 (43)	170 (47)
Risk behaviours			
high risk sexual behaviours [†] (%)	162 (30)	181 (52) ^{*‡}	180 (51) ^{*∫}
men who have sex with men (%)	7 (1.3)	8 (2.3) [‡]	8 (2.3) [∫]
injection drug use (%)	5 (0.9)	27 (8) ^{*‡}	24 (7) ^{*∫}

* $P < 0.05$ compared to phase 1.

[†] high risk sexual behaviours include men who have sex with men (MSM), sex with MSM, sex for money, paid sex, sex with HIV-positive, sex with injection drug users, sex under influence, sexual assault victim, or having being diagnosed with a sexually transmitted disease.

[‡] 351 patients responded to the questions.

[∫] 350 patients responded to the questions.