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ORIGINAL PAPER

Assessing Timely Presentation to Care Among People Diagnosed with HIV During Hospital Admission: A Population-Based Study in Ontario, Canada

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Abstract

Timely presentation to care for people newly diagnosed with HIV is critical to optimize health outcomes and reduce onward HIV transmission. Studies describing presentation to care following diagnosis during a hospital admission are lacking. We sought to assess the timeliness of presentation to care and to identify factors associated with delayed presentation. We conducted a population-level study using health administrative databases. Participants were all individuals older than 16 and newly diagnosed with HIV during hospital admission in Ontario, Canada, between April 1, 2007 and March 31, 2015. We used modified Poisson regression models to derive relative risk ratios for the association between sociodemographic and clinical variables and the presentation to out-patient HIV care by 90 days following hospital discharge. Among 372 patients who received a primary HIV diagnosis in hospital, 83.6% presented to care by 90 days. Following multivariable analysis, we did not find associations between patient sociodemographic or clinical characteristics and presentation to care by 90 days. In a secondary analysis of 483 patients diagnosed during hospitalization but for whom HIV was not recorded as the principal reason for admission, 73.1% presented to care by 90 days. Following multivariable adjustment, we found immigrants from countries with generalized HIV epidemics (RR 1.265, 95% CI 1.133–1.413) were more likely to present to care, whereas timely presentation was less likely for people with a mental health diagnosis (RR 0.817, 95% CI 0.742–0.898) and women (RR 0.748, 95% CI 0.559–1.001). Future work should evaluate mechanisms to facilitate presentation to care among these populations.

Keywords HIV/AIDS · Linkage · Care presentation · Cascade · Institute for Clinical Evaluative Sciences (ICES)

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Introduction

Presentation to HIV care is a prerequisite for initiating antiretroviral therapy and establishing relationships with health care providers that are conducive to achieving virologic suppression and supporting long-term retention in care [1–4]. In addition to the well documented reductions in HIV-related morbidity and mortality imparted by antiretroviral therapy [4], timely presentation to care is a cornerstone of the test-and-treat approach to preventing further transmission of HIV [4]. In addition, timely presentation can also reduce costs to the health care system because virologically suppressed patients need fewer intensive clinical interventions over time to manage their health than people with a high viral load [2]. Timely presentation to care is associated with improved outcomes for individual patients, public health, and health systems; thus, the proportion of patients completing a visit with an HIV medical provider within 90 days of diagnosis is a commonly adopted metric for characterizing this component of the HIV care continuum [5].

Previous studies have identified several barriers to timely presentation to care among people with HIV, including individual-level factors (e.g. age, sex or gender, income, immigration status) [6–12], psychosocial factors (e.g. mental health status, substance use, homelessness) [13–15], and geographic factors (e.g. rural or remote residence) [16]. Conversely, people are more likely to present to care if they are employed [13].

Diagnosis of HIV during hospital admission may also influence timely linkage to care. While a hospital admission may afford the opportunity for interaction with HIV/infectious disease specialists and scheduling of outpatient follow-up prior to discharge, it is also possible that patients diagnosed in the inpatient setting represent a particularly marginalized group of high risk individuals. In one study, patients diagnosed with HIV during hospital admission were primarily uninsured men [17]. However, this study was examined in a single center over a short time period (2011–2012). A population-based study examined presentation to care following diagnosis of HIV in outpatient units in Sao Paulo, Brazil and found women sought care earlier than men [18]. However, to our knowledge, no population-based studies in developed regions have studied presentation to care after a diagnosis of HIV in the inpatient setting. These data are important because patients diagnosed during hospitalization are likely to have late HIV disease and experience social or structural barriers to care. Accordingly, we examined the timeliness of presentation to care for people newly diagnosed with HIV as inpatients in Ontario, Canada, and determined which factors were associated with timely presentation following an HIV diagnosis in hospital.

Methods

Setting

We conducted a population-based study among people diagnosed with HIV during hospital admission between April 1, 2007 and March 31, 2015 in Ontario, Canada. This study was approved by the Research Ethics Board of Sunnybrook Health Sciences Centre, Toronto, Ontario.

Data Sources

We used Ontario's administrative health databases, which are securely linked using unique, encoded identifiers, and analyzed at the Institute for Clinical Evaluative Sciences (ICES, www.ices.on.ca). We obtained basic individual demographic data, including age, postal code, and death from the Registered Persons Database, a registry of all Ontario residents eligible for health insurance. We identified adults with a diagnosis of HIV during hospital admission using the Canadian Institute for Health Information's Discharge Abstract Database. We used the Ontario Health Insurance Plan database and the Community Health Centres database to identify claims for physician services. We used the Immigration, Refugees and Citizenship Canada database to identify individuals who had immigrated to Ontario in 1985 or later.

Study Population and Recruitment

We used the Discharge Abstract Database to identify all adults aged 16 years and older with incident HIV diagnosis during inpatient hospital admission during the study period [International Classification of Diseases (ICD-10) primary discharge diagnosis codes B20–B24]. We restricted the analysis to people who were diagnosed during hospital admission to ensure that our study cohort only consisted of people who were newly diagnosed with HIV. To distinguish an incident from a prevalent diagnosis, we looked back to April 1, 2002 to identify and exclude individuals with previous physician claims or hospital admissions for HIV and associated opportunistic infections (ICD9 codes 042, 043, 044, ICD10 codes B20–B24). We excluded people who died during the index hospital admission. We conducted a secondary analysis and expanded our definition of HIV diagnosis in hospital to include admissions for which HIV was included as any discharge diagnosis, retaining the same exclusions for no previous HIV diagnoses.

Outcomes

Our primary outcome was delayed presentation to care, defined as no outpatient encounter for HIV care (a visit

with ICD billing code 042, 043, or 044) by 90 days of the index hospital discharge [19–22].

Analysis

We compared baseline characteristics between individuals with and without delayed presentation to care using summary statistics. We used modified Poisson regression [23] to determine characteristics associated with delayed presentation to care, including patient age and sex, urban versus rural residence, neighborhood income quintile as a proxy for socioeconomic status, co-morbidity burden in the preceding year, number of primary care visits in the preceding year, whether the admitting hospital was an academic or community institution, and immigration status, which was categorized as immigrants from HIV prevalent countries, immigrants from non-HIV prevalent countries, and Canadian born or long-term residents of Canada (immigration status data dates back only to 1985). We assigned patient socioeconomic status at the neighborhood level using postal code information and Statistics Canada census data. We also used postal code information to assign urban, non-major urban, or rural residence [24] to be able to control for neighbourhood of residence, while direct inference of neighbourhood-level effects was not evaluated in this study. We used the Johns Hopkins Adjusted Clinical Groups Case-Mix System to adjust for differences in comorbidity burden [25]. This system uses diagnostic information from administrative databases to describe and predict level of comorbidity and use of health care resources. In this study, we used Aggregated Diagnosis Groups (ADGs), which are clusters of diagnostic codes that are similar in terms of severity and expected persistence, ranging from a low level of comorbidity of 0 to the highest level of 32. We categorized comorbidity as low (0–5 ADGs), medium (6–9 ADGs) and high (10 + ADGs). We used a validated approach to ascertain whether participants had a mental health diagnosis [26]. We counted the number of primary care visits in the previous year and categorized these as 0–2 visits, 3–5 visits, 6–8 visits, or 9+ visits. We repeated these analyses for our secondary analysis cohort. Cell sizes of 6 or less are reported in aggregate only to preserve privacy. All analyses were conducted using SAS® software version 9.3 [27].

Role of the Funding Source

The study was funded by the Canadian Institutes of Health Research (CIHR) FRN TT5-128270. CIHR had no role in the design of the study, the collection, analysis, and interpretation of the data, and the reporting of the findings.

Results

Sample Description

Over the course of the study, 399 people had a primary diagnosis of HIV during hospital admission in Ontario, of whom 27 (6.8%) individuals were excluded from the analysis because they died within 90 days of hospital discharge. Our cohort had a mean age of 44 years (SD 11.6 years) and 16.7% were women (Table 1). Most patients lived in urban centres (n = 328, 88.2%), were Canadian born or long term residents of Canada (n = 289, 77.7%), and lived in the two lowest income quintile neighborhoods (n = 197, 52.9%). We observed a high rate of comorbidities, with 245 (65.9%) of individuals being in the highest comorbidity category and 123 (33.1%) experiencing a mental health condition in the previous 2 years (Table 1).

The median (interquartile range [IQR]) length of hospital stay was 13 (7–28) days; 17 (3.5%) left the hospital against medical advice. Almost half of people diagnosed with HIV (n = 165, 44.4%) saw an infectious disease physician during their hospital stay. The proportion of patients who presented to care for individuals with a primary HIV diagnosis during admission was 66.4% within 30 days and 83.6% within 90 days. By 365 days, 89.2% of people had presented to care.

Bivariate Statistics: Primary Analysis

The length of hospital stay did not differ between patients who presented to care by 90 days and those who did not [13 median days (IQR 8–28) versus 10 median days (IQR 5–29) ($p = 0.15$)]. Those who presented to care by 90 days were more likely to be seen by an infectious disease specialist during admission (n = 150, 48.2% vs. n = 15, 24.6%, $p < 0.001$), and were less likely to leave the hospital against medical advice (n = 7, 2.3% vs. $n \leq 10$, $\leq 16\%$, $p = 0.003$) than people who presented to care later than 90 days following their HIV diagnosis (Table 2).

Bivariate Statistics: Secondary Analysis

In the secondary analysis, we identified 483 patients for whom HIV was not recorded as the primary diagnosis at the time of discharge. This sample included more women than the cohort of people with a primary diagnosis of HIV during admission (n = 102, 21.1% versus n = 62, 16.7%), but we observed no other major demographic differences between the cohorts (Table 1).

Table 1 Demographic characteristics of people diagnosed with HIV during hospital admission in Ontario, Canada by type of HIV diagnosis

Variable	HIV as primary diagnosis n = 372	HIV as any diagnosis n = 483
Patient characteristics		
Year of diagnosis		
2007/2008	56 (15.1)	74 (15.3)
2008/2009	49 (13.2)	65 (13.5)
2009/2010	44 (11.8)	52 (10.8)
2010/2011	51 (13.7)	63 (13.0)
2011/2012	49 (13.2)	65 (13.5)
2012/2013	40 (10.8)	51 (10.6)
2013/2014	48 (12.9)	62 (12.8)
2014/2015	35 (9.4)	51 (10.6)
Age (mean, SD)	43.52 (11.60)	43.79(11.80)
Age category		
<= 25	19 (5.1)	26 (5.4)
26–35	70 (18.8)	88 (18.2)
36–45	140 (37.6)	168 (34.8)
46–55	89 (23.9)	132 (27.3)
> 56	54 (14.5)	69 (14.3)
Female	62 (16.7)	102 (21.1)
Income quintile		
1	127 (34.1%)	174 (36.0)
2	70 (18.8%)	91 (18.8)
3	55 (14.8%)	68 (14.1)
4	58 (15.6%)	77 (15.9)
5 + missing[b]	62 (16.7%)	73 (15.1)
Rurality		
Major urban	328 (88.2)	422 (87.4)
Non major urban	27 (7.3)	35 (7.2)
Rural	17 (4.6)	26 (5.4)
Number of ADGs[c] in 2 years prior to cohort entry (Median (IQR))	11 (8–13)	11 (8–14)
Low comorbidity (0–5 ADGs)	7 (1.9)	10 (2.1)
Medium comorbidity (6–9 ADGs)	120 (32.3)	153 (31.7)
High comorbidity (>=10 ADGs)	245 (65.9)	320 (66.3)
Immigrant status		
Canadian born or long-term resident	289 (77.7)	385 (79.7)
Immigrant, country without generalized HIV epidemics	39 (10.5)	47 (9.7)
Immigrant, country with generalized HIV epidemics	44 (11.8)	51 (10.6)
Number of primary care visits in year prior to cohort entry Median (IQR)	5 (2–8)	5 (2–9)
Mental Health Diagnosis (yes)	123 (33.1)	178 (36.9)
Index event characteristics		
Hospital admission that started in the Emergency Department	337 (90.6)	431 (89.2)
Length of stay in hospital in day (Median (IQR))	13 (7–28)	11 (7–26)
Primary admission diagnosis		
HIV	357 (96.0%)	363 (75.2)
Infectious Causes	≤ 5	≤ 20
Other	≤ 15	100 (20.7)
Seen by Infectious Disease Specialist during admission (yes)	165 (44.4)	190 (39.3)
Left against medical advice	13 (3.5)	18 (3.7)
Hospital characteristics		
Teaching hospital (yes)	198 (53.2)	269 (55.7)

Results are presented as N (%), mean (standard deviation), or median (interquartile range)

[a]Cell sizes < 6 are not reported to ensure privacy

[b]Missing category collapsed due to small cell sizes

[c]Aggregated Diagnosis Groups

Multivariable Statistics

Following multivariable adjustment, we did not find any patient characteristics to be associated with delayed presentation to care in our primary analysis. However, in the secondary multivariable analysis that was extended to patients with HIV as primary or any hospital diagnosis, we found successful presentation to care by 90 days more likely for immigrants from countries with generalized HIV epidemics compared to long-term residents of Canada (RR 1.265, 95% CI 1.133–1.413) and people with a high (10 + ADGs) comorbidity burden (RR 1.631, 95% CI 0.997–2.669) compared to living with low comorbidity (0–5 ADGs). We found that patients were less likely to present to care in a timely manner if they had a mental health diagnosis (RR 0.817, 95% CI 0.742–0.898). Women were also less likely to present to care by 90 days (RR 0.748, 95% CI 0.559–1.001) (Table 3).

Discussion

In our population-based study of people who were diagnosed with HIV during hospital admission in Ontario, Canada, we observed that while the majority of patients with HIV as their primary diagnosis (83.6%) and with HIV as any diagnosis (73.1%) presented to care by 90 days, a sizeable minority did not present to care in a timely manner, particularly women, and people with mental health diagnoses. People who had a consultation with an infectious disease specialist, immediately following their HIV diagnosis at the hospital, were more likely to present to care by 90 days.

The finding that men appear to be more likely to present to care by 90 days is consistent with previous research from the United States [28]. Moore [29] describes that women face barriers such as having to find accessible and affordable child care that might prevent them from initiating care. Furthermore, women who are newly diagnosed with HIV have been found to be more likely to experience depressive symptoms than men [30], and depression is independently associated with lower rates of presentation to care [9]. This finding has particular implications in our setting, where the proportion of new infections among women is increasing [29].

We further found that people who have emigrated from a country with generalized HIV epidemics were more likely to present to care by 90 days than long-term residents of Canada. This finding is different from European settings, where immigrants from countries in Sub-Saharan Africa were less likely to present to a care provider to control their HIV infection [15]. Previous Canadian research has also found a higher engagement in HIV care with lower rates of loss to follow-up in care after care presentation among recent immigrants compared to long-term residents [31]. HIV care and social services for immigrant communities are often well integrated in Ontario, Canada [32], which could facilitate timely care presentation. Finally, it is possible that immigrant communities in Canada face fewer systemic barriers to care than immigrants to other countries, given our single payer, universal health care system.

People with a high number of comorbidities are high users of the health system and tend to be well engaged in care in Canada [33]. Correspondingly, we found in our cohort that people with greater comorbidity were more likely to have timely presentation to care, likely associated with increased opportunities for care. However, people with a mental health diagnosis were significantly less likely to present to care by 90 days. This is consistent with previous literature in which people with HIV and concurrent mental health conditions have been found to be less likely to adhere to antiretroviral treatment [34] and to be retained in care [35] to achieve an undetectable viral load, in part related to stigmatization [36]. Given the complexity and multifaceted nature of the barriers to present to and engage in HIV care for people with concurrent mental illness, strategies that integrate mental health with HIV primary care, such as co-location of services [36] or home visits by nurses and transition managers, are critical to presentation to and retention in care [37].

Our study builds on previous research in several ways. Although other studies have characterized risk factors for delayed linkage to care, we examined this outcome specifically for those individuals diagnosed during a hospital admission. These individuals may represent particularly marginalized patients for whom linkage to care may be especially challenging. Our finding that individuals with co-existing mental health conditions were less likely to present to care within 90 days supports this assertion, and highlights the need for additional supports for these patients following discharge, such as case coordination and/or home care. Similarly, the finding that women were less likely to present to care than men suggests that measures to prevent loss to follow-up of women following discharge are required, including assistance with transportation and child care.

Our study has a number of strengths and limitations. Using population level data allowed us to examine the incidence of care presentation among all residents of Ontario who have been newly diagnosed with HIV. We excluded 4997 people from the study due to a previous HIV diagnosis and we only included people with a new diagnosis starting in 2002 to avoid bias because the ICD diagnostic codes changed in 2002. We used validated administrative billing code data to ascertain people who were newly diagnosed with HIV rather than laboratory diagnoses. We focused our analyses on patients diagnosed during hospital admission, and our findings may therefore not be generalizable to patients diagnosed in other settings. However,

Table 2 Demographic characteristics of people with a primary diagnosis of HIV during hospital admission in Ontario, Canada by presentation to care status at 90 days

	Presentation < 90 days n = 311	Presentation 90 + days n = 61	p-value
Patient characteristics			
Year of diagnosis			
2007/2008	49 (15.8)	7 (11.5)	0.479
2008/2009	40 (12.9)	9 (14.8)	
2009/2010	35 (11.3)	9 (14.8)	
2010/2011	42 (13.5)	9 (14.8)	
2011/2012	≤ 50	≤ 5	
2012/2013	34 (10.9)	6 (9.8)	
2013/2014	36 (11.6)	12 (19.7)	
2014/2015	≤ 40	≤ 5	
Age (mean, SD)	44.07 (11.52)	40.69 (11.66)	0.037
Age category			
<= 25	12 (3.9)	7 (11.5)	0.069
26–35	55 (17.7)	15 (24.6)	
36–45	120 (38.6)	20 (32.8)	
46–55	78 (25.1)	11 (18.0)	
> 56	46 (14.8)	8 (13.1)	
Female	48 (15.4)	14 (23.0)	0.150
Income quintile			
1	103 (33.1)	24 (39.3)	0.638
2	60 (19.3)	10 (16.4)	
3	44 (14.1)	11 (18.0)	
4	49 (15.8)	9 (14.8)	
5 + missing[b]	55 (17.7)	7 (11.5)	
Rurality			
Major urban	271 (87.1)	57 (93.4)	0.341
Non major urban	≤ 25	≤ 5	
Rural	≤ 20	≤ 5	
Number of ADGs[c] (median, IQR) in 2 years prior to cohort entry	11 (8–13)	11 (7–14)	0.816
Low-Medium comorbidity (0–9 ADGs)	103 (33.1)	24 (39.3)	0.137
High comorbidity (>=10 ADGs)	208 (66.9)	37 (60.7)	
Immigrant status			
Canadian born or long-term resident	242 (77.8)	47 (77.0)	0.694
Immigrant, country without generalized HIV epidemics	31 (10.0)	8 (13.1)	
Immigrant, country with generalized HIV epidemics	38 (12.2)	6 (9.8)	
Number of primary care visits in year prior to cohort entry (Median (IQR))	5 (2–8)	4 (1–9)	0.618
Mental Health Diagnosis (yes)	99 (31.8)	24 (39.3)	0.254
Index event characteristics			
Hospital admission that started in the Emergency Department	285 (91.6)	52 (85.2)	0.118
Length of stay in hospital days (median (IQR))	13 (8–28)	10 (5–29)	0.147
Primary admission diagnosis			
HIV	298 (95.8)	59 (96.7)	0.583
Infectious causes	≤ 5	0 (0.0)	
Other	≤ 10	≤ 5	
Seen by Infectious Disease Specialist during admission (yes)	150 (48.2)	15 (24.6)	< 0.001
Left against medical advice (yes)	7 (2.3)	≤ 10	0.003
Hospital characteristics			
Teaching hospital (yes)	165 (53.1)	33 (54.1)	0.881

Results are presented as N (%), mean (standard deviation), or median (interquartile range)

[a]Cell sizes < 6 are not reported to ensure privacy

[b]Missing category collapsed due to small cell sizes

[c]Aggregated Diagnosis Groups

Table 3 Relative risk for presentation to care by 90 days for people diagnosed with HIV during hospital admission as their main or as any diagnosis

Covariate	Linkage to care by 90 days post discharge			
	Main diagnosis of HIV at discharge (n = 372)		Any diagnosis of HIV (n = 483)	
	RR (95%CL)	p-value	RR (95%CL)	p-value
Patient covariates				
Age (continuous)	1.003 (0.995–1.008)	0.117	1. (0.949–1.054)	0.9988
Sex				
Male	Referent		Referent	
Female	0.916 (0.729–1.152)	0.454	0.748 (0.559–1.001)	0.0509
ADG category				
High, 10 + ADGs	1.549 (0.951–2.525)	0.0788	1.631 (0.997–2.669)	0.0513
Medium, 6–9 ADGs	1.478 (0.929–2.352)	0.0992	1.46 (0.907–2.351)	0.1194
Low, 0–5 ADGs	Referent			
Mental Health	0.942 (0.87–1.021)	0.1436	0.817 (0.742–0.898)	< 0.0001
Income quintile				
1 (lowest)	0.942 (0.821–1.082)	0.4001	0.916 (0.78–1.076)	0.2842
2	0.961 (0.845–1.094)	0.5479	0.904 (0.784–1.043)	0.1664
3	0.923 (0.777–1.095)	0.3554	0.903 (0.717–1.136)	0.3831
4	0.96 (0.855–1.078)	0.489	0.861 (0.733–1.01)	0.0655
5 (Highest)	Referent		Referent	
Rurality				
Rural	1.101 (0.955–1.268)	0.1844	0.986 (0.796–1.22)	0.8931
Suburban	1.064 (0.918–1.232)	0.4103	0.98 (0.831–1.157)	0.8136
Urban	Referent		Referent	
Immigration status				
Immigrant, country without generalized HIV epidemics	0.952 (0.813–1.115)	0.5415	1.265 (1.133–1.413)	< 0.0001
Immigrant, country with generalized HIV epidemics	1.107 (0.997–1.228)	0.0563	0.79 (0.451–1.382)	0.4082
Canadian born or long-term resident	Referent		Referent	
Number of primary care visits before index				
0–2	1.03 (0.884–1.199)	0.7086	1.006 (0.859–1.177)	0.9458
3–5	1.07 (0.978–1.171)	0.1402	1.114 (0.984–1.26)	0.0874
6–8	1.047 (0.934–1.174)	0.428	1.137 (0.998–1.296)	0.0539
9+	Referent		Referent	
Hospital covariates				
Teaching hospital	1.02 (0.903–1.153)	0.7454	0.999 (0.869–1.149)	0.9875

the demographic profile of our cohort is consistent with public health estimates by the province of Ontario [38]. Due to overall small numbers, our differences may not have met statistical significance; however, an association may still be clinically important as the goal is to link all people with HIV to care and to start treatment in a timely manner. Finally, ICES data are collected for administrative rather than research purposes, thus social variables such as income are ascertained using neighborhood-level metrics (postal codes).

Conclusion

The presentation of people diagnosed with HIV to care in a timely fashion is critical to improve their health outcomes [1] and to reduce the risks associated with possible transmission of HIV [39]. Our findings can be applied to guide targeted interventions, such as same day testing and initiation of treatment among both, inpatients and outpatient settings [40], contacting people diagnosed with HIV to promote presentation to care [41], or using mobile apps to connect people newly diagnosed with HIV with support programs

in their community [42]. These interventions need to promote presentation to care among the populations identified as underserved, specifically women and people with mental health conditions.

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Compliance with Ethical Standards

Conflict of interest The authors have no conflicts of interest to declare.

Ethical approval The study was approved by the Research Ethics Board of Sunnybrook Health Sciences Centre, Toronto, Ontario. All study procedures were in accordance with the ethical standards of the Research Ethics Board and with the 1964 Helsinki declaration and its later amendments.

Informed consent Informed consent was not required because no patient identifiable data were obtained.

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