Barriers to HIV testing, linkage to care, and treatment adherence: a cross-sectional study from a large urban center of Brazil

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Abstract

Objective: Early, continued engagement with the HIV treatment continuum can help achieve viral suppression, though few studies have explored how risk factors for delays differ across the continuum. The objective of this study was to identify predictors of delayed diagnosis, delayed linkage to care, and nonadherence to treatment in the city of Salvador, Bahia, Brazil.

Methods: Data were collected during 2010 in a cross-sectional study with a sample (n = 1970) of HIV-infected individuals enrolled in care. Multiple logistic regression analyses identified sociodemographic variables, behaviors, and measures of health service quality that were associated with delayed diagnosis, delayed linkage to care, and treatment nonadherence.

Results: For delayed diagnosis, male gender (adjusted odds ratio (AOR), 3.02; 95% confidence interval (CI), 2.0–4.6); age 45 years and older (AOR, 1.67; 95% CI, 1.1–2.5); and provider-initiated testing (AOR, 3.00; 95% CI, 2.1–4.4) increased odds, while drug use (AOR, 0.29; 95% CI, 0.2–0.5) and receiving results in a private space (AOR, 0.37; 95% CI, 0.2–0.8) decreased odds. For delayed linkage to care, unemployment (AOR, 1.42; 95% CI, 1.07–1.9) and difficulty understanding or speaking with a health care worker (AOR, 1.61; 95% CI, 1.2–2.1) increased odds, while posttest counseling (AOR, 0.49; 95% CI, 0.3–0.7) decreased odds. For nonadherence, experiencing verbal or physical discrimination related to HIV (AOR, 1.94; 95% CI, 1.3–3.0) and feeling mistreated or not properly attended to at HIV care (AOR, 1.60; 95% CI, 1.0–2.5) increased odds, while posttest counseling (AOR, 0.34; 95% CI, 0.2–0.6) decreased odds.

Conclusions: More attention is needed on how policies, programs, and research can provide tailored support across the treatment continuum.

RESUMEN

La participación temprana y continua en el continuo de tratamiento de la infección por el VIH puede ayudar a lograr la supresión viral, aunque pocos estudios han explorado la manera en que los factores de riesgo debidos a los retrasos difieren a lo largo del proceso continuo. El objetivo de este estudio fue determinar los factores predictivos de un diagnóstico tardío, la demora en la vinculación con la atención y el incumplimiento del régimen terapéutico en la ciudad de Salvador de Bahía, en Brasil.

Se recopilaron datos en un estudio transversal realizado durante el 2010, con una muestra (n = 1 970) de personas con la infección por el VIH que recibían atención. Por medio de múltiples análisis de regresión logística se determinaron variables socio-demográficas, comportamientos y mediciones de la calidad del servicio de salud que estaban asociadas a un diagnóstico tardío, así como a la demora en la vinculación con la atención y el incumplimiento del régimen terapéutico.

Con relación a los diagnósticos tardíos, ser de sexo masculino (razón de posibilidades ajustada (AOR) 3,02; intervalo de confianza (IC) de 95%, 2,0–4,6), tener más de 45 años (AOR, 1,67; IC de 95%, 1,1–2,5) y que las pruebas hayan sido iniciadas por el proveedor (AOR, 3,00; IC de 95%, 2,1–4,4) aumentaron las probabilidades, mientras que el consumo de drogas (AOR, 0,29; IC de 95%, 0.2–0.5) y la recepción de los resultados en un espacio privado (AOR, 0,37; IC de 95%, 0,2–0,8) disminuyeron las probabilidades. Con respecto a la vinculación tardía a la atención, el desempleo (AOR, 1,42; IC de 95%, 1,07–1,9) y las dificultades para comprender al trabajador de salud o hablar con él (AOR, 1,61; IC de 95%, 1,2–2,1) aumentaron las probabilidades, mientras que la orientación posterior a las pruebas (AOR, 0,49; IC de 95%, 0,3–0,7) disminuyó las probabilidades. Con respecto al incumplimiento del régimen terapéutico, la discriminación verbal o física relacionada con la infección por el VIH (AOR, 1,94; IC de 95%, 1,3–3,0) y el sentirse maltratado o no atendido adecuadamente en los establecimientos de atención (AOR, 1,60; IC de 95%, 1,0–2,5) aumentaron las probabilidades, mientras que la orientación posterior a las pruebas (AOR, 0,34; IC de 95%, 0,2–0,6) disminuyó las probabilidades.

Debe prestarse mayor atención a la forma en que las políticas, los programas y la investigación pueden prestar apoyo personalizado a lo largo del proceso continuo de tratamiento.

Keywords

AIDS; HIV; continuity of patient care; diagnosis; patient compliance; Brazil

The advent of antiretroviral therapy (ART) has demonstrated that earlier and continued engagement in HIV care can help achieve viral suppression, minimize transmission risk, and reduce HIV-related morbidity and mortality (1–4). While previous research has investigated access to HIV/AIDS services at a single point of care, increasing attention is placed on the HIV treatment continuum, a model used to outline the critical stages of HIV care. These include HIV diagnosis, linkage to care, retention in care, provision of ART, and achievement of viral suppression (2). Notably, few HIV-infected individuals reach viral suppression. In 2012, for example, the U.S. Centers for Disease Control and Prevention (CDC) released data indicating that in the United States of America, only 25% of individuals infected with HIV achieved viral suppression (5). Even in Brazil, the first middle-income country to guarantee

free, universal provision of ART, only a third of Brazilians infected with HIV have achieved viral suppression (6, 7).

Many studies have identified risk factors associated with delays or interruptions at a single stage of the continuum. However, few studies have explored how risk factors for such delays and losses to follow-up may differ across stages of care (8). Investigating how risk factors for delays or interruptions in care are similar or different across and at specific stages of care can help ensure that research, programs, and policies more effectively engage individuals in services, improve the quality of patient care, and facilitate achievement of viral suppression. Therefore, this study uses data from a large, low-income urban center in Brazil to identify predictors of delayed diagnosis, delayed linkage to care, and nonadherence to treatment.

METHODS

Data were collected in a cross-sectional study conducted from August 2010 to June 2011 among HIV-infected individuals (n = 1 970) age 18 or older enrolled in care at three main health facilities in the city of Salvador, Bahia, Brazil. Salvador is the third most populous and one of the lowest-income urban centers of the country. The health facilities included in the study—the only state reference center for specialized HIV/AIDS care and two large hospitals providing general health services and HIV/AIDS outpatient care—are the main facilities providing HIV care in the state of Bahia. HIV/AIDS care and treatment is provided free of charge at these facilities, which belong to the Brazilian national health system.

Primary outcome variables of interest

Outcome variables utilized in this study include delayed diagnosis, delayed linkage to care, and treatment nonadherence. To date, there are no standard measures of late presentation along the HIV treatment continuum. Therefore, we used measures informed by global and national guidelines as well as the peer-reviewed literature (Table 1). Individuals with a delayed diagnosis were defined as those with a first CD4 count < 350, excluding individuals delayed in linking to care. Individuals with delayed linkage to care were those who enrolled in care after six months or more of knowing their HIV status. Treatment nonadherence was self-reported by participants indicating if they took their medication all the time (yes vs. no). To complete and validate data on first CD4 cell count, information was reviewed by trained research assistants from handwritten clinical records and from the national database of SISCEL (Laboratory Test Control System of the Brazilian National CD4+/CD8+ T Lymphocyte Count and Viral Load Network), which contains information on lymphocyte count CD4/CD8 and viral load. This system is organized by patient identifier codes and is powered by a nationwide network of reference laboratories.

Covariates of interest

Covariates of interest are highlighted in the participants' descriptive statistics (Table 2) and were based on a review of the literature. Sociodemographic covariates of interest included sex (female vs. male); age (18 to 44 vs. 45 and older); self-reported skin color (white vs. nonwhite); self-identified sexual orientation (heterosexual vs. homosexual and bisexual); civil status (with partner vs. without); education (having up to eight years of

education vs. having more than eight years); individual income (minimum monthly wage of 510 Brazilian reais (US$ 328.11) or less vs. receiving a wage above it); and employment (individuals formally and informally employed vs. unemployed). The following covariates were dichotomized as yes vs. no: received clothes, bus voucher, food, or financial assistance in the previous three months; ever experienced transportation difficulties to HIV care; ever had trouble finding child care when seeking HIV services; ever used drugs; and ever experienced verbal or physical discrimination related to HIV. Additionally, sexual and behavioral health measures were dichotomized as yes vs. no, including: had five or more sexual partners in past 12 months; had prior sexually transmitted infection; provider initiated HIV test (vs. patient or other); and ever experienced forced sex. Finally, variables related to quality of health services were also dichotomized as yes vs. no, including: ever felt mistreated or not properly attended to at HIV care; ever had difficulty understanding or speaking with a health care worker; receiving confidential services (received HIV test result in a private space and trusted their health worker not to disclose the result); and receipt of counseling (pre- and posttest counseling, individually or as a group).

Analysis

The model-building process followed these steps:

1. A review of the literature was conducted to identify risk factors consistently highlighted as correlates associated with delayed or interrupted care at each stage of the treatment continuum. Final covariates explored included sociodemographic variables, sexual and behavioral health measures, and quality of health services.

2. Descriptive statistics were conducted on study population.

3. Bivariate analyses were conducted using each outcome variable, and covariates with P values 0.10 were then considered for inclusion in the multivariate analysis (Table 3).

4. Further diagnostic tests were conducted to determine if variables were associated with one another.

5. Logistic regression analyses started with a saturated model, and then variables were progressively removed with a backward elimination procedure with a criterion of P 0.10 to identify the best models for delayed diagnosis, delayed linkage to care, and nonadherence. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were estimated from logistic regression (9). The analyses were completed using Stata Statistical Software, version 13.1 (StataCorp)

This study was approved by the Ethics and Research Committee of the State Health Department of Bahia and by the Institutional Review Board of the Harvard School of Public Health. Written informed consent was given by all participants.

RESULTS

The sample had slightly more men (*n* = 1 056, 53.6%) than women (*n* = 914, 46.4%) with a majority under the age of 44 (*n* = 1 344, 68.2%) and self-identifying as nonwhite (*n* = 1 783, 90.8%). Participants largely self-identified as heterosexual (*n* = 1 489, 75.8%), and most participants identifying as homosexual or bisexual were men. Roughly half of all participants had completed 8 or fewer years of education (*n* = 986, 50.1%), and a slight majority was unemployed (*n* = 1 077, 54.7%). Participants largely were without a current partner (*n* = 1 262, 64.1%) and had never used drugs (*n* = 1 607, 81.6%). The prevalence of delayed diagnosis, delayed linkage to care, and treatment nonadherence, respectively, were 60.5% (*n* = 698), 36.1% (*n* = 652), and 15.2% (*n* = 240). Summary descriptive characteristics of the sample are detailed in Table 2.

Bivariate analyses revealed that a wide range of sociodemographic variables, sexual health and behavioral measures, and quality of health services were associated with all three outcomes. Self-reported skin color and self-identified sexual orientation were the only nonsignificant variables in the bivariate analyses; however, they were included in the multivariate analysis due to their importance in the peer-reviewed literature. All significant covariates of interest were included in the multiple logistic regression backward elimination procedures. Final bivariate and multivariate results are presented in Tables 3 and 4, respectively.

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Delayed diagnosis

According to our final logistic regression model, male gender (AOR, 3.02; 95% CI, 2.0–4.6); being age 45 years and older (AOR, 1.67; 95% CI, 1.1–2.5); and provider-initiated testing (AOR, 3.00; 95% CI, 2.1–4.4) increased the odds of delayed diagnosis. Drug use (AOR, 0.29; 95% CI, 0.2–0.5) and receiving results in a private space (AOR, 0.37, 95% CI 0.2–0.8) decreased the odds of delayed diagnosis.

Delayed linkage to care

Unemployment (AOR, 1.42; 95% CI, 1.07–1.9) and ever having difficulty understanding or speaking with a health care worker (AOR, 1.61; 95% CI, 1.2–2.1) increased odds of delayed linkage to care. Receipt of posttest counseling (AOR, 0.49; 95% CI, 0.3–0.7) decreased odds of delayed linkage to care.

Treatment nonadherence

Ever experiencing verbal or physical discrimination related to HIV (AOR, 1.94; 95% CI, 1.3–3.0) and feeling mistreated or not properly attended to at HIV care (AOR, 1.60; 95% CI, 1.0–2.5) increased the odds of treatment nonadherence. Posttest counseling (AOR, 0.34, 95% CI 0.2–0.6) decreased the odds of treatment nonadherence.

DISCUSSION

Among the variables analyzed, receipt of quality health services significantly decreased the odds for all three outcomes, while sociodemographic variables had a variable impact at each stage of care measured.

Delayed diagnosis

Several variables increased the odds of delayed diagnosis. Being male was associated with increased odds of late diagnosis. Notably, recent estimates from Brazil show men constitute 65% of reported AIDS cases, and HIV-infected men experienced nearly double the mortality rate of women (6). While research from the United States and Europe has documented that men have greater delays in receiving an HIV diagnosis and accessing HIV-related treatment and care than do women (10, 11), few studies have explored how factors associated with delay differ at distinct stages of care. A recent qualitative study from the city of Salvador assessing engagement in services along the treatment continuum found that late diagnosis was a challenge due to poor quality health services, emotional and psychosocial challenges, and low perceived risk of infection (12). Together, these studies underscore the need to explore how gender dynamics may impact access to care.

Being age 45 years and older was also associated with an increased odds of delayed diagnosis. Our results were consistent with the findings of other studies among the general population in high-income countries (13–16). Research has shown that the progression of infection may be more rapid in older individuals (17). It is also possible that older individuals are less likely to be tested for HIV because they do not feel at risk. At the same time, providers may not perceive their older patients to be at risk for HIV infection (18, 19). In Brazil, the Ministry of Health drew attention to HIV/AIDS among individuals beyond reproductive years by launching an awareness-raising campaign in 2010, which was subsequently highlighted in the peer-reviewed literature (20). Despite increased attention to the needs of older individuals, the results of our analysis suggest that awareness of HIV, among both providers and older patients themselves, continues to be lacking. Therefore, efforts should be expanded to test older individuals and to support those who test positive to link into continued care.

The multivariate results highlighted that provider-initiated testing, compared to patient-initiated testing, was associated with an increased odds of delayed diagnosis. Given that Brazil has a concentrated epidemic, UNAIDS suggests that HIV testing and counseling be recommended to all adults who present to care with signs of underlying HIV infection (21). Often, providers may not request individuals be tested for HIV until they are already presenting symptoms of AIDS. These results suggest that testing should shift away from

a risk-based strategy, as it likely ignores individuals who may not report certain behaviors traditionally associated with an increased risk of transmission.

Interestingly, our results showed lifetime drug use was associated with decreased odds of delayed diagnosis, contrary to prior literature in Brazil (22, 23). In fact, lifetime and frequent usage of a range of drugs has been linked with higher levels of stigma associated with accessing services and lower likelihood of achieving viral suppression (24, 25). This contrast could reflect a difference in measures used since few studies disaggregate late presentation to specific stages of care. Notably, one study in Italy showed that injection drug use was associated with decreased odds of late diagnosis but increased odds of delayed linkage to care (26). Additionally, an unpublished quantitative study in Salvador found that different types of drug use (e.g. injection drugs, cocaine, marijuana) were associated with distinct delays along the treatment continuum. Thus, while lifetime drug use may not be an initial barrier to care, distinct drug use patterns may increase likelihood of delays in accessing services after diagnosis. These results highlight the need for measures that assess delay along the entire continuum rather than at a single point of care. Further, additional research is needed to identify how drug users may need different types of support at distinct stages of care.

Receiving results in a private space was also associated with decreased odds of delayed diagnosis. A critical review of worldwide legislation on HIV/AIDS showed that notifications of HIV-infected status are kept confidential by law in only 20% of 121 countries reviewed; however, it remains unknown if these laws are fully implemented in practice (27). Thus, challenges persist in providing and maintaining confidentiality in practice, in both high-resource settings (28) and low-resource settings (29, 30). The fear of HIV status disclosure to partners, families, and community has often been a substantial barrier to HIV testing (31, 32) Notably, studies have demonstrated that health care workers often do not have adequate infrastructure or workforce to ensure completely confidential services, despite their willingness or desire to do so (29, 33, 34). These results demonstrate the importance of providing confidential services—which requires addressing provider attitudes and ensuring adequate physical space—in order to successfully engage HIV-infected individuals in continued care.

Delayed linkage to care

Earning minimum wage or less was associated with increased odds for delayed linkage to care. Results from previous studies report mixed findings. For example, one Italian study reported that unemployment was associated with increased odds of late presentation (15), while another study found it was associated with decreased odds of late presentation (26). Though studies have noted that lower income is associated with an increased likelihood of HIV infection among some groups (26), few studies have explored how structural factors such as poverty can influence an individual's ability to access services. Future research on delayed linkage to care should expand to consider how actual expenses related to seeking care (such as cost of transportation) or opportunity costs (such as wages lost) may impede timely presentation for care.

Ever having difficulty understanding or speaking with a health care worker increased odds of delayed linkage to care. Prior studies in Brazil and other high- and low-income settings similarly found that dissatisfaction with a specific provider, perceived stigma, or lack of confidentiality could discourage HIV testing and exacerbate loss to follow-up along one's entire care trajectory (35–38). Further, other studies from Brazil have highlighted the importance of provider-patient communication to support continued engagement in care (39). Taken together, these results underscore the critical role that provider communication plays in successfully linking people to care.

Again, quality of health services was a strong predictor of earlier engagement in care, given that posttest counseling decreased odds of delayed linkage to care. Previous studies have emphasized the importance of posttest counseling by underscoring the role of counselors in successfully linking individuals to care (40, 41). For example, when individuals in eastern Uganda received posttest counseling and at-home visits by community support agents, there was an 80% increase in the percentage of recently diagnosed individuals presenting to care (42). Additional studies in Uganda, Haiti, and Vietnam reinforced the importance of different combinations of both pre- and posttest counseling in order to successfully link individuals to HIV/AIDS care (43–45). Going forward, efforts to engage individuals testing positive for HIV should emphasize the critical role of counseling.

Treatment nonadherence

Ever experiencing verbal or physical discrimination related to HIV increased odds of treatment nonadherence. Studies in Brazil and the United States have found that HIV-infected individuals are more likely than non-HIV-infected individuals to report verbal or physical violence (46, 47). Further, experiencing violence has been linked to treatment nonadherence, poor retention in care, loss to follow-up, and a range of poor health-related outcomes (48, 49). Notably, studies suggest that resilience-based interventions for trauma patients may improve adherence and continued engagement in HIV care (50). In the future, screening for experiences with violence should be implemented to ensure that barriers to continued engagement in care are effectively addressed.

Health service quality was also a strong predictor of treatment nonadherence. Specifically, feeling mistreated or not properly attended to at HIV care increased odds of treatment nonadherence. Results from a study in Salvador found that poor quality of care administered by service providers and lengthy wait times were challenges not only to adherence but also to linking to care earlier (12). This suggests measures to improve patient satisfaction are necessary first steps to improve continued engagement in services. Potential strategies include training health care workers to maintain confidentiality and improve provider-patient interactions and further assessing areas of patient satisfaction for targeted improvement.

Posttest counseling was also associated with decreased odds of treatment nonadherence. Studies in Uganda and South Africa suggest that strategies such as individualized motivational counseling and community-based HIV testing and counseling have improved linkage to care, retention in care, and adherence (51, 52). In addition, research in Brazil has suggested that increased patient- provider communication can improve adherence (39). Importantly, this finding speaks to the role of providing high-quality health services.

This study has both strengths and limitations. Importantly, one strength is the study's unique approach to evaluating the factors associated with delays in care, by investigating how those factors differ along stages of the treatment continuum. Our results built on existing research by emphasizing the entire trajectory through care. This approach can help determine how best to support individuals in achieving viral suppression. Salvador, Brazil, is a unique setting for this research, as it is a large, low-income city in a socioeconomically diverse country that has a historic universal treatment program.

Nonetheless, there are some limitations to note. HIV-infected individuals completely disengaged from care were not surveyed. Therefore, while this analysis identifies many risk factors for delays in care in a population largely engaged in services, the most disenfranchised HIV-infected individuals were not reached. Further, the study instrument did not include questions that would have allowed us to analyze continued engagement in care with additional retention metrics, so some stages of the treatment continuum could not be evaluated.

Conclusions

This study highlights two critical points regarding changes in service provision. One is the importance of evaluating multiple stages of care along the continuum, rather than only focusing on a single entry point to care. The other is the need for nuanced intervention strategies that support the needs of HIV-infected individuals along their entire care trajectory. As policies, programs, and research take into account ways to better support individuals who test positive for HIV at each stage of the continuum, more attention is needed as to how interventions should provide tailored, or consistent, support based on a range of factors. Our research shows that the provision of high-quality services impacts each stage of the continuum, whereas individuals with certain characteristics may warrant additional attention at specific stages of care. Only in doing so can researchers and practitioners comprehensively address the needs of people infected with HIV/AIDS.

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TABLE 1.

Outcome measures of late presentation along the treatment continuum based on global and national guidelines as well as the peer-reviewed literature

Model	Delayed diagnosis	Delayed linkage to care	Treatment nonadherence
Global guidelines (2013)	There was no standard measure of delayed diagnosis.	There was no standard measure of delayed linkage to care.	There was no standard measure of nonadherence. The World Health Organization defines adherence for HIV/AIDS but has no standardized measure.
Brazilian Ministry of Health (2013)	There was no Brazilian measure of delayed diagnosis.	There was no Brazilian measure of delayed linkage to care.	There is no Brazilian measure of nonadherence.
Peer-reviewed literature (2000–2015)	Delayed diagnosis is commonly defined in the peer-reviewed literature in terms of a concurrent diagnosis as an AIDS case at the time of HIV diagnosis, or as a measurement of time between HIV and AIDS diagnosis.	Delayed linkage to care is commonly defined as time between HIV diagnosis and presentation to a range of HIV-related services, including linkage to care, CD4 evaluation, and treatment initiation. The time intervals used have included six months, three months, or even fewer months. Other studies defined delayed linkage to care by some combination of CD4 count and/or clinical symptoms.	ART adherence assessments include self-reporting, pill counts, electronic monitoring, and drug levels. Wireless electronic adherence monitoring may be best. Nonetheless, self-reported adherence is informative for clinical monitoring and program evaluation.
Outcome measures used in our study (2010)	Identify individuals with a first CD4 count below 350 and then exclude individuals who were delayed in linking to care.	Individuals linked to care after six months or more of knowing their HIV status. [a]	Self-reported adherence

[a] Based on date data collected at the three study sites (date of diagnosis and date of first CD4 count, with first CD4 count serving as enrollment date).

TABLE 2.

Descriptive statistics of study population (n = 1 970) receiving HIV/ AIDS care in Salvador, Brazil, 2010

Characteristic	*n*	*%*
Sex		
Female	914	46.4%
Male	1 056	53.6%
Age (years)		
18 to 44	1 344	68.2%
45 and older	626	31.8%
Self-reported skin color[a]		
White	181	9.2%
Brown/Black/Indigenous/Yellow/Other	1 783	90.8%
Self-identified sexual orientation		
Heterosexual	1 489	75.8%
Homosexual and Bisexual	474	24.2%
Education		
8 or fewer years of education	986	50.1%
More than 8 years of education	984	49.9%
Employment status		
Employed (formally or informally)	892	45.3%
Unemployed	1 077	54.7%
Civil status		
With a partner	708	35.9%
Without a partner	1 262	64.1%
Drug use		
Ever	363	18.4%
Never	1 607	81.6%

[a]Race and ethnicity in Brazil are commonly referenced in terms of the "color" or phenotype (physical attribute) rather than one's genotype (ancestry or origin).

TABLE 3.

Bivariate statistics, including odds ratio (OR) and 95% confidence interval (CI), of delayed diagnosis, delayed linkage to care, and treatment nonadherence among patients receiving HIV/AIDS care in Salvador, Brazil, 2010

	Delayed diagnosis OR (95% CI)	Delayed linkage to care OR (95% CI)	Treatment nonadherence OR (95% CI)
Sociodemographic variables			
Gender			
Female	1.00 (ref)	1.00 (ref)	1.00 (ref)
Male	1.75 (1.4–2.2) [a]	0.87 (0.7–1.1)	0.97 (0.7–1.3)
Age			
18 to 44	1.00 (ref)	1.00 (ref)	1.00 (ref)
45 years and older	1.59 (1.2–2.1) [a]	1.02 (0.8–1.3)	0.72 (0.5–1.0) [b]
Color of skin			
White	1.00 (ref)	1.00 (ref)	1.00 (ref)
Brown/Black/Indigenous/Yellow/Other	0.82 (0.5–1.3)	0.86 (0.6–1.2)	0.85 (0.5–1.3)
Self-identified sexual orientation			
Heterosexual	1.00 (ref)	1.00 (ref)	1.00 (ref)
Homosexual and bisexual males	0.96 (0.7–1.3)	0.99 (0.8–1.2)	1.19 (0.9–1.6)
Civil status			
With partner	1.00 (ref)	1.00 (ref)	1.00 (ref)
Single	1.27 (1.0–1.6) [c]	1.14 (0.9–1.4)	0.90 (0.7–1.2)
Education			
Completed 8 or fewer years of education	1.00 (ref)	1.00 (ref)	1.00 (ref)
Completed more than 8 years of education	0.99 (0.8–1.3)	0.81 (0.7–1.0) [b]	1.08 (0.8–1.4)
Employment and assistance			
Unemployed	1.26 (1.0–1.6) [c]	1.64 (1.3–2.0) [a]	0.90 (0.7–1.2)
Received social or financial assistance in past 3 months	0.86 (0.7–1.1)	1.11 (0.9–1.4)	1.41 (1.1–1.9) [d]
Transportation and child care			
Experienced transportation difficulties to care (ever)	1.01 (0.8–1.4)	1.33 (1.1–1.6) [a]	1.11 (0.8–1.5)
Had trouble finding child care when seeking HIV services	0.53 (0.4–0.8) [a]	1.17 (0.9–1.6)	1.56 (1.1–2.3) [d]

	Delayed diagnosis OR (95% CI)	Delayed linkage to care OR (95% CI)	Treatment nonadherence OR (95% CI)
Drug user	0.67 (0.5–0.9)[b]	1.45 (1.1–1.8)[a]	1.56 (1.1–2.2)[a]
Verbal or physical discrimination (ever, related to HIV)	0.89 (0.7–1.2)	1.44 (1.2–1.8)[a]	1.84 (1.4–2.5)[a]
Sexual health and behavior (yes vs. no)			
Has steady partner	0.82 (0.6–1.0)	0.77 (0.6–0.9)[a]	0.93 (0.7–1.2)
5 or more sexual partners in past 12 months	0.66 (0.4–1.0)[b]	1.16 (0.8–1.6)	1.37 (0.9–2.1)
Prior sexually transmitted infection	0.97 (0.8–1.2)	1.28 (1.0–1.6)[b]	1.23 (0.9–1.6)[c]
Provider initiated testing (not patient, or other)	3.00 (2.3–3.9)[a]	0.92 (0.8–1.1)	0.91 (0.7–1.2)
Experienced forced sex (ever)	0.53 (0.4–0.8)[a]	1.29 (1.0–1.7)[c]	1.64 (1.1–2.4)[d]
Quality of health services (yes vs. no)			
Felt mistreated or not properly attended at HIV care (ever)	0.85 (0.6–1.2)	1.43 (1.1–1.8)[a]	2.16 (1.6–2.9)[a]
Difficulty understanding or speaking with a HCW[d] (ever)	1.09 (0.8–1.4)	1.43 (1.2–1.7)[a]	1.74 (1.3–2.3)[a]
Confidentiality (both private space and HCW trust)	0.77 (0.5–1.1)	0.69 (0.5–0.9)[a]	0.58 (0.4–0.8)[a]
Received results in private space	0.38 (0.2–0.6)[a]	0.74 (0.5–1.0)[c]	0.70 (0.5–1.1)[c]
Trusted HCW to not disclose results	0.95 (0.6–1.4)	0.76 (0.6–1.0)[c]	0.55 (0.4–0.8)[a]
Counseling	0.81 (0.6–1.0)[c]	0.94 (0.8–1.2)	1.12 (0.8–1.5)
Received pretest counseling	0.81 (0.6–1.0)[c]	0.92 (0.8–1.1)	1.25 (0.9–1.7)
Received posttest counseling	0.62 (0.4–0.9)[a]	0.76 (0.6–1.0)[b]	0.62 (0.4–0.9)[a]

[a]
P 0.01.

[b]
P 0.05.

[c]
P 0.10.

[d]
HCW = health care worker.

TABLE 4.

Multivariate statistics, including adjusted odds ratio (AOR) and 95% confidence interval (CI), of delayed diagnosis, delayed linkage to care, and treatment nonadherence among patients receiving HIV/AIDS care in Salvador, Brazil, 2010

	Delayed diagnosis AOR (95% CI)	Delayed linkage to care AOR (95% CI)	Treatment nonadherence AOR (95% CI)
Sociodemographic variables			
Gender			
Female	1.00 (ref)		
Male	3.02 (2.0–4.6)[a]		
Age			
18 to 44	1.00 (ref)		1.00 (ref)
45 years and older	1.67 (1.1–2.5)[c]		0.68 (0.4–1.1)
Color of skin			
White			
Brown/Black/Indigenous/Yellow/Other			
Self-identified sexual orientation			
Heterosexual			1.00 (ref)
Homosexual and bisexual			1.91 (0.9–4.1)
Civil status			
With partner	1.00 (ref)		1.00 (ref)
Single	1.45 (1.0–2.1)		0.48 (0.3–0.9)[c]
Education			
Completed 8 or fewer years of education			
Completed more than 8 years of education			
Employment and assistance			
Unemployed (vs. formally or informally employed)		1.42 (1.1–1.9)[c]	
Received social or financial assistance in past 3 months			
Transportation and child care			
Experienced transportation difficulties to care (ever)			
Had trouble finding child care when seeking HIV services			
Drug user	0.29 (0.2–0.5)[a]	1.39 (1.0–2.0)	

	Delayed diagnosis AOR (95% CI)	Delayed linkage to care AOR (95% CI)	Treatment nonadherence AOR (95% CI)
Verbal or physical discrimination (ever, related to HIV)			1.94 (1.3–3.0)[b]
Sexual health and behavior (yes vs. no)			
5 or more sexual partners in past 12 months			1.93 (0.9–4.0)
Prior sexually transmitted infection		1.30 (1.0–1.8)	0.67 (0.4–1.0)
Experienced forced sex (ever)	0.58 (0.3–1.1)		
Quality of health services (yes vs. no)			
Provider initiated testing (not patient, or other)	3.00 (2.1–4.4)[a]		
Felt mistreated or not properly attended at HIV care (ever)			1.60 (1.0–2.5)[c]
Difficulty understanding or speaking with a HCW[d] (ever)		1.61 (1.2–2.1)[a]	1.44 (1.0–2.2)
Confidentiality			
Received results in private space	0.37 (0.2–0.8)[b]		
Trusted HCW to not disclose results			
Counseling			
Received pretest counseling			1.50 (1.0–2.3)
Received posttest counseling		0.49 (0.3–0.7)[a]	0.34 (0.2–0.6)[a]

[a] P 0.01.

[b] P 0.05.

[c] P 0.10.

[d] HCW = health care worker.