

ORIGINAL RESEARCH

Prevalence of undiagnosed HIV, hepatitis B, and hepatitis C among patients in an Indian emergency department

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Abstract

Objectives: HIV, hepatitis B, and hepatitis C remain significant causes of morbidity and mortality in low resource settings. Emergency department (ED)-based screening has proven effective in decreasing the spread of undiagnosed disease, although such programs are rare in low–middle income countries.

Methods: A prospective, cross sectional study of all adult patients presenting to the ED in a 600-bed teaching hospital in Tamil Nadu, India. This study used an opt-in strategy in which patients were offered testing at the end of their ED visit. Costs of testing were paid out of pocket by patients. Patients with known HIV, hepatitis B, or hepatitis C were excluded from the study.

Results: During the study period 26,465 patients presented to the ED, and 18,286 patients consented to participate (68.9%). Among the 18,286 patients tested, 174 were positive for either HIV (39, 0.21%), hepatitis C (52, 0.28%), or hepatitis B (83, 0.45%). Three patients tested positive for both HIV and hepatitis C, and 1 patient tested positive for both HIV and hepatitis B. A total of 69.2% of patients with HIV, 61.2% of patients with hepatitis B, and 83% of patients with hepatitis C presented for reasons unrelated to their underlying diagnosis.

Conclusion: Although limited to only 1 hospital in southern India, this study represents the largest ED-based screening program for HIV, hepatitis B, and hepatitis C ever conducted in India or any other low–middle income countries. The majority of patients presented for reasons unrelated to their underlying diagnosis. Future research is needed on implementation strategies, cost feasibility, and linkage to care.

KEYWORDS

global health, HIV, infectious disease, public health

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1 | INTRODUCTION

1.1 | Background

Despite advances in testing and treatment, HIV and hepatitis remain a significant cause of morbidity and mortality around the world, especially in low resource settings, where access to testing and treatment may be limited.¹⁻³ India is home to an estimated 2.1 million people living with HIV, the third largest population in the world.^{4,5} Starting in the 1990s, the government of India led an ambitious effort to curb new infections, focused on targeted testing of high risk populations.^{5,6} As a result of these efforts, HIV rates in India have been in decline over the past 2 decades from a peak of 0.38% in 2001 to 0.26% in 2015; however, infection rates remain high in at-risk populations and significant barriers to testing remain.⁵⁻⁹ A lack of adequately trained counselors, inadequate knowledge amongst providers, testing sites that are few in number and may require patients to travel great distances, as well as shortages of testing kits remain persistent barriers to more widely available testing.^{8,9} Considering these limitations, it is possible that the true prevalence of undiagnosed HIV in India may be higher than reported.

There are currently no national guidelines on emergency department (ED)-based screening for acquired blood-borne infections in India. As the primary source of medical care for many vulnerable populations, the ED has the potential to serve an important role in early detection and prevention programs. Routine ED screening programs in the United States (US) have shown that ED screening is feasible and can detect infections that would otherwise have gone undetected.¹⁰ The Center for Disease Control and Prevention (CDC) and the American College of Emergency Physicians both advocate for widespread ED-based screening guidelines.^{11,12} Unfortunately, although expansion of ED-based screening has shown success in high-income countries, the same progress has not been made in many low-middle income countries.

1.2 | Importance

Despite the vast need, there is a dearth of data on ED-based testing strategies for low-middle income countries. Fragmented health care systems, the expense of medical treatment, and emergency care systems that are still in their infancy all complicate efforts to make ED-based screening programs more readily available.^{13,14} Although data are limited, prior research has been widely variable.¹⁵ In India, efforts at ED-based surveillance report anywhere between 2% and 6% prevalence of undiagnosed HIV, and rates of hepatitis B and hepatitis C around 3% and 1%, respectively.¹⁶⁻¹⁸ Although these studies represent an important first step, most are limited by small sample size, retrospective methodology, occur at a single institution, or target-specific patient populations, such as those who are acutely symptomatic, making results difficult to interpret.¹⁶⁻²¹

The Bottom Line

This is the largest ED surveillance study of HIV, hepatitis B, and hepatitis C from a low-middle income country—India—with 18,286 consented patients undergoing testing at a single emergency department (ED) in southern India. Positivity rates were 0.21%, 0.45%, and 0.28% for HIV, hepatitis B, and hepatitis C, respectively. This study underscores the ability of EDs to serve as a screening site for these important infections within low-middle income countries.

1.3 | Goals of this investigation

The primary aim of this study was to better understand the prevalence of previously undiagnosed HIV, hepatitis B, and hepatitis C in the patient population in an Indian ED.

2 | METHODS

2.1 | Study design

This was a prospective cross sectional study of all adult patients age 18 years or older presenting to the ED at the Meenakshi Mission Hospital and Research Centre (MMHRC), a 600-bed teaching hospital located in Madurai, Tamil Nadu, India between November 1, 2017 and June 1, 2019. The study design was approved by the Meenakshi Mission Hospital and Research Centre Ethics Committee. All patients 18 years or older who presented to the Meenakshi Mission Hospital and Research Centre ED during the study period were approached to participate in the study. Exclusion criteria were any patient with a known diagnosis of HIV, hepatitis B, or hepatitis C. Data analysis consisted of basic descriptive statistics and comparisons of raw numbers, reporting of raw differences, and differences in raw proportions in the case of binary outcomes, all calculated with 95% confidence intervals (CI). Chi-squared analysis used to compare differences between men and women for prevalence of HIV, hepatitis B, and hepatitis C.

2.2 | Study protocol

Patients were approached by trained ED staff during the end of their ED visit after completing the emergency evaluation and intervention, and offered the option to opt-in to an ED-based screening program for HIV, hepatitis B, and hepatitis C. Eight ED staff nurses, 4 paramedics, and 4 doctors were trained in how to properly approach and enroll patients. Informed consent was collected from all patients before enrollment, and participation was strictly voluntary. ED staff performing enrollment were not blinded to the purpose of the study.

TABLE 1 Patient demographics

	HIV	Hepatitis B	Hepatitis C
Male (%)	24 (61)	57 (68)	44 (84)
Female (%)	15 (38)	26 (31)	8 (15)
Age (yr)			
18–22	2	4	0
23–27	8	8	7
28–32	6	21	11
33–37	9	14	10
38–42	7	12	8
43–47	3	7	9
48–52	4	11	3
>53	0	6	4
Total	39	83	52

In the event of a critically ill patient, relatives were asked to provide consent for testing on the patient's behalf. Laboratory technicians were available for 24 hours in the department for collecting samples. Blood samples were analyzed by chemiluminescence immunoassay technique to detect antibody to HIV, hepatitis C antibody, and hepatitis B surface antigen (HBsAg). Fourth generation HIV antibody tests with ability to detect p24 antigen were used. Costs for testing were paid out of pocket by patients or their family members at a cost of 500 rupees (\$6.62) for HIV and hepatitis B tests, and 800 rupees (\$10.59) for hepatitis C tests. Patients were made aware of all costs before enrollment. Patients who tested positive were counseled on their new diagnoses and referred to the infectious disease department for initiation of treatment and further testing.

3 | RESULTS

During the study period 26,465 adult patients presented to the Meenakshi Mission Hospital and Research Centre ED of which 18,286 (10,831 men, 7905 women) consented to participate in the study (68.9%). Of the 18,286 patients tested, 174 were positive for either HIV ($n = 39$, 0.21%, 95% CI = 0.15%–0.28%), hepatitis B ($n = 83$, 0.45%, 95% CI = 0.36%–0.56%), or hepatitis C ($n = 52$, 0.28%, 95% CI = 0.2%–0.37%). Three patients tested positive for both HIV and hepatitis C. One patient tested positive for both HIV and hepatitis B. Men were more likely to be positive for hepatitis B ($P < 0.01$) and hepatitis C ($P < 0.01$) than women. There was no statistically significant difference between men and women for HIV infection ($P = 0.55$). Demographics of patients who tested positive can be found in Table 1.

Reasons for presentation to the ED among patients who tested positive for HIV, hepatitis B, or hepatitis C can be found in Table 2. Among patients who tested positive for HIV, 27 (69%) were asymptomatic at the time of their diagnosis. Of the 12 patients with HIV who were symptomatic, 11 presented with weight loss, and 1 presented with recurrent chest infections, all of whom were later found to have confection

TABLE 2 ED-presenting complaint among patients positive for HIV, hepatitis B, or hepatitis C

Reason	HIV	Hepatitis B	Hepatitis C
Trauma	4	7	7
GI symptoms	13	30	28
Difficulty breathing	16	8	6
Poisoning	2	1	0
Soft tissue infection/cellulitis	4	0	0
Jaundice	0	24	8
Altered mental status	0	13	3
Total	39	83	52

TABLE 3 Patient risk factors

Risk factor	HIV	Hepatitis B	Hepatitis C
IV drug use	3	14	3
History of sex with a prostitute	5	9	11
Multiple sexual partners	10	31	24
MSM (men who have sex with men)	6	2	7
Sex worker	1	0	0
Known HIV-positive sex partner	1	0	0
History of blood products transfusion	1	1	0
Does not know	4	7	1
Declined to disclose	8	19	6
Total	39	83	52

with tuberculosis. Three of these patients also presented with diarrhea later found to be due to cryptosporidium and abdominal tuberculosis infection.

Among patients who tested positive for hepatitis B, 32 (39%) were symptomatic at the time of their presentation: 24 presented with jaundice (29%), 6 with gastrointestinal (GI) symptoms (7%), and 2 with altered mental status subsequently found to be a due to hepatic encephalopathy (2%). Among patients who tested positive for hepatitis C, 9 (17%) were symptomatic at the time of their presentation, 8 (15%) of whom presented with jaundice, while 1 (2%) presented with abdominal pain and distention and passing dark urine. A total of 62% of patients who were found to have hepatitis B and 83% of patients who were found to have hepatitis C presented to the ED for reasons unrelated to their underlying diagnosis.

Risk factors for patients who tested positive can be found in Table 3. Having multiple sexual partners was the most common risk factor identified among patients who were positive for HIV (10), hepatitis B (31), and hepatitis C (24). Reasons given for declining among the 8179 patients that were not enrolled in the study can be found in Table 4. Although the majority of patients did not give a reason, patients cited fear of results (23) and recent testing at an outside hospital (52) as other common reasons. Thirty-one patients were excluded for having

TABLE 4 Reasons for declining screening

Reason	No. of patients (%)
Recently tested in outside hospitals	52 (0.6)
Previously diagnosed HIV	5 (0.1)
Previously diagnosed hepatitis B	17 (0.2)
Previously diagnosed hepatitis C	9 (0.1)
Do not want to do it here; planning to get tested in outside hospital	3680 (44.6)
Afraid to know the result	23 (0.3)
No reason given	4393 (53.2)
Total	8179

previously diagnosed HIV (5), hepatitis B (17), or hepatitis C (9). Combining these patients with the new diagnoses made during the study, the overall prevalence of HIV, hepatitis B, and hepatitis C was 0.17% ($n = 44$, 95% CI = 0.12%–0.22%), 0.38% ($n = 100$, 95% CI = 0.31%–0.46%), and 0.23% ($n = 61$, 95% CI = 0.18%–0.30%), respectively.

4 | LIMITATIONS

This study was conducted at single private, university-affiliated hospital and may lack external validity. This study used an opt-in screening strategy and may be subject to selection bias, because patients who chose to opt-into the study may have already been suspicious of their seropositive status. With only 69% of patients opting into the study, there leaves a significant portion of the ED population that opted not to participate, and the results, therefore, may not be indicative of the ED population as a whole. Data were not collected on patients who did not participate in the study, leaving us unable to make demographic comparisons between participants and non-participants. More than half of patients who declined testing did not give a reason for doing so, making drawing conclusions around patient rationale for declining to participate difficult. As the study took place at a private hospital, which sees a greater number of patients with health insurance and may charge higher fees, there may have been a selection bias toward patients of higher socioeconomic status. The need to pay out of pocket may further have introduced a selection bias toward patients of higher socioeconomic status. Fourth generation HIV antibody tests are unable to detect acute HIV infection during the first 3 weeks after a person has been infected, and it is possible that patients with acute HIV infection were missed during this study.

5 | DISCUSSION

This study represents the largest cross sectional analysis of ED-based screening for acquired blood-borne infections ever conducted in India or any other low-middle income country. The data show that the majority of patients who received new diagnoses of HIV, hepatitis B,

or hepatitis C presented for reasons unrelated to their underlying diagnosis. Among patients who were symptomatic at the time of their presentation, the majority presented with symptoms of advanced disease, either related to tuberculosis coinfection in the case of patients with HIV or hepatic failure in the case of patients with hepatitis. Such late presentations suggest that there remain significant barriers to early screening and prevention among vulnerable populations in India and highlight the role ED-based screening can play in community surveillance and treatment programs.

This study detected an overall HIV prevalence of 0.17% and a prevalence of 0.21% among previously undiagnosed cases. This closely matches nationwide statistical models, which estimate that the HIV rate in India is around 0.26%, with a rate of 0.22% in Tamil Nadu, where the current study was completed.^{5,6} Despite this congruency, it may be unwise to consider the finding indicative that the HIV prevalence in the ED population is the same as that of the general population in India. Computer models of nationwide HIV rates are calculated using census data and make assumptions about multiple variables including fertility and migration patterns to create their estimates. They do not measure HIV prevalence directly nor do they have any specificity to the ED population. The ED acts as a safety net for many vulnerable populations who may lack access to basic health care. As such, one may expect higher rates of undiagnosed HIV in the ED than in other settings. The seemingly low rates of undiagnosed HIV infections found in the current study may be the result of a number of previously described limitations that may have introduced selection bias toward persons of higher socioeconomic status. Future studies conducted at multiple sites, including public hospitals that may serve patients of lower socioeconomic status, as well as methods that do not require patients to pay, may help to mitigate these factors.

Prior studies on ED HIV screening programs in low-middle income countries have reported prevalence rates between 2% and 43%.¹⁵ Studies in India report rates of between 2% and 6%, of which $\approx 65\%$ to 95% were previously undiagnosed before their ED visit.^{17–20} Unfortunately, the paucity of data, as well as methodological differences, make drawing comparisons difficult. A recent systematic review of ED-based HIV screening in low-middle income countries identified only 5 prior studies in India, most of which were retrospective, with small sample sizes and focused on targeted patient populations.^{15,19–21} Only two of these studies were cross sectional analyses of ED patients, both of which were smaller in size than the current study and had unclear inclusion criteria or targeted testing toward acutely symptomatic patients.^{17,18} Not surprisingly, these studies reported a higher prevalence of HIV than the current study.^{17,18} However, considering the differences in methodology, comparisons are difficult to draw, and prior studies may overestimate the true prevalence of undiagnosed HIV in the Indian ED population.

Studies investigating the seroprevalence of undiagnosed hepatitis B and hepatitis C among ED patients in India are also limited. We identified only one prior study of ED patients in India, a retrospective chart review of patients for whom hepatitis antibody testing had been ordered by the primary treatment team during their ED evaluation.¹⁶ This study, which reported a prevalence hepatitis B and hepatitis C of

3% and of 1%, respectively, was likely subject to selection bias, because testing would only have been ordered on patients for whom there was clinical suspicion of disease. The overall lack of data on hepatitis B and hepatitis C seroprevalence in the ED population in India and other low-middle income countries leaves little opportunity for comparison of our results. To date, there have been no prior prospective cohort studies screening patients for hepatitis B and hepatitis C in the ED population, making the current study the first attempt to do so.

This study had a participation rate of 69%, which is lower than other similar studies conducted in low-middle income countries.¹⁵ This can likely be attributed to the use of an opt-in testing strategy, which traditionally have lower rates of participation than opt-out testing, in which screening is done as a routine part of every medical examination.²² In opt-out testing, patients are informed that they will be getting a test, but explicit consent is not needed, and tests are sent on everyone unless they explicitly refuse. Opt-out testing programs have repeatedly shown a higher rate of participation, and the CDC recommends opt-out ED-based testing for HIV.²³ The higher rate of participation in opt-out programs has been evident even in low-middle income countries, where one study in Kenya reported a 97.7% participation level.²⁴ Unfortunately, the fact that patients had to pay out of pocket compromised the investigators' ability to make this an opt-out study. Nonetheless, the results of the current study are encouraging. The fact that almost 70% of patients willingly paid for additional testing suggests that cost did not represent a significant financial burden. Future studies into cost analysis are needed before large scale, opt-out screening could be made available.

Patients gave a variety of reasons for declining testing. The only prior study of ED-based screening programs in low-middle income countries to qualify why patients declined to participate found that an array of reasons were given including the patients' belief that he/she is not at risk, embarrassment, and fear of knowing the results.²⁵ Although fear of results was cited infrequently by patients in the current study, it should be noted that among the 174 patients who tested positive for a blood-borne disease, 45 (25.8%) either claimed they did not know, or declined to disclose their risk factors, suggesting that stigma surrounding HIV and hepatitis infection remains a factor.

6 | CONCLUSION

HIV, hepatitis B, and hepatitis C continue to pose significant burdens of disease in many low-middle income countries. ED-based testing has been shown to be effective in targeting high risk populations and decreasing the spread of previously undiagnosed infections, although such programs in low-middle income countries are still relatively rare. Prior studies have shown that when ED-based HIV testing can be implemented in low-middle income countries, acceptance rates among patients are high (as is follow-up with long-term care), and patients generally view the concept of ED-based testing favorably.²⁴⁻²⁶ As home to the third largest population of people living with HIV infection, India has a vested interest in improving early identification and treatment strategies. This study, which represents the largest ED-based screen-

ing study for HIV, hepatitis B, and hepatitis C ever conducted in India or any other low-middle income country, shows that a long-term, ED-based, opt-in antibody testing strategy can be feasibly implemented in an Indian hospital. Further research is needed into implementation strategies, cost feasibility, and linkage to follow-up care.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

SP and NNJ conceived and designed the study, supervised the conduct of the study, supervised data collection, and managed the data including quality control. SP and KD analyzed the data. SP, KD, AG-R, ND, NN, and JB conducted relevant background research and drafted the manuscript. All authors contributed substantially to the manuscript and its revision. SP takes responsibility for the paper as a whole.

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