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Quantifying alcohol use among Ecuadorian human immunodeficiency virus positive individuals and assessing alcohol as an independent risk factor for human immunodeficiency virus
A case control study STROBE

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Abstract

Alcohol abuse has been identified as a risk factor for contracting human immunodeficiency virus (HIV) and accelerating disease progression. Our study aims to determine alcohol consumption rates among Ecuadorian HIV positive (HIV+) patients prior to diagnosis to evaluate its impact as an independent risk factor for contracting HIV. Additionally, we will examine post-diagnosis consumption rates among the HIV+ population.

We provided anonymous questionnaires to 300 HIV+ patients and 600 internal medicine patients at 3 hospitals in Quito, Ecuador. Questionnaires quantified alcohol usage prior to HIV diagnosis, at time of diagnosis, and post-diagnosis while accounting for other potential HIV risk factors. We then determined frequencies of alcohol consumption and confounding variables. Finally, we performed a multivariable logistic regression controlling for confounders to determine the statistical significance of alcohol consumption as an independent risk factor for HIV.

Our results showed increased odds for contracting HIV among those who drank daily (OR 5.3, CI 2.0–14.0) and those who consumed 6 or more alcoholic beverages on days they drank (OR 5.0, CI 3.1–8.2). Through multivariable analysis, we found that abstaining from binge drinking was a protective factor with an OR 0.5 (0.3–0.96). The percentage of HIV+ patients abstaining from alcohol increased from 30% twelve months prior to diagnosis to 57% after diagnosis.

Our results show that alcohol abuse significantly increases the risk of contracting HIV. We found that prior to diagnosis, HIV patients consistently drank more frequently and a greater amount than the control group. Alcohol use significantly decreased among HIV+ patients after diagnosis.

Abbreviations: ART = antiretroviral therapy, HIV = human immunodeficiency virus, HIV+ = human immunodeficiency virus positive, USFQ = Universidad San Francisco de Quito.

Keywords: 90-90-90, Ecuador, ethanol, human immunodeficiency virus, risk factors

1. Introduction

In 2014, The Joint United Nations Program on human immunodeficiency virus (HIV)/ acquired immunodeficiency syndrome released the "90–90–90" treatment goals which outlined the following targets: 90% of all HIV positive (HIV+) individuals will know their status, 90% of all people diagnosed with HIV will receive Antiretroviral Therapy (ART), and 90% of people receiving ART will achieve viral suppression. As of 2019,

according to United Nations Program on HIV/AIDS, there are an estimated 37.9 million people around the world living with HIV and 1.7 million newly infected individuals every year. In Latin America, according to this data, HIV-related deaths declined by 14% between 2010 and 2018. However, in this same time period there was a 7% increase in the rate of new HIV infections. In Ecuador specifically, there are an approximate 44,000 people currently living with HIV, but estimates indicate that only 76% of the HIV positive population is aware of their status. During the past decade, the rates of new infections in Ecuador have decreased from 2,500 per year to 2,200. Proper identification and mitigation of risk factors for contracting HIV in Ecuador could aid in further decreasing the rate of new HIV infections, thereby reducing the number of new HIV+ patients unaware of their status in accordance with the 90-90-90 goals.

One risk factor implicated in HIV transmission is alcohol abuse. While the relationship between alcohol, other risk factors such as unsafe sex, and HIV seroconversion is not entirely understood, previous studies have shown a correlation between alcohol consumption and HIV status.[1,2]

Numerous studies have independently concluded that alcohol consumption adversely affects the health of HIV positive patients, regardless of treatment status. These effects are thought to be primarily manifested through decreased drug penetration in target cells, increased viral replication, immunosuppression, and reduced ART adherence.[3–6]

Within recent years, the Ecuadorian government has increased funding to provide nationwide treatment to HIV+ individuals, then 57% of them are receiving ART but only 51% have achieved viral suppression.[7] Due to the negative impact of alcohol on disease progression, a reduction in alcohol consumption among the Ecuadorian HIV+ population should improve patients' outcomes and prognoses, reduce associated healthcare costs, and allow more patients to be treated.[8] These outcomes would contribute positively towards reaching the goals of 90% of HIV diagnosed individuals receiving treatment and 90% of individuals having viral suppression.

Considering this information, the objectives of this study are 2 fold. Our first aim is to determine whether alcohol consumption is an independent risk factor for contracting HIV and what type of drinking behavior, chronic consumption or binge drinking, is associated with HIV positive status. The second aim of this study is to determine whether the rate of alcohol consumption decreases among HIV+ individuals post-diagnosis.

2. Methods

2.1. Study design

A multicentric case-control study was carried out in the 3 main Ministry of Health and Social Security Institute hospitals located in Quito, Ecuador. The HIV positive patients within the hospitals were matched with a hospital control based on sex, age, and gender. In order to increase the power of the study, a 1:2 case: control ratio was chosen. The inclusion criteria were over the age of 18 and diagnosed with HIV for at least 1 year, and the exclusion criteria were mentally incapacitated and < 18 years.

2.2. Procedures

Participants were asked to complete an anonymous, multiple choice questionnaire about their past and current alcohol use, tobacco use, drug use, sexual patterns, age, gender, and occupation. The questionnaires were administered in Spanish and proofread by bilingual medical students from Universidad San Francisco de Quito in Ecuador to ensure accurate translation from English to Spanish. Investigators administering the questionnaire explained the study to participants, outlined risks and benefits of participation, and were available to clarify questions if requested. The alcohol portion of the questionnaire was based off recommended questions from the National Institute on Alcohol Abuse and Alcoholism, and addressed the number of days per week the person drank, number of drinks consumed each day the person drank, and frequency of binge drinking which was defined as how often the person consumed 5 or more (males) or 4 or more (females) drinks containing any kind of alcohol within a 2-hour period. The use of 3 different measures of consumption was intended to distinguish between chronic, consistent consumption and intermittent episodes of heavy drinking.

The questionnaire for the experimental group focused on 3 time periods: 1 year prior to HIV diagnosis, at the time of diagnosis, and 1 year after diagnosis. The control group questionnaire focused on the current time period and 1 year prior. Questionnaire administration took place at Hospitals Eugenio Espejo and Enrique Garces from the Ministry of Health and Carlos Andrade Marin from the Social Security Institute in Quito, Ecuador throughout the summer of 2018. The experimental group consisted of HIV patients, 18 years old or older and diagnosed with HIV for at least 1 year waiting at outpatient HIV clinics and control participants, 18 years old or older, waiting at an outpatient internal medicine clinic. No identifying information such as name, date of birth, or identification number was collected from patients and there was no follow up.

The study size was calculated using a 95% confidence interval and power of 80%. The outpatient settings were located within the same hospital facilities in order to control for socioeconomic status. Potential confounders include tobacco use, drug use, and sex worker usage. Selection of participants was based on availability and all patients present in the facility were asked to participate.

2.3. Analysis

We reported mean and standard deviation for current age and age of first sexual encounter, and frequency (percentage) for categorical variables.

Differences in continuous variables were compared using Student t test (2 groups). We used Chi-square test and simple logistic regression to investigate association between outcome and categorical variables, and to generate the odds ratio without adjustment. Logistic regression model was used for the multivariate analysis of outcome: HIV diagnosis (event: "Cases") to identify determinants of HIV positivity. Associations were assessed by calculation of the odds ratio (OR) with 95% confidence intervals (CI). Statistical analyses were performed using the SAS 9.4 (SAS Institute Inc., Cary, NC). P-values of less than .05 were considered statistically significant.

To avoid the issue of complete separation on logistic regression, for the number of beverages consumed on a typical day which the patient drank, we combined the first 2 categories of "6 drinks or more per day" and "2 to 5 drinks per day" together due to low frequency. Similarly, for the variables of Binge Drinking, the first 3 categories of "Every day", "One or more times per week", and "One or more times per month" were

combined. The variables of Tobacco Consumption were regrouped to be binary variables ("Yes" vs. "No") by combining the first 2 categories into 1.

2.4. Ethical considerations

The rights of participants were protected throughout the study by adherence to Good Clinical Practices and other requirements as directed by institutional review boards. This case-control study and the subsequent data analysis were approved by registered institutional review boards in Ecuador (CEISH, Universidad San Francisco de Quito and the Ministry of Public Health) and in the United States (Institutional Review Board, University of South Florida). All responses were kept under encryption and after data collection was completed, data was de identified prior to analyzation.

3. Results

3.1. Patient demographics (Table 1)

In order to interview an adequate number of patients while mitigating differences in hospital volume we included 150 HIV+ patients and 299 HIV- controls from Hospital Enrique Garcés, 50 HIV+ patients and 100 HIV- controls from Hospital Carlos Andrade Marín, and 99 HIV+ patients and 200 HIV- controls from Hospital Eugenio Espejo. Extra surveys were obtained at some sites and used as supplements to replace surveys at the same site from patients who had not had HIV for at least 1 year. The final number of participants included in the analysis was 880. Three records with missing values under "Gender", 7 records with "Unknown Gender" and 6 with "Never had sex" were removed due to low frequencies. There were 289/880 (33%) HIV cases and 591/880 (67%) control cases for a case: control ratio of 1:3 in order to maximize power.

Of the HIV cases, 76% were male (n=219) while in the control cases 44% were male (n=262). The OR of having HIV if male was 3.9 (CI 2.9–5.4) versus female. The average age of HIV cases was 37.3±11.3 and 39.6±14.4 for control cases (p=.0136). No information regarding race, ethnicity, or socioeconomic status was collected.

3.2. Alcohol as a risk factor (cases vs. controls)

Upon univariate analysis, 2 of the 3 highest levels of alcohol consumption rates twelve months prior to diagnosis showed statistically significant increased OR for being HIV+. Patients who drank every day had an OR of 5.3 (95% CI 2.0–14.0) (Table 2), and patients who consumed 6 or more alcoholic beverages on days they drank exhibited an OR 5.0 (95%CI 3.1–8.2). In contrast, the highest levels of binge drinking prior to

diagnosis did not exhibit statistically significant associations, with those who reported binge drinking every day having an OR 1.2 (95%CI 0.5–3.0).

Moderately increased alcohol consumption rates prior to diagnosis were also associated with increased odds of HIV seropositivity, albeit to a lesser degree. Those who drank multiple times per week (vs. None) were at 1.6 times higher odds of being HIV+ (CI 1.1–2.5), while those who drank 1 or less times per week (vs. None) had an OR 2.7 (CI 2.0–3.7). Those who consumed 2–5 beverages on days they drank had an OR 1.9 (CI 1.2–2.8) and those who consumed less than 2 drinks per day had an OR 2.5 (CI 1.7–3.5). While the highest levels of binge drinking showed no statistically significant associations with HIV seropositivity, those who binge drank 1 or more times per week had an OR 2.6 (CI 1.6–4.0) and those who binge drank 1 or more times per month had an OR 2.2 (CI 1.5–3.3).

Associations between alcohol consumption at time of diagnosis and HIV seropositivity exhibited more variability. In terms of days the patient drank per week, only those drinking 1 or less times per week had a significant associations with HIV positivity (OR 1.9 CI 1.4–2.6). While consuming 6 or more drinks per day (OR 3.7 CI 2.1–6.3) and drinking less than 2 drinks per day (OR 1.9 CI 1.4–2.6) on days they drank had significant associations; however, consuming 2–5 drinks per day on drinking days (OR 1.3 CI 0.8–2.1) was not significant. Apart from those who binge drank every day (OR 1.3 CI 0.4–4.7), higher levels of binge drinking at the time of diagnosis was significantly associated with higher odds of being HIV+. Those who participated in binge drinking 1 or more times per week had an OR 3.7 (CI 2.1–6.5) and binge drinking 1 or more times per month showed an OR 1.8 (CI 1.2–2.8).

3.3. Other risk factors (Table 3)

The results showed that HIV+ patients were more likely to have used drugs prior to diagnosis (Table 3). Tobacco use among HIV+ cases and controls were similar. At twelve months prior to diagnosis, 38% of HIV+ cases used tobacco vs. 32% of controls, with no significant associations noted for being HIV+. At the time of diagnosis, 30% of HIV patients used tobacco vs. 29% of controls, with no significant associations with being HIV+ shown. However, marijuana usage prior to diagnosis was significantly associated with being HIV+, with 19% of HIV+ patients reporting usage of marijuana prior to their diagnosis vs. 12% of controls. Cocaine usage prior to diagnosis was also significantly associated with being HIV+, with 9% of HIV+ cases reporting using cocaine prior to diagnosis vs. 3.9% of controls. IV drug usage showed no significant associations between groups.

Regarding sexual practices, first sexual encounter was younger (16.9 years) in HIV+ cases than controls (17.8 years) (P<.05).

Table 1

Patient Demographics.

	HIV Cases (n=289)	Controls (n=591)	OR (95% CI)
Age	37.3±11.3	39.6±14.4	*P*=.0136
Age of 1st sexual encounter	16.9±3.8	17.8±4.0	*P*=.0013
Gender (vs Female)			
Male	219/289 (75.8)	262/591 (44.3)	**3.9 (2.9–5.4)**
Female	70/289 (24.2)	329/591 (55.7)	1.0

HIV = human immunodeficiency virus.

Comparison of consumption rates between HIV+ patients and controls at twelve months prior to diagnosis and time of diagnosis.

	HIV		
	Cases	**Controls**	**OR (95% CI)**
Gender (Male vs Female)	221/296 (74.7)	264/597 (44.2)	**4.0 (2.9–5.4)**
Age of 1st sexual encounter	16.8±3.8	17.8±4.1	**P=.0004**
Days the patient drank per wk 12 mo prior (vs None)			
Every day	11/297 (3.7)	7/597 (1.2)	**5.3 (2.0–14.1)**
Multiple times per week	41/297 (13.8)	85/597 (14.2)	**1.6 (1.1–2.5)**
One or less times per week	153/297 (51.5)	193/597 (32.3)	**2.7 (2.0–3.7)**
None	92/297 (31.0)	312/597 (52.3)	
Did not respond	2	2	
Drinks per day the patient drank 12 months prior (vs none)			
6 drinks or more per day	52/295 (17.6)	39/593 (6.6)	**5.0 (3.1–8.2)**
2–5 drinks per day	56/295 (19.0)	114/593 (19.2)	**1.9 (1.2–2.8)**
Less than 2 drinks per day	118/295 (40.0)	179/593 (30.2)	**2.5 (1.7–3.5)**
None	69/295 (23.4)	261/593 (44.0)	
Did not respond	4	6	
Binge drinking 12 mo prior (vs never)			
Every day	7/298 (2.4)	16/597 (2.7)	1.2 (0.5–3.0)
One or more times per wk	55/298 (18.5)	59/597 (9.9)	**2.6 (1.6–4.0)**
One or more times per mo	69/298 (23.2)	87/597 (14.6)	**2.2 (1.5–3.3)**
One or more times per yr	33/298 (11.1)	92/597 (15.4)	1.0 (0.6–1.6)
Less than once per yr	53/298 (17.8)	120/597 (20.1)	1.2 (0.8–1.8)
Never	81/298 (27.2)	223/597 (37.4)	
Did not respond	1	2	
Days the patient drank per week at diagnosis (vs none)			
Every day	2/297 (0.7)	9/593 (1.5)	0.6 (0.1–2.7)
Multiple times per wk	17/297 (5.7)	35/593 (5.9)	1.2 (0.7–2.3)
One or less times per wk	132/297 (44.4)	177/593 (29.9)	**1.9 (1.4–2.6)**
None	146/297 (49.2)	372/593 (62.7)	
Did not respond	2	6	
Drinks per day the patient drank at diagnosis (vs none)			
6 drinks or more per d	36/294 (12.2)	29/591 (4.9)	**3.7 (2.1–6.3)**
2–5 drinks per d	33/294 (11.2)	73/591 (12.4)	1.3 (0.8–2.1)
Less than 2 drinks per d	123/294 (41.8)	189/591 (32.0)	**1.9 (1.4–2.6)**
None	102/294 (34.7)	300/591 (50.8)	
Did not respond	5	8	
Binge Drinking at Diagnosis (vs never)			
Every day	4/298 (1.3)	7/594 (1.2)	1.3 (0.4–4.7)
One or more times per wk	36/298 (12.1)	23/594 (3.9)	**3.7 (2.1–6.5)**
One or more times per mo	45/298 (15.1)	58/594 (9.8)	**1.8 (1.2–2.8)**
One or more times per yr	29/298 (9.7)	87/594 (14.7)	0.8 (0.5–1.3)
Less than once per yr	58/298 (19.5)	123/594 (20.7)	1.1 (0.8–1.6)
Never	126/298 (42.3)	296/594 (49.8)	
Did not respond	1	5	

HIV = human immunodeficiency virus, HIV+ = human immunodeficiency virus Positive.

Having more than 1 sexual partner prior to diagnosis was significantly associated with being HIV+, with 71% of HIV+ patients responding "yes" vs 42% of controls. For sexual preference, sex with both men and women showed increased odds for HIV seropositivity, vs females only and men only.

General overall condom usage ("yes" vs "no") showed no significance for being HIV+. However, when asked about condom usage with vaginal sex, those who reported not having vaginal sex and intermittent ("sometimes") condom usage were at significantly increased odds for being HIV+ vs "always." Abstinence from anal sex and never using condoms with anal sex were protective factors for being HIV+, with 11.9% of HIV+ patients abstaining vs 28.7% controls, and 34.4% reporting "never" vs 46.3% controls. Nevertheless, this last finding shows a marginal significance which may be explained as a random finding. Conversely, intermittent condom usage with anal sex

(34.4% HIV+ cases vs 10.4% controls) was associated with increased odds of HIV seropositivity.

Having sex under the influence of alcohol or drugs and reporting previous STIs were significantly associated with increased odds for being HIV+. Usage of sex workers or employment as a sex worker were both associated with increased odds of contracting HIV. Prior military service showed no associations with being HIV+.

3.4. Multivariable controlled

Multivariable logistical regression analysis (Table 4) controlling for the covariates and considering effect modifications, found the following independent variables to be significantly and positively associated with being HIV+: being male (OR: 11.0 CI 4.9–24.9), having more than 1 sexual partner prior to diagnosis (OR: 2.3 CI

Table 3

Other risk factors.

	HIV+ Cases (n = 289)	Controls (n = 591)	OR (95% CI)
More than 1 sexual partner prior to diagnosis (vs No)			
Yes	205/287 (71.4)	242/573 (42.2)	3.4 (2.5–4.6)
No	82/287 (28.6)	331/573 (57.8)	
Gender preference (vs "Females only")			
Males only	151/289 (52.3)	328/556 (59.0)	1.0 (0.8–1.4)
Both	44/289 (15.2)	17/556 (3.1)	5.8 (3.2–10.7)
Females only	94/289 (32.5)	211/556 (38.0)	1.0
General condom usage (vs no)			
Yes	133/287 (46.3)	262/570 (46.0)	1.0 (0.8–1.3)
No	154/287 (53.7)	308/570 (54.0)	1.0
Condom usage with oral sex (vs "Always")			
Sometimes	48/243 (19.8)	83/472 (17.6)	1.4 (0.8–2.5)
Never	142/243 (58.4)	251/472 (53.2)	1.3 (0.8–2.2)
I don't have oral sex	28/243 (11.5)	79/472 (16.7)	0.8 (0.4–1.6)
Always	25/243 (10.3)	59/472 (12.5)	1.0
Condom usage with vaginal sex (vs "Always")			
Sometimes	53/243 (21.8)	104/471 (22.1)	1.9 (1.1–3.1)
Never	89/243 (36.6)	209/471 (44.4)	1.6 (0.99–2.5)
I don't have vaginal sex	68/243 (28.0)	37/471 (7.9)	6.7 (3.9–11.7)
Always	33/243 (13.6)	121/471 (25.7)	1.0
Condom usage with anal sex (vs "Never")			
Sometimes	84/244 (34.4)	49/471 (10.4)	2.5 (1.5–4.2)
Never	84/244 (34.4)	218/471 (46.3)	0.6 (0.4–0.9)
I don't have anal sex	29/244 (11.9)	135/471 (28.7)	0.3 (0.2–0.5)
Always	50/253 (19.8)	69/476 (14.5)	1.0
Sex while under the influence (vs No)			
Yes	124/288 (43.1)	153/584 (26.2)	2.1 (1.6–2.9)
No	164/288 (56.9)	431/584 (73.8)	1.0
Other STI's (vs No)			
Yes	75/266 (28.2)	79/579 (13.6)	1.4 (1.7–3.3)
No	191/266 (71.8)	500/579 (86.4)	1.0
Sex worker usage prior to diagnosis (vs no)			
Yes	68/289 (23.5)	45/583 (7.7)	3.7 (2.4–5.5)
No	221/289 (76.5)	538/583 (92.3)	1.0
Employment as a sex worker (vs no)			
Yes	21/287 (7.3)	9/585 (1.5)	5.1 (2.3–11.2)
No	266/287 (92.7)	576/585 (98.5)	1.0
Military service (vs no)			
Yes	23/287 (8.0)	28/584 (4.8)	1.7 (0.98–3.1)
No	264/287 (92.0)	556/584 (95.2)	

HIV+ = human immunodeficiency virus positive.

1.4–3.7), gender preference for males only (OR 8.2 CI 3.4–19.4) or both genders (OR 11.7 CI 4.3–32.3), condom usage "sometimes" with anal sex (OR: 2.3 CI 1.0–5.3 vs. always), sex worker usage (OR: 2.6 CI 1.3–5.2), and employment as a sex worker (OR: 4.5 CI 1.2–16.6).

The following variables were negatively associated with being HIV+: binge drinking once or more per year (but less than once or more per month) at time of diagnosis (OR: 0.3, CI 0.1–0.7, vs never), binge drinking less than once per year at diagnosis (OR: 0.5, CI 0.3–1.0, vs never), consumption of tobacco at diagnosis (OR: 0.3 vs No), never having had anal sex (OR: 0.4 vs always using condom with anal sex), and never having used condoms with anal sex (OR: 0.3 vs always), being this an unexpected finding.

3.5. Trends in alcohol consumption among the HIV+ population

Alcohol consumption decreased in the HIV population in each category of measurement both from twelve months prior to time of diagnosis, and from time of diagnosis to twelve months post diagnosis, while also showing a compensatory rise in lower levels of consumption.

Regarding the number of days HIV+ patients drank per week, those reporting "Every Day" decreased from 4% twelve months prior to 1% at time of diagnosis, and again decreased to 0% at twelve months post diagnosis (Table 5). Those who drank "multiple times per week" decreased from 14% to 6% to 5% in these same respective timeframes. The "one or less times per week" category also decreased from 52% to 44% to 38%, while those who selected "none" increased from 31% to 49% to 57%.

The number of drinks consumed on each day in which HIV+ patients drank alcohol also decreased across the highest levels of consumption. Those consuming "six or more drinks per day" decreased from 18% to 12% to 5%, and those drinking "between 2 and 5 beverages per week" decreased from 19% to 11% initially before remaining at 11% twelve months post diagnosis. Those consuming "less than 2 drinks per day" remained relatively stable at 40%, 42%, and 41% and those who

Table 4

Multivariate analysis of HIV risk factors.

Variables	β-value	S.E	Odds Ratio (95% CI)	P-value
Gender (vs Female)				
Male	2.40	0.42	11.0 (4.9–24.9)	<.0001
Drinks Per Day the Patient Drank 12 months Prior to Diagnosis (vs. None)				
2 drinks or more	−0.39	0.48	0.68 (0.26–1.7)	.4229
Less than 2 drinks	0.43	0.40	1.5 (0.71–3.4)	.2740
Binge Drinking at Diagnosis (vs. Never)				
One or more times per month or per week or every day	−0.44	0.34	0.6 (0.3–1.3)	.1996
One or more times per year	−1.20	0.42	0.3 (0.1–0.7)	.0043
Less than once per year	−0.68	0.32	0.5 (0.3–0.95)	.0346
Tobacco consumption at diagnosis (vs No)				
Yes	−1.32	0.65	0.3 (0.1–0.96)	.0424
More than 1 sexual partner prior to diagnosis (vs No)				
Yes	0.83	0.25	2.3 (1.4–3.7)	.0007
Gender preference for sexual partner (vs female only)				
Male only	2.10	0.44	8.2 (3.4–19.4)	<.0001
Both	2.46	0.52	11.7 (4.3–32.3)	<.0001
General condom usage (vs Yes)				
No	0.75	0.55	2.1 (0.7–6.3)	.1711
Condom usage with oral sex (vs always)				
Sometimes	−0.62	0.47	0.5 (0.2–1.4)	.1877
Never	0.63	0.45	1.9 (0.8–4.5)	.158
Never had oral sex	0.87	0.53	2.4 (0.8–6.7)	.1005
Condom usage with vaginal sex (vs Always)				
Sometimes	0.48	0.45	1.6 (0.7–3.9)	.287
Never	−0.67	0.55	0.5 (0.2–1.5)	.2273
Never had vaginal sex	1.07	0.56	2.9 (0.98–8.7)	.0553
Condom usage with anal sex (vs. Always)				
Sometimes	0.84	0.43	2.3 (1.003–5.3)	.0492
Never	−1.14	0.48	0.3 (0.1–0.8)	.0183
Never had anal sex	−0.87	0.44	0.4 (0.2–0.99)	.0466
Sex worker usage prior to diagnosis (vs. No)				
Yes	0.96	0.35	2.6 (1.3–5.2)	.0059
Employment as a sex worker (vs. No)				
Yes	1.50	0.67	4.5 (1.2–16.6)	.0258

HIV = human immunodeficiency virus.

Table 5

Trends in alcohol consumption among the HIV+ population.

	12 mo prior HIV+ diagnosis	At time of HIV+ diagnosis	12 mo post HIV+ diagnosis
Number of days patient drank per wk			
Every day	11/297 (3.7)	2/297 (0.7)	0/294 (0.0)
Multiple times per wk	41/297 (13.8)	17/297 (5.7)	15/294 (5.1)
One or less times per wk	153/297 (51.5)	132/297 (44.4)	112/294 (38.0)
None	92/297 (31.0)	146/297 (49.2)	167/294 (56.8)
Number of drinks each day the patient drank			
6 drinks or more per day	52/295 (17.6)	36/294 (12.2)	15/292 (5.1)
2–5 drinks per day	56/295 (19.0)	33/294 (11.2)	33/292 (11.3)
Less than 2 drinks per day	118/295 (40.0)	123/294 (41.8)	119/292 (40.8)
None	69/295 (23.4)	102/294 (34.7)	125/292 (42.8)
Number of binge drinking days			
Every day	7/298 (2.4)	4/298 (1.3)	2/297 (0.7)
One or more times per wk	55/298 (18.5)	36/298 (12.1)	24/297 (8.1)
One or more times per mo	69/298 (23.2)	45/298 (15.1)	40/297 (13.5)
One or more times per yr	33/298 (11.1)	29/298 (9.7)	24/297 (8.1)
Less than once per yr	53/298 (17.8)	58/298 (19.5)	58/297 (19.5)
Never	81/297 (27.3)	126/298 (42.3)	149/297 (50.2)

HIV+ = human immunodeficiency virus positive.

reported "zero drinks per day" increased from 23% to 35% to 43%.

Among HIV+ patients the binge drinking category also decreased at the higher levels of consumption with the percentage reporting binge drinking "every day" initially decreasing from 2% to 1% then stabilizing at 1% twelve months post diagnosis. There were also decreases in the "one or more times per week" group from 19% to 12% to 8%, the "one or more times per month" from 23% to 15% to 14%, and the "one or more times per year" from 11% to 10% to 8%. There was an increase in HIV + patients reporting binge drinking "less than once per year" from 18% to 20% and 20%, and those selecting "never" from 27% to 42% to 50%.

4. Discussion

On univariate analysis in isolation of other risk factors, the significantly increased OR among those who drank every day and those who consumed 6 or more drinks per day they drank indicate chronic alcohol use has a large impact on a person's odds of being HIV+. Although binge drinking every day prior to diagnosis did not exhibit a statistically significant association with being HIV+, the significant positive associations between binge drinking 1 or more times per week and 1 or more times per month imply that this type of consumption is another major risk factor for HIV. The consistency and magnitude of the increased odds ratios in higher categories of chronic consumption give the impression that elevated, chronic alcohol intake has the greatest impact on a person's odds of being HIV+.

The lack of significant positive associations between alcohol consumption and HIV seropositivity in the multivariate analysis indicate that alcohol consumption as a risk factor for HIV is likely tied to its association with other risky behaviors. However, the significant negative associations in abstinence from and lower levels of binge drinking indicate that avoiding this type of consumption is protective from contracting the disease. The exclusion of all other measures of drinking at other time periods from the multivariate analysis was an unfortunate necessity for simplifying the data in order to utilize this statistical method and makes it difficult to draw conclusions about alcohol, specifically, as an independent risk factor for contracting HIV when controlling for other risky behaviors.

The significant positive univariate associations we have found between high levels of alcohol consumption and being HIV+ combined with the lack of associations on multivariate analysis indicate that the mechanism of increased HIV+ status is likely through alcohol's association with a propensity for other risky behaviors. Regardless, these results indicate that health policy targeted towards responsible alcohol consumption would be beneficial in the 90–90-90 aim to decrease the HIV burden, specifically in Ecuador, but possibly on a broader scale as well.

While males showed higher odds of being HIV+, this is not necessarily a modifiable risk factor, and could likely be accounted for by the higher prevalence of HIV among men who have sex with men. The higher rates of HIV positivity with employment as a sex worker, having more than 1 sexual partner, participation in sex with both genders, intermittent condom usage with anal sex, sex while under the influence of alcohol or drugs, sex worker usage, and diagnosis with other previous STI's indicate that inconsistent condom usage is a risk factor for HIV seroconversion. The recent focus on quality sexual education by the Ministry of Public Health's Ecuador Multisectoral National Strategic Plan on HIV in 2018 is a crucial step towards lowering the rate of HIV diagnoses and will play a major role in achieving the goals of the 90-90–90 program.

The striking decrease among the HIV+ population in higher levels of consumption twelve months after diagnosis along with the significant increase in those reporting lessened or complete abstinence from alcohol consumption is a promising sign for health outcomes in the HIV+ population in Ecuador. Despite the lack of a dramatic difference in alcohol reduction between those who did and did not speak to a provider about cessation, the overall reduction is still encouraging and could be accounted for by the spread of information within the tight knit HIV+ population in these clinics.

Our finding that HIV+ patients had higher rates of alcohol cessation discussions with healthcare providers vs controls is a positive 1 and indicates that physicians were more likely to promote healthier drinking habits among this population. However, with only 37% of HIV+ patients and 29% of controls reporting an alcohol cessation discussion, this highlights that there is still room for improvement in the area of alcohol education in both the HIV+ and general population.

There are inherent limitations to using a case-control study. One of these limitations being recall bias where patients may not remember their exact drinking habits or may omit certain information. Additionally, we can only establish correlation, not causation.

Utilizing a newly created questionnaire provides its own unique set of limitations. While there were informed study personnel on site to provide clarification, there was confusion among some participants regarding wording of some questions which could have led to errors in the data. Additionally, we encountered unexpected answers, for example in the case of participants who had never had sex before. Language barrier is another source of possible limitation although we mitigated this as best as possible through our Ecuadorian counterparts.

5. Conclusions

Alcohol consumption is by no means exclusive to Ecuador, and its associated increase in other risky behaviors such as unprotected sex is likely universal. For this reason, our findings should be applicable to other countries and cultures where high levels of alcohol use are prevalent. In addition, our findings highlight the necessity of quality sex education about condom usage both in Ecuador and globally.

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