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Association of Substance Use with Hospitalization and Virologic Suppression in a Southern Academic HIV Clinic

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Abstract

Background—Persons with HIV infection who do not achieve virologic suppression contribute significantly to the ongoing HIV epidemic and have an increased risk of clinical sequelae related to immunosuppression. The extent to which substance use and mental health diagnoses impact HIV outcomes and the care continuum has not been previously assessed at the Medical University of South Carolina (MUSC), a large academic HIV clinic.

Methods—To address this knowledge gap and identify targets for intervention, we performed a retrospective chart review to examine associations of substance use and mental health diagnoses with hospitalization and virologic suppression.

Results—Patients with substance use or mental health diagnoses had increased rates of hospitalization and lower rates of sustained longitudinal HIV suppression. Prevalence of distinct substance-related disorders differed by race and gender. While cocaine, alcohol and cannabis use were common, documented opiate use disorder was surprisingly infrequent given the ongoing opioid epidemic in South Carolina.

Conclusions—These data suggest effective assessment and treatment of substance use disorders will help improve the HIV care continuum in South Carolina.

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Conflicts of Interest: None

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Keywords

HIV; substance use disorder; mental health disorder; electronic medical record; HIV care continuum

Introduction

In the United States, nearly half of all new HIV infections now occur in southern states (1). In South Carolina (SC), there are ~750 newly reported HIV cases annually, and SC has the 8th and 9th highest national HIV prevalence and incidence rates, respectively (2). New transmission events in SC occur primarily through heterosexual and male-to-male homosexual transmission (3), while reported intravenous drug use (IVDU) contributes less significantly (6–7%). The Charleston-North Charleston area is consistently in the top 20 US metropolitan areas for HIV prevalence, with a prevalence of 504.8 infections/100,000 persons and an incidence of 29.2 infections/100,000 persons in 2014 (4). Nearly half of all South Carolinians with known HIV infection are not retained in care (5, 6). As lack of retention in care is a known risk factor for new HIV transmission events (7), efforts to understand factors that impact the HIV care continuum are urgently needed to help end the HIV epidemic.

The extent to which the HIV and substance use epidemics overlap in those living with HIV in SC is not firmly established. Between 2003–2012, alcohol-related hospitalizations remained stable, cocaine-related admissions decreased, while opiate-related admissions (heroin, methadone, oxycodone, and other opiates) increased markedly in SC (8). While the recorded drug poisoning death rate in SC is similar to national rates, the number of opioid-pain reliever prescriptions per capita in SC (rate of 101.8 per 100 persons, 11th ranked state) exceeds national averages (rate of 82.5/100 persons) (IMS National Prescription Audit, 2012). Previous work in people living with HIV has shown that having a substance related disorder (SRD) is associated with lower rates of retention and virologic suppression, as well as a higher prevalence of economic and social barriers and concomitant mental health disorders (9–11). As an academic medical center that provides comprehensive care for the under-served, the Ryan White HIV clinic at the Medical University of South Carolina (MUSC) cares for over 1200 people living with HIV infection, including approximately 100 new patients annually. Here, we performed a retrospective chart review to assess the prevalence of substance use and mental health diagnoses in outpatients with HIV infection at MUSC. Differences based on race and gender, and relationships to hospital admission and maintenance of virologic suppression, were examined, with an aim towards defining areas that would benefit from targeted intervention.

Methods

We first utilized an electronic reporting tool within the Epic electronic medical record (SlicerDicer) to conduct a feasibility analysis based on clinical and demographic characteristics (12). SlicerDicer allows for extraction of aggregate population level data in de-identified fashion based on user-defined search terms. Data in SlicerDicer for patients seen in the outpatient setting were available from 5/1/2012 through 5/31/2016. HIV status

was determined using ICD9/10 codes for HIV disease (042/B20), while substance use was assessed using ICD9/10 codes including alcohol related disorders (F10.*), cocaine related disorders (F14.*), cannabis related disorders (F12.*), and opiate related disorders (F11.*).

We next performed a retrospective chart review of persons with HIV infection seen in the outpatient infectious diseases (ID) clinic at MUSC using information retrieved from the clinical data warehouse. Approval for this study was received from the MUSC Institutional Review Board (Pro00056049). The patient cohort was defined using ICD9/10 codes (042/B20) to identify persons with HIV infection and a location visit consistent with at least one completed outpatient visit in the ID clinic between 07/01/14 and 5/31/16, resulting in identification of 1201 individuals. Laboratory and clinical data for this cohort were then retrieved from 06/01/06 and 05/31/16 and included HIV viral loads, urine toxicology screens, and hospitalizations that occurred during this 10-year time frame. Data on race, gender, and age were collected and are reported in aggregate. Diagnosis codes for each patient were reviewed for presence of documented alcohol, cocaine, cannabis, or opiate use disorders, as well as presence of a mental health diagnosis. Poly-substance use was not examined, nor was prescription medication use analyzed for individual patients given the complexity of the data both within and outside of our health care system. Presence or absence of any hospitalization for any reason, i.e. for an HIV-related or unrelated indication, was determined and is reported as a dichotomous outcome irrespective of the total number of hospitalizations during the 10-year period of analysis.

A review of longitudinal HIV viral load values available for each patient revealed a broad distribution in the range of available data within the 10-year period of analysis. Because we did not examine prescription patterns, response to antiviral treatment was inferred based on virologic response. To simplify virologic suppression data for analysis, patients were grouped into 1 of 3 categories based on their viral load trend, irrespective of whether there were missing data during the 10 year period of analysis: a) “complete virologic suppression” was defined as sustained virologic control based on data available during the 10-year period of analysis, without a viral load increase over 200 copies/ml *once virologic suppression had been achieved* after treatment initiation (n=720); b) “incomplete virologic suppression” was defined as evidence of at least one episode of loss of virologic control (viral load over 200 copies/ml) after virologic suppression had already been achieved with treatment (n=338); and c) individuals who could not be placed into one of these two categories based on insufficient data or lack of evidence that treatment had been initiated (n=143). This third group includes patients in whom virologic suppression was never achieved, either due to lack of treatment initiation or due to lack of virologic suppression with treatment, a distinction we could not make based on the available data. For this reason, patients in this third group were excluded from subsequent analyses that examined virologic suppression; thus the cohort size was n=1058 for analysis of virologic suppression. Of note, for the “complete virologic suppression” group, successful treatment was defined based on the first instance when virologic suppression was achieved, irrespective of when this occurred, as initiation of treatment in all patients irrespective of CD4 count was not considered standard of care during the entire time; thus, lack of virologic suppression may have reflected treatment delay due to provider or patient preference rather than lack of virologic response. Finally, of the 1201 patients defined in this cohort, 37 were reported as deceased at some

point during the 2-year period in which the cohort was defined. Retrospective data for these patients was still considered and grouped as for the rest of the cohort based on available data.

Data were analyzed by unpaired t-test, Pearson's Chi-squared test, or logistic regression, as indicated in each figure, using the statistical software R version 3.4.

Results

A preliminary analysis in SlicerDicer, a de-identified searchable database in the electronic medical record, suggested that alcohol, cocaine, and cannabis use were more common diagnoses in people living with HIV cared for at MUSC than opiate use disorders (data not shown), in contrast to the aforementioned recent increase in opioid related deaths and diagnoses in South Carolina as a whole (8). To better understand and analyze substance use patterns, and potential relation to HIV suppression and the care continuum, we conducted a retrospective chart review of the outpatient HIV cohort at MUSC. This cohort was defined as having received care during a 2-year period between 2014 and 2016, and used 10 years of their retrospective data. As shown in Table 1, this HIV+ cohort numbered 1201 patients, were mostly African-American and male and had a mean age of 46, consistent with reported HIV demographics in the South. Most patients did not have a hospitalization at MUSC during the 10-year period examined (58.5%), did not have a documented mental health diagnosis (63.2%), and had complete virologic suppression over the 10-year time period examined (60%), based on data available within the MUSC health care system (Table 1). Having a diagnosis code for any substance use was relatively common (19.2%), with a significantly higher recorded rate of alcohol, cocaine, and cannabis use than opioid use disorder (Table 1), consistent with results obtained analyzing aggregate data in SlicerDicer. While no difference in age was observed based on virologic suppression, cannabis use, or mental health diagnosis, patients who had at least 1 hospitalization, or used alcohol, cocaine, or opiates were significantly older than patients without these diagnoses (Fig. 1).

We next addressed the association of substance use and mental health diagnoses with hospitalization and complete virologic suppression. We found that patients with a documented mental health diagnosis or any substance use disorder had a significantly higher rate of both inpatient hospitalization (Fig. 2A) and incomplete virologic suppression (Fig. 2B), with the exception that opiate use did not associate with virologic suppression. We used logistic regression to examine the impact of each individual diagnosis on hospitalization risk, and found significant associations for: cocaine use (odds ratio (OR) 3.4, $p < 0.001$), cannabis use (OR 2.4, $p = 0.006$), alcohol use (OR 2.1, $p = 0.001$) and mental health diagnosis (OR 1.64, $p < 0.001$), while opiate use was not significant. A logistic regression examining the impact of each individual diagnosis on incomplete virologic suppression revealed associations of: cannabis use (OR 2.4, $p = 0.002$), alcohol use (OR 2.0, $p = 0.001$), and mental health diagnosis (OR 1.4, $p = 0.018$), with no significant difference based on cocaine or opiate use.

To better understand the demographics of substance use and mental health diagnoses, we examined rates within groups of persons based on race and gender. Relative to most or all of

the rest of the cohort, African American women had higher rates of hospitalization, mental health diagnoses, and cocaine use. African American men had lower rates of hospitalization and mental health diagnoses, but higher rates of cannabis use (Fig. 3). Caucasian women had higher rates of mental health diagnoses and alcohol use, while Caucasian men had lower rates of incomplete HIV suppression, hospitalization, alcohol use, and cocaine use (Fig. 3). No significant differences relative to the cohort were observed in any category for Hispanic women and men (data not shown), although Hispanic persons only compose 3.4% of the clinic population (Table 1), limiting the statistical power to make this assessment.

Because data were derived from diagnostic codes entered into the medical record by physicians for the purpose of documentation and/or billing, they are subject to both over- and under-reporting based on individual physician practices. To help assess the extent to which this may have impacted the results, we used laboratory urine toxicology data to explore the relationship between having a coded substance use diagnosis and substance use testing. Interestingly, only a minority of patients with a coded substance use diagnosis for cocaine (43/118, 36%), cannabis (23/82, 28%), or opioids (10/27, 37%) had received a urine toxicology screen during the 10-year period of observation. Of those who had received testing, a slight majority of those with a cocaine (25/43, 58%), cannabis (12/23, 52%), or opiate use (5/10, 50%) diagnosis had a positive result for the respective analytes, although the context and timing in which testing was performed was not examined. Interestingly, a significant proportion of patients who had a positive urine toxicology screen for cocaine (11/36, 31%) or cannabis (17/29, 59%) did not have a documented corresponding diagnosis code.

Discussion

We report high rates of substance use and mental health diagnoses in the HIV clinic at MUSC, both of which associated with higher rates of inpatient hospitalization and incomplete virologic suppression. These associations were observed for alcohol, cocaine, and cannabis, while documented opioid use disorder was relatively uncommon. These findings are consistent with previous work associating SRDs in the setting of HIV infection with economic disparities, lower measures of HIV virologic suppression, and higher rates of morbidity and mortality, reflected in part by higher rates of hospitalization (10, 11). These data identify comorbid conditions in our HIV clinic that will benefit from greater resources to improve both clinical outcomes and the continuum of care.

Previous data from studies conducted by Metsch and colleagues in hospitals in Miami and Atlanta indicated that substance users with HIV infection comprised over one-third of HIV-related hospitalizations and that crack cocaine use was associated with patients having never enrolled in HIV primary care (11). These results are consistent with the findings reported here, although the populations studied were different. A subsequent study enrolled 801 patients with HIV infection and substance use from 11 hospitals across the United States and sought to incentivize linkage and retention in care to achieve viral suppression (10). Patients were middle-aged (mean age 44), mostly male (67%), mostly African-American (75%) and had high rates of alcohol (49%) and cocaine (44% crack cocaine, 29% powder cocaine) use prior to study enrollment. After six months of study interventions that attempted to improve

viral suppression among patients with unsuppressed viral loads and substance use who were recruited as hospital inpatients, there was no sustained viral suppression, with Southern institutions (vs. institutions from other regions) having lower proportions of patients with viral suppression. The data reported here indicate similar magnitude and demographics of substance use at our institution, suggest the potential generalizability of our findings to HIV clinics in the south, and highlight the need to further develop approaches to positively impact this population.

To our surprise, although opioid-related hospitalizations and deaths in the state of SC and in the country as a whole are on the rise (8, 13, 14), opioid SRD was the least prevalent coded SRD in our HIV outpatient cohort. Because prescription opiate use is so common and because it can be challenging to distinguish appropriate prescription drug use from inappropriate abuse using urine drug screens and other tools, we suspect that unless formally screened, assessed, and coded, opioid SRD will be prone to under-reporting. Alcohol, cannabis, and cocaine use, in contrast, are perhaps more readily and appropriately coded in the medical record in the context of more objective tests to measure their presence in patient blood and serum.

The primary study limitation is the reliance upon coded diagnoses to assess the prevalence of substance use in our clinic population. As indicated by the analysis of urine toxicology screens, we found an inconsistent relationship between documentation of substance use and testing for substance use. As an extension of this limitation, it is possible that a diagnosis code for substance use remains in the “active” medical record and problem list long after the problem has resolved, a possibility we could not address with the available data. Our study also does not account for data or events that may have occurred outside of our medical system or medical record, including measures of virologic control or hospitalizations outside of MUSC. Our approach to assessing virologic suppression for the purposes of conducting this analysis was likely an oversimplification of individual patient complexity, including the potential exclusion of treated individuals who never achieved virologic suppression, as outlined in the methods section. Our approach to assessing hospitalization did not account for the reason for hospitalization, i.e. HIV- or substance-related, or the frequency of admissions. Finally, because heroin use disorder does not have an ICD10 code that is distinct from opiate use disorders, and because heroin is not uniquely detected from other opiates using our standard UDS, we were unable to assess prevalence of this disorder.

Conclusions

In summary, we demonstrate that substance use, in particular alcohol, cocaine, and cannabis, is common in the HIV cohort receiving care in the MUSC infectious diseases clinic, and that this associates with increased rates of hospitalization and incomplete virologic suppression. We intend for these findings to prompt increased efforts to screen for substance use disorders and identify resources for their treatment in order to advance efforts to improve retention and outcomes on the HIV care continuum. Specifically, integration of substance use services within the clinic, increased case management services, and greater use of mobile health technologies to facilitate engagement in care will be pursued.

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Figure 1.

Comparison of age of patient groups with or without each indicated diagnosis. Shown are population means with 95% confidence intervals. Statistical analysis was by unpaired t-test with significant differences indicated.

Figure 2.

Association of substance use and mental health with hospitalization and virologic suppression. Shown are the percentage of patients with and without each diagnosis that had at least 1 hospitalization (A) or incomplete virologic suppression (B). Statistical analysis was performed by Pearson's Chi-squared test with Yates' continuity correction. * denotes a p-value < 0.05 and NS denotes not significant.

Figure 3.

Prevalence of each diagnosis within groups defined by race and gender. Shown are the percentage of each race-gender cohort with each diagnosis. Statistical analysis was performed by Pearson's Chi-squared test with at Yates' continuity correction for each indicated group relative to the rest of the patient cohort. * denotes a p-value < 0.05.

Table 1

Demographics of the HIV+ cohort examined in this study.

Outpatient HIV Cohort (n=1201)	
Race	
-African American	874 (72.7%)
-Caucasian	281 (23.4%)
-Hispanic	41 (3.4%)
-Other	5 (0.4%)
Gender	
-Male	784 (65.3%)
-Female	417 (34.7%)
Age: mean (range)	46 (19–91)
Any Hospitalization	
-No	703 (58.5%)
-Yes	498 (41.5%)
Virologic Suppression	
-Complete	720 (60.0%)
-Incomplete	338 (28.1%)
-Insufficient Data	143 (11.9%)
Mental Health Diagnosis	
-No	759 (63.2%)
-Yes	442 (36.8%)
Any Substance Use	231 (19.2%)
-Alcohol	147 (12.2%)
-Cocaine	117 (9.7%)
-Cannabis	82 (6.8%)
-Opiates	27 (2.2%)