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The impact of patient-provider attachment on hospital readmissions among people living with HIV: a population-based study

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Abstract

Background—Hospital readmission 30 days after discharge is associated with adverse health outcomes, and people living with HIV(PLWH) experience elevated rates of hospital readmission. While continuity of care with a healthcare provider is associated with lower rates of 30-day readmission among the general population, little is known about this relationship among PLWH. The objective of this study is to examine whether engaging with the same provider, defined as patient-provider attachment, is associated with 30-day readmission for this population.

Setting—Data derived from the Seek and Treat for Optimal Prevention of HIV in British Columbia, cohort.

Methods—Using generalized estimating equation with a logit link function, we examined the association between patient-provider attachment and 30-day hospital readmission. We determined whether readmission was due to all cause or to similar cause as the index admission.

Results—7013 PLWH were hospitalized during the study period. 921 (13.1%) were readmitted to hospital for all cause, and 564 (8.0%) for the similar cause as the index admission. Patient-provider attachment was negatively associated with 30-day readmission for all causes [adjusted odds ratio (AOR)=0.85, confidence interval (CI)=0.83–0.86]. A second multivariable model indicated that patient-provider attachment was also negatively associated with 30-day readmission for a similar cause (AOR=0.86, CI= 0.84–0.88).

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Conclusion—Our results indicate that a higher proportion of patient-provider attachment was negatively associated with 30-day hospital readmission among PLWH. Our study findings support the adoption of interventions that seek to build patient-provider relationships in order to optimize outcomes for people living with HIV, and enhance healthcare sustainability.

Keywords

people living with HIV; patient-provider attachment; hospital readmission; Canada

INTRODUCTION

Hospital readmission is associated with a number of adverse health outcomes, including increased patient stress and excess mortality. Among patients in intensive care units (ICU), mortality rates were higher for patients who were readmitted compared to those who were not.[1,2] In contrast, the available literature is equivocal among the general population, with some reporting no or an inverse association between mortality and readmission.[3] In addition, hospital readmissions can have major resource and cost implications, adversely affecting the sustainability of the healthcare system. A review of Medicare claims in the United States reported that the cost of unplanned re-hospitalizations in 2004 was $17.4 billion.[4] As such, hospital readmission has become an important quality of care indicator for health systems worldwide.[5–11]

Despite the success of antiretroviral therapy (ART) in the treatment of human immunodeficiency virus (HIV) infection, it has been consistently reported that people living with HIV (PLWH) experience elevated rates of hospital readmission compared to the general population [12,13], yet there is a paucity of evidence on the health consequences of readmission for this specific population. Clinical factors associated with readmission for PLWH include low uptake of ART, low CD4 cell counts, acquired immuno-deficiency syndrome (AIDS)-defining illness, and comorbid conditions, such as kidney and cardiovascular disease.[13–16] Social factors, including unstable housing and homelessness, low-income level, living alone, and unmanaged illicit substance use, have also been shown to be important predictors of 30-day readmission for PLWH.[13,14] Nevertheless, a recent study indicated that up to half of readmissions among PLWH are avoidable.[17]

In the context of HIV, the continuum of care relies on engaging and retaining PLWH in care. It is known that patients who leave hospital against medical advice (i.e., are not retained in care) are more likely to be readmitted with a worsened condition and have higher rates of mortality[18] To prevent this, evidence has suggested that engaging with the primary care system and being attached to a healthcare provider in the community may reduce hospital utilization among patients.[19,20] Indeed, a growing number of studies suggest that suboptimal care during hospitalization and after discharge, such as wrong or missed diagnosis or premature discharge, is negatively associated with unplanned 30-day readmission.[17,21] In contrast, high quality care (including patient satisfaction with their care) is positively associated with lower 30-day readmission among the general population.[22] Indeed, continuity of care with a healthcare provider is associated with lower risk of 30-day readmission among the general patient population, with an odds ratio (OR) of being

readmitted ranging between 0.37 (95% CI 0.21–0.67) to 0.87 (95% CI 0.77–0.97).[23–26] Specifically among PLWH, having an ongoing relationship with a particular healthcare provider has been linked to a number of positive health- and treatment-related outcomes, including antiretroviral medication adherence [27–29] and viral suppression.[30,31] One study reported that patients who had an effective relationship with their healthcare provider were significantly more likely to be on ART (60% vs 47%) and to be adherent to ART (76% vs 67%), and to achieve an undetectable plasma viral load (49% vs 39%), compared with those who do not have a relationship with their care provider.[31] However, little is known about whether engaging with the same provider (versus any provider) can impact 30-day hospital readmission among PLWH who are already engaged in the HIV continuum of care. As such, the objective of this study was to examine the relationship between patient-provider attachment and 30-day all- and similar- cause hospital readmissions for PLWH who are engaged in care.

METHODS

Study Population

Data were derived from the Seek and Treat for Optimal Prevention (STOP) HIV/AIDS in British Columbia (BC) cohort, a province-wide, population-level linked database of persons diagnosed with HIV between January 1996 and March 2015 in BC. This cohort has been described in detail elsewhere.[32] Briefly, the provincial datasets included are: 1) the BC Centre for Excellence in HIV/AIDS, which provides data on antiretroviral distribution, viral load and resistance testing, and CD4 cell count measurement;[33] 2) The BC Centre for Disease Control, which provides data on HIV testing and new HIV diagnosis;[34,35] 3) Medical Service Plan physician billing database, which provides data on HIV and non-HIV physician services;[36] 4) Discharge Abstract Database (DAD), which provides data on hospital admissions and discharges;[37] 5) the BC PharmaNet database, which provides data on non-ART drug dispensations;[38] and 6) BC Vital Statistics database, which provides data on deaths.[39] This study was approved by the University of British Columbia/Providence Health Care's research ethics board.

The study cohort was followed in a unique environment where medical care, including HIV/AIDS treatment, is delivered free-of-charge. In BC, all provision of ART is centralized through a province-wide ART dispensation program at the BC Centre for Excellence in HIV/AIDS.

Eligibility

We included all PLWH following their first dispensation of ART who had at least one hospitalization in BC with an admission date between April 1, 1996 and March 31st, 2015. We included participants who received four or more medical services in one calendar year to allow for some degree of differentiation in the main explanatory variable. We chose this number in accordance with the number of recommended yearly medical visits for PLWH.[40] Medical services excluded lab and diagnostic procedures given that these procedures may not be a good indicator of patient-provider attachment. Participants who transferred out-of-

province during their hospitalization and those in long-term care facilities were not included in the study. We also excluded individuals who died during the index hospitalization.

Measures

The main outcome measure was 30-day hospital readmission. Any admission to a BC hospital lasting at least one day was defined as the index admission. We chose this definition to align with the Centers for Medicare and Medicaid Services 30-Day Risk-Standardized Readmission Measures.[41] Readmissions were defined as any re-hospitalization that occurred less than 30 days after the index hospitalization. In our analysis, additional hospitalizations occurring within 30 days from the discharge date of an index hospitalization were not eligible to be counted as another index hospitalization. We included readmissions to any BC hospital given that prior studies revealed that readmissions for PLWH often occur in a different hospital than the index hospital.[14] Hospital transfers were treated as part of the original hospitalization. Causes for all hospitalizations were recorded, and we examined whether readmission was related to any diagnosis ("all causes") or to a similar diagnosis as the index admission ("similar cause"). We determined whether the readmission was related to the index hospitalization by using the Canadian Institute for Health Information Case Mix Group variables taken from the DAD database.[42] Consistent with the Canadian Institute for Health Information[42], this case-mix methodology sorts patient information into over a thousand similar categories (e.g., Seizure and Headaches; Non-traumatic Stupor and Coma; Major Eye Infections) thus allowing monitoring and comparison of patients groups.[42] To be considered a readmission for similar cause, both the index admission and the readmission had to be in the same category.

The main explanatory measure was patient-provider attachment. Similar to previous studies[30,43], we defined this variable by calculating the percentage of services provided by the physician who provides the most services in a year (per 10% increase in attachment). For example, if a patient received 10 services in a year and one physician provided seven of those services, the patient-provider attachment would be 70%.

The following characteristics that have been previously associated with readmission were accounted for as potential confounders in this analysis: patient's age at admission (per 10 year increase); sex (female vs male); calendar year (per 10-year increase); history of injection drug use (yes vs unknown vs no [reference]); Charlson comorbidity index (per unit increase); patient CD4 cell count measured within 12 months of admission date (100 cells/mL); viral load (log 10 increase); and discharge against medical advice (yes vs no).[13,18,30,44–46]

Statistical analysis

First, we used descriptive statistics to compare baseline characteristics of participants who were readmitted to hospital within 30 days to those who were not readmitted. Second, we used generalized estimating equations (GEE) with a logit link function to determine the degree to which each independent variable was associated with 30-day readmission. We noted the degree of association; however, as stated above, all variables selected as confounders were known to be associated with the main explanatory and outcome of

interest, and as such, were included in the multivariate model regardless of their p-value in bivariable analyses. We constructed two multivariable models with different outcomes of interest: 1) 30-day readmission for all causes and 2) 30-day readmission for a similar cause. Given that studies have also looked at same-day readmissions[13], as a sensitivity analysis, we also conducted multivariable GEE models where the outcome included readmissions that occurred within one day. All statistical analyses were computed using SAS software version 9.4 (SAS Institute, Cary, NC) and all p-values were two-sided.

RESULTS

A total of 7013 individuals were included in the study between April 1996, and March 2015, and contributed to a total of 27,417 index hospitalization records. Participants had a median age of 43 years at the first admission (Q1-Q3= 37–51 years). Table 1 outlines demographic and clinical characteristics, stratified by 30-day readmission for all and similar causes. At baseline, the highest proportion (38%) of participants had an attachment between 30% and 50%, and 34.8% of participants had an attachment of more than 50%. The majority of physicians who provided the most services to patients were general practitioners (GPs) (73.3%), internal medicine specialists (10.1%), and psychiatrists (5.0%). The three most common causes of admissions and readmissions were diseases and disorders of the digestive system, multisystemic site infections, and mental diseases and disorders.

Of 7013 first hospitalizations, 921 (13.1%) resulted in 30-day readmission for all causes at baseline. The unadjusted and adjusted estimates of odds ratio for 30-day readmission for all causes after discharge are presented in Table 2. In bivariable analyses, each 10% increase in patient-physician attachment was associated with lower odds of being readmitted to the hospital within 30 days after discharge (OR = 0.82, 95% confidence interval [CI]: 0.80–0.84). The multivariable GEE model presented in Table 2 indicated that this association remained statistically significant when adjusting for various demographic and clinical confounders [adjusted OR (AOR)= 0.85, 95% CI: 0.83–0.86].

Table 3 presents the results from the bivariable and multivariable GEE analysis for 30-day readmission for the similar cause. Of a total of 7013 first hospitalizations, 564 (8%) were readmitted within 30-days for a similar cause at baseline. In bivariable analyses, there was a significant and negative association between patient-physician attachment and 30-day readmission for a similar cause (OR = 0.84, 95% CI: 0.82–0.86). This relationship remained statistically significant when accounting for various confounders (AOR = 0.86, 95% CI: 0.84– 0.88).

In sensitivity analyses where we included same-day readmissions (data not shown), of 6596 first hospitalizations, 699 (10.6%) resulted in 30-day readmission for all causes at baseline. When considering readmission for all causes, attachment to a primary physician was associated with lower readmission in multivariable analyses (AOR = 0.88, 95% CI: 0.86–0.91). The relationship between patient-physician attachment and hospital readmission for readmission for a similar cause remained as well (AOR = 0.89, 95% CI: 0.86–0.93).

DISCUSSION

For PLWH in BC, a higher proportion of patient-provider attachment was associated with lower odds of being readmitted to hospital within 30-days of discharge for all causes and a similar cause, even after adjusting for various confounders. We also found that 30-day hospital readmission for all causes at baseline was 13.1%, which is slightly lower compared to other settings in North America, which have ranged from 19.0% to 26.2%.[12–14,17] There may be a number of reasons for this, including differences in the definition of readmission. For example, Berry and colleagues (2013)[13] included same-day readmissions, while in our primary analysis, we defined an index hospitalization as lasting more than one day. However, in our sensitivity analyses including same day readmission, the 30-day readmission for all causes was even lower, at 10.6% at baseline. Nyweide and colleagues (2013)[15] measured continuity of care for older adults using two measures: first, physician's share of patients visits, and second, the highest concentration of a patient's total visits to a single provider. A possible reason for the low readmission we observed in the present study may be that in BC, large initiatives have focused on expanding access to HIV treatment and care, including centralized physician training and universal and free access to ART medication through a single-payer system.[47] Thus, PLWH living in BC may have better outcomes compared to those in other settings where more barriers to HIV care may be present.[48] Nevertheless, our finding that a substantial proportion of PLWH are being readmitted to hospital is concerning given the high cost to health systems and the negative health consequences associated with hospital readmission.[1,4] In this context, the finding that a higher proportion of patient-provider attachment is associated with lower readmission rate should help design novel strategies that can be integrated into discharge planning, to strengthen patient-provider attachment.

Our finding that engaging with the same provider was associated with a lower risk of readmission for PLWH may be because relational aspects of care are particularly important for this population. Despite many advances towards the de-stigmatization of HIV infection, many PLWH continue to experience stigma and discrimination as a result of their HIV status or comorbid conditions such as mental illness, homelessness, or injection drug use.[49–51] Stigmatization, in turn, leads to mistrust in the healthcare system, causing reluctance to seek and remain engaged in care. [52–54] Physicians may also inadvertently contribute to PLWH disengagement in care by using excessive precautions, refusing or discouraging treatment, or mistreating PLWH. [55,56] Therefore, it is important that healthcare providers are trained to deliver trauma-informed care in an effort to build trust and rapport with their patients.[57] Other factors that may foster patient-provider attachment include good communication and shared decision-making.[31,58] Promoting these aspects of care through physician training or stewardship may help promote health system performance. Future research should seek to examine these pathways more directly.

With the success of ART treatment in reducing AIDS-related illnesses and reducing mortality, other complications, such as cardiovascular or kidney disease, have emerged in the aging PLWH population.[59–63] This shift from an acute to chronic condition represents a unique challenge for the healthcare system, particularly as it relates to the provision of consistent care.[64] The delays between HIV diagnosis and time to accessing specialist care

can result in leakage from the cascade of care.[63] Our study reports that nearly three quarters of physicians who provided the most services to PLWH were GPs. Indeed, GPs can effectively and appropriately manage care for PLWH.[63] For example, GPs trained in recognizing acute HIV infection, which is often mistaken for other common viruses, may promote case finding and early ART intervention.[65] Additionally, GPs are better suited to provide the versatility of care PLWH now need, and are capable of providing important psychosocial support and a person-centered approach, thus increasing care quality.[63,66,67] Integrating HIV care into GPs' clinical practices can provide comprehensive care for this population [66], and decrease hospital admission.[19,68] As GPs take on more of the care for PLWH, there is room for future studies to examine whether trends for reasons for admission to hospital change over time.

Our study has a few limitations. First, we may have missed patients who were readmitted in a different jurisdiction outside of BC. However, our population-level linked cohort is comprehensive in that the DAD encompasses data from all hospitals within the province. Second, this study was observational in nature and as such, causation cannot be inferred. Additionally, unmeasured confounders may have been present. For example, injection drug use is known to be associated with being readmitted. Our data only indicates whether a participant had a history of injection drug use but not whether the participant currently uses injection drugs. We also did not adjust for the size of the physician's practice given that this information was not available in our database. However, it is worth noting that in BC, most of the care is provided in solo practices. Additionally, all of our participants were engaged in some form of care, and as such, our findings may not be generalizable to a population of PLWH not engaged in care. Third, we calculated patient-provider attachment as the percentage of services provided by the physician who provides the most services in a year. While this method has been used by other studies[30,43], it has not been validated, and as such, there is potential for future studies to validate this variable in other datasets, and determine whether there is an appropriate cutoff threshold for this attachment variable. Fourth, patient-provider attachment was assessed quantitatively in this study. Future qualitative studies should seek to explore whether emotional attachment with the same physician is associated with better hospital outcomes among PLWH. Lastly, this study was conducted in a universal healthcare context, and as such, may not be applicable to other settings.

In summary, we found that a higher proportion of patient-provider attachment was associated with less likelihood of readmission among PLWH, for both all causes and similar cause readmission. Our findings support the adoption of measures to promote engaging with the same provider for PLWH. Changes in health systems towards models that promote attachment, such as patient-centered medical homes, integrated care services, and the implementation of widespread physician education programs, are needed in order to optimize outcomes for PLWH, and enhance healthcare sustainability.

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TABLE 1.

Baseline characteristics of 7013 people living with HIV in British Columbia, Canada

Characteristic	n (% or median) (N=7013)	30-day readmission- all cause		*p* - value
		Yes (column *% or median)* (*n* = 921)	No (column % or median) (*n* =6092)	
Attachment[1] to primary physician within 12 months				
0–10%	68 (1.0)	28 (3.0)	40 (0.7)	< 0.01
>10% & ≤ 20%	667 (9.5)	142 (15.4)	525 (8.6)	
>20% & ≤ 30%	1156 (16.5)	202 (21.9)	954 (15.7)	
>30% & ≤ 40%	1377 (19.6)	178 (19.3)	1199 (19.7)	
>40% & ≤ 50%	1305 (18.6)	133 (14.4)	1172 (19.2)	
>50% & ≤ 60%	853 (12.2)	92 (10.0)	761 (12.5)	
>60% & ≤ 70%	683 (9.7)	63 (6.8)	620 (10.2)	
>70% & ≤ 80%	531 (7.6)	50 (5.4)	481 (7.9)	
>80% & ≤ 90%	280 (4.0)	29 (3.2)	251 (4.1)	
>90% & ≤ 100%	93 (1.3)	4 (0.4)	89 (1.5)	
Sex				
Female	1364 (19.5)	205 (22.3)	1159 (19.0)	0.02
Male	5649 (80.6)	716 (77.7)	4933 (81.0)	
Age at admission (median, Q1-Q3)	43 (37 −51)	42 (35 −50)	43 (37 −51)	< 0.01
History of IDU[2]				
No	3149 (44.9)	330 (35.8)	2819 (46.3)	< 0.01
Yes	2839 (40.5)	437 (47.5)	2402 (39.4)	
Unknown	1025 (14.6)	154 (16.7)	871 (14.3)	
Discharge against medical advice				
No	6492 (92.6)	750 (81.4)	5742 (94.2)	< 0.01
Yes	521 (7.4)	171 (18.6)	350 (5.8)	
Calendar year (median, Q1-Q3)	2005 (2000, 2010)	2004 (1999, 2009)	2005 (2000, 2010)	< 0.01
Charlson comorbidity index (median, Q1-Q3)	5 (4, 7)	6 (4,8)	5 (4,7)	< 0.01
Latest viral load within 12 months (median, Q1-Q3)	2.1 (1.7, 4.2)	2.9 (1.7–4.9)	2.0 (1.7, 4.0)	< 0.01
Latest CD4 within 12 months (100 cells/ mm3)				
0–49	653 (9.3)	176 (19.1)	477 (7.8)	< 0.01
50–199	1283 (18.3)	210 (22.8)	1073 (17.6)	< 0.01
200–349	1483 (21.2)	180 (19.5)	1303 (21.4)	< 0.01
350+	3198 (45.6)	309 (33.6)	2889 (47.4)	< 0.01
Unknown	396 (5.7)	46 (5.0)	350 (5.8)	< 0.01

[1]Attachment is defined as the percentage of HIV-related services provided by the physician who provides the most services in a year

[2]Injection drug users

TABLE 2.

Bivariable and multivariable GEE[1] analyses of factors associated with hospital readmission within 30-days of discharge for all causes

Characteristic	Odds Ratio (OR) excluding same-day readmission	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Attachment to primary physician within 12 months (per 10% increase)	0.82 (0.80–0.84)	0.85 (0.83–0.86)
Sex (female vs male)	1.08 (0.99–1.19)	0.93 (0.85–1.03)
Age at admission (per 10 years)	0.94 (0.90–0.97)	1.00 (0.96–1.04)
History of injection drug use		
No	Reference	
Yes	1.64 (1.50–1.79)	1.16 (1.05–1.27)
Unknown	1.72 (1.51–1.95)	1.44 (1.26–1.64)
Discharge against medical advice (yes vs no)	3.15 (2.86–3.47)	2.73 (2.46–3.02)
Calendar year (per 10 years)	0.83 (0.77–0.89)	0.73 (0.67–0.80)
Charlson comorbidity index (per unit increase)	1.13 (1.11–1.14)	1.13 (1.12–1.15)
Latest viral load within 12 months (log10 copies/ml)	1.21 (1.17–1.24)	1.06 (1.06–1.10)
Latest CD4 within 12 months (100 cells/ mm3)		
0–49	Reference	
50–199	0.58 (0.51 – 0.65)	0.66 (0.58–0.75)
200–349	0.39 (0.34–0.44)	0.53 (0.46–0.60)
350+	0.32 (0.28–0.35)	0.51 (0.44–0.58)
Unknown	0.35 (0.29–0.42)	0.54 (0.44–0.66)

[1] Generalized estimating equations

TABLE 3.

Bivariable and multivariable GEE[1] analyses of factors associated with hospital readmission within 30-days of discharge for the similar cause

Characteristic	Odds Ratio (OR) excluding same day readmission	
	Unadjusted OR (95% CI)	**Adjusted OR (95% CI)**
Attachment to primary physician within 12 months (per 10% increase)	0.84 (0.82–0.86)	0.86 (0.84–0.88)
Sex (female vs male)	1.10 (0.98–1.23)	0.95 (0.84–1.07)
History of injection drug use		
No	Reference	
Yes	1.51 (1.36–1.68)	1.04 (0.93–1.17)
Unknown	1.71 (1.47–2.00)	1.30 (1.11–1.52)
Discharge against medical advice (yes vs no)	3.49 (3.12– 3.90)	2.94 (2.61–3.32)
Age at admission (per 10 years)	0.86 (0.82–0.89)	0.96 (0.91–1.01)
Calendar year (per 10 years)	0.73 (0.67–0.79)	0.73 (0.65–0.81)
Charlson comorbidity index (per unit increase)	1.07 (1.06–1.09)	1.08 (1.07–1.10)
Latest viral load within 12 months (log10 copies/ml)	1.24 (1.20–1.28)	1.05 (1.01–1.09)
Latest CD4 within 12 months (100 cells/mm3)		
0–49	Reference	
50–199	0.48 (0.42–0.55)	0.56 (0.48–0.64)
200–349	0.33 (0.29–0.38)	0.46 (0.39–0.53)
350+	0.29 (0.25–0.33)	0.47 (0.40–0.55)
Unknown	0.31 (0.25–0.39)	0.51 (0.40–0.65)

[1] Generalized estimating equations