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Profiles of Risk Among HIV-infected Youth in Clinic Settings

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Abstract

Despite the rising number of new HIV infections among youth, few tailored interventions for youth living with HIV (YLH) have been developed and rigorously tested. Developing tailored interventions necessitates identifying different profiles of YLH and understanding how risk and protective factors cluster together. Obtaining this critical information requires accessing a sufficiently large sample of YLH from diverse geographic settings such as those available through the Adolescent Trials Network for HIV Interventions (ATN). We recruited a cross-sectional sample of 1,712 YLH from ATN clinics; participants completed a survey on psychosocial and health factors. Using latent class analysis on nine composite variables representing risk factors, we identified five classes distinguished by substance use, sexual behavior, and pregnancy history and

differing on health outcomes. Findings suggest a need for tailored interventions addressing multiple risky behaviors of HIV-infected youth and research to clarify how intervention effectiveness may differ by risk profile.

Keywords

HIV infected youth; Risk profiles; Latent class analysis

Introduction

Adolescence is the developmental period during which risk behaviors peak, including those associated with HIV transmission and acquisition, like unprotected sex and substance abuse [1]. Not surprisingly, HIV infection has become a disease of adolescents and young adults in the United States as evidenced by the growing number of new HIV cases identified in this population [2]. Young men of color who have sex with men (YMSM) carry a disproportionate burden of HIV infection and evidence suggests that rates are increasing [3]. Developing interventions to reduce the further spread of HIV in adolescents and young adults remains a public health priority.

There are a number of efficacious interventions for reducing HIV risk among HIV-negative youth [4–7] but only two such interventions are available for youth living with HIV (YLH) [8, 9]. Both of these interventions, one a multi-session information and skills-building group administered intervention [8] and the other a four session motivational enhancement individually administered intervention, were successful in reducing sexual risk-taking and substance use behaviors [9]. A challenge to intervention development efforts is that YLH are not a homogenous group [10]. Although they share the common thread of living with HIV infection, these youth are highly diverse in terms of psychosocial and behavioral factors of import to intervention development [11–13]. For instance, YLH differ in how they acquired HIV infection. Some YLH were infected perinatally, acquiring the virus through mother-to-child transmission. Such youth have lived all of their lives under the veil of a chronic infection that presents unique challenges particularly as they make their sexual debut. Others acquired HIV by having unprotected sex or sharing needles with an infected partner or through contaminated drug paraphernalia, which presents different issues that need to be addressed. Furthermore, not all YLH engage in high risk sexual or drug use behaviors [14]. Many YLH choose to abstain from penetrative sex or to be celibate [15]; others choose not to use drugs [16]. YLH also vary in terms of their sexual orientation. Gay or bisexual YLH youth often face discrimination and oppression because their sexual identity is socially stigmatized. They have different needs and face different challenges than their heterosexual counterparts. YLH vary in their developmental trajectories regarding adult identity development. Some do not exhibit the identity challenges frequently present in individuals who are living with a chronic, life threatening disease while others do [17, 18]. Given the multiplicity of factors that influence risk and protection among YLH and how their influence varies in relation to differing needs, the paucity of efficacious interventions is not surprising. There is a pressing public health imperative to develop tailored interventions that address the needs and challenges unique to different groups of YLH.

A starting point for these efforts is to identify different subgroups of YLH according to profiles of risk. Describing risk profiles will promote greater efficiency in the development and modification of interventions by describing the clusters of risks to address in interventions and identifying which groups of YLH to target with different interventions. Additionally, these risk profiles may be helpful in explaining why certain interventions work for some youth, while others do not. In this way, risk profiles serve as potential effect-modifiers of interventions and can be useful for understanding what “active ingredients” are necessary for interventions to improve outcomes in diverse groups of YLH. Unfortunately, the data needed to identify these risk profiles are not currently available since most extant studies of YLH focus on describing risk behaviors rather than identifying distinct subgroups differentiated by how risk and protective factors cluster together. Furthermore, the sample sizes of many of the available studies are small to moderate and the generalizability of their findings is limited given that participants were recruited from circumscribed geographic areas.

We report on a large, ethnically diverse sample of YLH receiving care at 15 adolescent medicine clinics (AMC) across the United States who were a part of the Adolescent Medicine Trials Network for HIV/AIDS interventions (ATN). Most ATN sites are associated with academic institutions located in major metropolitan areas across the United States and Puerto Rico. These clinics serve the majority of YLH engaged in care in the United States and thus provide a viable setting in which to recruit a large sample of YLH from diverse geographical areas to identify different risk profiles [19]. The goal of this article is to describe the population of YLH served by the ATN clinics and to classify YLH according to different risk profiles as an initial step towards the development of tailored prevention interventions.

Methods

Participants

From December 2009 through January 2011, we recruited 1,712 YLH or AIDS to participate in a cross sectional survey. To be eligible, youth had to be: (1) between 12 and 24 years of age; (2) living with HIV/AIDS; (3) aware they were HIV-infected; (4) engaged in care in one of the ATN’s adolescent medicine clinical sites or affiliates; and (5) able to understand English or Spanish. The study was approved by the Institutional Review Boards (IRB) at each participating site as well as those from the members of the protocol team.

Sampling and Recruitment

Youth were recruited at 15 AMCs that were a part of the ATN as of December 2009. Research staff approached all youth meeting eligibility criteria during one of their regularly scheduled clinic visits to describe the study. After a thorough explanation of the study and its procedures, staff obtained signed informed consent or youth assent from all youth who agreed to participate. Although the majority of IRBs granted a waiver of parental consent, we obtained written parental permission when required.

Procedures

Within 2 weeks of providing informed consent/assent, participants completed audio-computer assisted self-interviews (ACASI) to assess psychosocial and health factors followed by a short 5–10 min debriefing interview. The assessment and debriefing interviews took 45–90 min. Participants were given a small incentive determined by the sites' IRB for their time and effort. As a complement to the self-report data, staff abstracted biomedical data (i.e. plasma viral load levels, CD4 T cell counts) from participants' medical charts. Site personnel did not have access to any of the participants' responses to the ACASI since all data were electronically transferred to the ATN Data and Operations Center (DOC) using a secure file transfer protocol.

Psychosocial Assessment

In addition to demographic factors, we designed the psychosocial battery to assess: (1) substance use; (2) mental health; (3) sexual behavior; and (4) adherence. It included the following measures.

Demographic Variables—Participants reported their age, birth gender, race and ethnicity, self-identified sexual orientation, route of infection with HIV, previous pregnancies for self or partner, past history of incarceration, and current employment status.

Mental Health—To assess mental health, we used the Brief Symptom Inventory-51 (BSI), a measure frequently used in studies with HIV positive youth [20]. The BSI yields nine primary symptom scales and a global index of overall distress. It has norms for adolescents and adults and takes 8–10 min to complete. Internal consistency estimates for the sub-scales range from 0.71 to 0.85 [20]. In the current sample, the internal consistency of the total scale was 0.97.

Substance Use—We used the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) to assess lifetime and 3 month use of alcohol and a variety of other drugs [21]. The ASSIST is an eight-item questionnaire developed in 1997 by the World Health Organization and addiction researchers for use in primary health care settings. We used the CRAFFT Substance Abuse Screening Test, a six question screening tool that addresses indicators of problems related to alcohol and substance use, as a measure of problematic substance use. “Yes” responses are assigned a score of “1” and “no” responses are assigned a score of “0”. Scores of “2” or greater across the six items are suggestive of problem substance use, abuse, or dependence that require further assessment [22].

Sexual Behavior—ATN scientists developed a 38 item questionnaire to assess sexual activity with male and female partners during the past 90 days and a nine item questionnaire to assess substance use with sexual activity during the past 90 days. Participants reported the number of sex partners and the frequency of protected and unprotected oral, vaginal, and anal sexual activity with HIV+ and HIV-/unknown status female and male partners. They also reported the frequency of unprotected vaginal or anal sexual activity with both HIV+ and HIV-/unknown partners after using three classes of recreational substances, including alcohol, marijuana, and other drugs.

Adherence—ATN scientists developed a 25 item questionnaire to assess adherence to HIV medications that was adapted from Chesney et al. [23] to be more appropriate for youth. The measure assessed frequency of dosing and number of pills prescribed per day, number of doses missed in the last 7 days and during the last weekend, barriers and facilitators of adherence, and reasons for not taking the medications as prescribed.

Biomedical Chart Abstraction—Within 1 week of the participants' completing the survey, we conducted a brief chart review to collect viral load and CD4 values.

Analysis

First, we computed frequencies, means and other measures of central tendency in order to describe the characteristics of the sample. We used frequency of drug use data from the ASSIST to create a binary indicator ('low' once per month vs. 'high' once per week) for each substance used during the past 3 months. Only the indicators for frequency of tobacco use, alcohol use and marijuana use were included in the latent class analysis (LCA) modeling because the frequency of use for the other substances did not support including them. We then used LCA to classify participants and identify profiles, or latent classes, of risk factors [24]. In LCA a logistic mathematical model is fitted to the observed data that comprise the key manifest variables. LCA estimates two types of interpretable parameters. The first set of parameters comprises the latent class membership probabilities (known as the gamma, γ parameters). The second set comprises the item-response probabilities conditional on latent class membership (also known as the rho, ρ parameters). The ρ parameters, which are referred to as "conditional probabilities," express the correspondence between the observed variables and the latent classes and form the basis for interpreting the latent classes. The final model is determined through an iterative process that entails fitting latent class models for n number of classes and calculating goodness-of-fit statistics including the Akaike Information Criterion (AIC) and the BIC (Schwarz Bayesian Information Criterion). The number of classes is determined as the fit that yields the lowest values for these two goodness-of-fit statistics.

We developed LCA models using nine key composite variables representing sexual and drug use behaviors that are most commonly associated with HIV risk. Variables included: (1) alcohol use, defined as drinking weekly or daily over the past 90 days; (2) ever being pregnant or ever getting someone pregnant; (3) ever being in jail; (4) problematic substance use, defined as a CRAFFT score of "2" or above; (5) tobacco use, defined as the use of tobacco weekly or daily over the past 90 days; (6) marijuana use, defined as the use of marijuana weekly or daily over the past 90 days; (7) number of sexual partners in the past 90 days collapsed into three categories: no partners, one partner, or two or more partners; (8) any episode of vaginal or anal intercourse without the use of condoms; and (9) any episode of unprotected vaginal or anal intercourse involving the use of alcohol or marijuana, defined as one or more unprotected sexual acts in the past 90 days. We included pregnancy as a surrogate marker for having had unprotected sex since 41 % of the young women in our sample had been pregnant. We then fitted latent class models that included two, three, four, five, and six classes. Then for all models that converged, we calculated the AIC and the BIC. We determined the number of classes by the fit that yielded the lowest values for these

two goodness-of-fit statistics and used the conditional probabilities to interpret each latent class. For example, if a subject is assigned to latent class k for key variable three (i.e., ever been in jail), then we know the probability of ever being in jail given that subject is in latent class k . Thus, we know the conditional probability for each latent class and key variable.

Last, we conducted post hoc analyses on dichotomized variables using logistic regression to identify differences among the classes on key demographic factors and to determine if class membership is associated with HIV-related factors and mental health outcomes. We used SAS Version 9.3 for all the analysis.

Results

Description of Sample

Table 1 illustrates the characteristics of the 1,712 youth who participated in the study. Sixty-seven percent ($n = 1,147$) were male and the remaining 33 % ($n = 565$) were female. The mean age was 20 years ($SD = 2.7$). The majority of the sample was racial/ethnic minorities; 18.9 % reported being Hispanic/Latino, 68.2 % Black/African American. Sixty-nine percent were either in school or had graduated from high school and one-third (33 %) were employed. The most frequently reported route of HIV infection for both males (71.7 %) and females (48.2 %) was having “sex with a man”. Approximately 31 % of participants (38.8 % of males and 14 % of females) had been diagnosed with HIV during the last 12 months. Sixty-seven percent of participants had a detectable viral load and 35 % of those who had taken antiretroviral medication for at least 6 months were detectable.

Risk Behaviors

Table 2 summarizes the risk behaviors used in the LCA. For the last 90 days, 34 % of youth reported weekly or daily use of tobacco; 28 % used marijuana weekly or daily; and 22 % used alcohol weekly or daily. Males averaged 4.1 ($SD = 19.3$) sex partners in the past 90 days and females averaged 1.4 ($SD = 2.8$) partners in the same time period. Participants averaged 5 ($SD = 14.4$) unprotected sexual acts with a HIV negative or unknown HIV status partner and 8.4 ($SD = 22.6$) unprotected sexual acts with all partners regardless of HIV status (includes HIV-positive, HIV-negative or unknown status partners) in the past 90 days. Forty-one percent of females reported that they were currently or had ever been pregnant while 9.4 % of males reported having gotten someone pregnant. Thirty-two percent of participants reported having been incarcerated at least once in their lifetime.

Latent Class Analysis

Table 3 summarizes the goodness of fit statistics used to determine the latent classes and Fig. 1 depicts the conditional probabilities of engaging in risk behaviors for participants assigned to each latent class. The five class solution had the lowest BIC and was deemed the best-fitting and most valid model. Differences among classes on risk variables support the existence of distinct sub-groups. We labeled the classes based on the probabilities of engaging in different risk behaviors resulting from the LCA.

Class 1—Low Overall Risk (LOR)—Class 1 members, which included 33 % of participants, had a low conditional probability of engaging in the nine risk behaviors in the past 90 days. Probabilities ranged from 0 % for having unprotected sex after using drugs and alcohol to 28 % for having one sexual partner.

Class 2—High Risk Substance Use (HRS)—Class 2 accounted for 23.4 % of participants. Youth in Class 2 engaged in risky substance use behaviors in the past 90 days. They had a 90 % conditional probability of being a problematic drug user (CRAFFT 2), a 67 % conditional probability of using tobacco and a 62 % conditional probability of using marijuana.

Class 3—High Risk Sexual Behavior (HRSB)—Class 3 members had high levels of risky sexual behaviors in the past 90 days. Specifically, they had an 83 % conditional probability of having more than two partners, a 66 % conditional probability of engaging in unprotected sexual behaviors, and a 59 % conditional probability of being problematic drug user. This class accounted for 16.5 % of participants.

Class 4—High Risk Sexual Behavior and Substance Use (HRSBS)—Class 4 members, which comprised 17.8 % of participants, had high levels of both sexual risk behaviors and substance use in the last 90 days. Members of this class had a 99 % conditional probability of being a problematic drug user, an 88 % conditional probability of having engaged in unprotected sex, a 78 % conditional probability of having more than two partners, a 74 % and 68 % conditional probability of being daily or weekly tobacco and marijuana users, respectively. They also had a 55 % conditional probability of ever having been in jail and a 50 % conditional probability of engaging in unprotected sex after using drugs and/or alcohol.

Class 5—Past Pregnancy Risk (PPR)—Class 5 accounted for 9.2 % of participants. Youth in Class 5 had an 83 % conditional probability of ever having been pregnant or getting someone pregnant and a 63 % conditional probability of having had one sexual partner in the past 90 days.

In Table 4, we present the results of the post hoc analysis. The classes differed on demographic variables, HIV-related issues, and mental health. We used Class 1 as the reference group because it had the lowest risk profile.

Demographic Differences—Members of Classes 2, 3, 4 and 5 tended to be older than those in Class 1. Youth 18–24 years of age engaged in more high-risk behavior than youth 12–17 years of age ($p < 0.001$). Members of Classes 2, 3 and 4 were more likely to be male, while those in Class 5 were more likely to be female ($p < 0.001$). Classes 1 and 5 had the highest percentage of members, 60.7 and 79.2 % respectively, who reported being heterosexual. Members of Classes 2, 3, and 4 were more likely ($p < 0.001$) than those in Class 1 to report their sexual orientation as “gay/bisexual” while those in Class 5 were less likely ($p < 0.001$) to do so.

HIV-Related Differences—Members of Classes 2, 3, 4, and 5 were more likely than those in Class 1 to have acquired HIV behaviorally as opposed to perinatally ($p < 0.001$). The length of time since HIV diagnosis also varied across the 5 classes. Members of Classes 2, 3 and 4 were more likely to have been diagnosed with HIV in the last year ($p < 0.001$) than those in Class 1. Class 1 and Class 5 had the highest percentages of members, 75.9 and 80 % respectively, who had been diagnosed with HIV for at least 12 months. In addition, members of Classes 2, 3, 4 and 5 were less likely to be on antiretroviral therapy than members of Class 1 ($p < 0.001$).

Mental Health Differences—Members of Class 2 and 4 were more likely to have considered suicide in the past 12 months and to have wanted mental health services than those in Class 1 ($p < 0.01$). Members of Classes 2, 3, 4 and 5 were more likely to have GSI scores above the clinical threshold than those in Class 1.

Discussion

This study is among the first to describe the salient characteristics of a large sample of YLH engaged in care in United States and classify them into distinct risk profiles that differ on key HIV-related and mental health variables. Although our descriptive findings provide an informative picture of YLH who are engaged in care at AMC in the U.S., the more unique contributions of our study stem from understanding how risk factors cluster within different subgroups of YLH and the implications this has for advancing intervention development efforts.

Since more than two-thirds of our sample identified as Black/African American, the results of our descriptive analysis once again highlight the significant toll that HIV continues to inflict on ethnic/racial minorities particularly those who are Black/African American. Our data clearly illustrate that gay or bisexual young men bear a significant burden and continue to be heavily impacted by HIV. More troubling, although unfortunately not surprising, is that 39 % of young men in our sample had been diagnosed with HIV within the last year compared with only 14 % of young women. This underscores the burgeoning epidemic among young gay/bisexual men and heightens the importance of launching effective prevention efforts tailored to the needs of this heavily impacted group of YLH.

Fifty-six percent of our sample scored two or higher on the CRAFFT, indicating problematic substance use. Additionally, approximately one third used selected sub-stances (tobacco, marijuana, or alcohol) regularly during the last 90 days. Given the documented extent of substance use among YLH, these numbers, although sobering, are not surprising. For instance, 8 % of the general pediatric population is estimated to suffer from depression, in contrast to a range of 15 % [14] to 50 % among YLH [25–27]. Approximately one third of YLH used tobacco on a daily or weekly basis which is higher than that of their HIV negative peers [28–30]. This is consistent with other studies indicating that rates of smoking among YLH are more than double that of HIV negative youth [28, 30]. Use of tobacco greatly increases the morbidity and mortality associated with HIV infection since it increases the risk for cardiovascular disease [31], certain cancers [32–34], weakens the immune system [35, 36], and is associated with a range of pulmonary disorders [37, 38]. Furthermore, there

is evidence that for persons living with HIV, multiple diagnoses including mental illness and substance abuse often leads to less than optimal care and non-adherence to medical treatment [39]. To ensure that all YLH receive optimal care and achieve viral suppression, it may be necessary to treat underlying mental health and substance abuse issues prevalent in some subgroups of YLH.

One of the more important findings from this study is that YLH are a heterogeneous population that can be classified into distinct groups with varying patterns of risk. For instance, members of Class 1 exhibited a low risk pattern since their level of engagement in the nine risk behaviors we used in the LCA were low. In contrast, members of Classes 2, 3, and 4 exhibited distinctly high risk patterns stemming from their level of engagement in sexual and/or substance use behaviors. Yet, for each of these three classes, members' risk behavior patterns were unique to their respective class. Specifically, the risk behaviors for members of Class 2 were associated with substance use, while those for Class 3 centered on risky sex. For members of Class 4, risk patterns were associated with *both* sexual and substance use behaviors. Patterns of risk for youth in Class 5 were also distinct. Compared to all other classes, members of Class 5 had the highest probability of ever having been pregnant or getting someone pregnant, a variable which we included in the LCA as a surrogate marker for unprotected sex. These findings illustrate the diversity in risk behavior patterns present among YLH and underscore the importance of tailoring interventions to address characteristics unique to different subgroups of YLH.

The differences in demographic, HIV-related and mental health factors detected in post hoc analyses are also worth noting and provide additional information to guide intervention development. For instance, the common points shared by members of Classes 2, 3, and 4 include being male, acquiring HIV behaviorally, self-identifying as gay/ bisexual, and having been diagnosed in the last 12 months. However, the classes differed in terms of their risk behavior patterns and YLH in each class may require tailored prevention messages and approaches. For instance, interventions for members of Classes 2, 3, and 4, could share core modules tapping issues of relevance for young gay/bisexual males who are recently diagnosed, but the intervention modules targeting risk behavior patterns would differ. Thus, youth in Class 2 would receive more content to address substance use behaviors, while those in Class 3 would receive content related to risky sex and condom use. The content for those in Class 4 would be a combination of the intervention modules for Classes 2 and 3. This modular approach to intervention development creates economies of scale and facilitates the tailoring process so that interventions address the unique needs of different subgroups of YLH.

Members of Classes 1 and 5 had low levels of substance use, had been diagnosed for 12 months or longer and were more likely than members of Class 2, 3, and 4 to identify as heterosexual. The unique features of Class 1 are that its members were more likely to have acquired HIV through perinatal transmission, to be on antiretroviral therapy, and to have low levels of sexual risk behaviors relative to youth in the other four classes. Intervention targets for youth in Class 1 may include development of life skills and self-management skills with special attention given to the needs of perinatally-infected youth. Although Class 1 members had the lowest levels of risk behaviors, this is not to say they had none. There is evidence

that some perinatally-infected youth engage in unprotected sex and have multiple partners not all of whom are seroconcordant [40]. Furthermore, substance use, which can potentiate sexual risk behaviors, occurs at levels comparable to the general population as perinatally-infected youth grow older [41]. Many perinatally-infected youth have significant mental health needs [42]. Interventions for Class 1 could be geared to help these youth sustain healthy behaviors, prevent or reduce risky sexual practices and use of substances, and develop coping strategies to help them remain adherent to their antiretroviral therapy and remain engaged in care as they transition to adult HIV clinics.

Class 5 is interesting in that their risk behavior pattern stemmed from pregnancy history, a surrogate marker for unprotected sex. Nineteen percent (40.6 % of females and 9.4 % of males) of our sample had a pregnancy history. Yet, this class comprised 9.2 % of the sample which suggests that there is something uniquely different among this subgroup of YLH that is not exclusively based on pregnancy history. Similar to Class 1, the majority of the members of Class 5 had been diagnosed for at least 12 months (80 %), identified as heterosexual (79 %) and had low levels of engagement in drug use behaviors. They differed from the other classes in that they had the highest conditional probability of having had only one sex partner in the past 90 days and a relatively high probability of engaging in unprotected sex in the same time period. These findings suggest that YLH in Class 5 were in intimate partner relationships, distinguishing them from other youth. Intervention targets for Class 5 may consist of couples-based interventions that focus on safe sex practices within the context of HIV and long-term relationships or programs that foster continued engagement in care and adherence to treatment regimens. They may also benefit from counseling on reproductive health [43].

In addition to providing a foundation for developing prevention interventions that are tailored to the unique characteristics of different subgroups of YLH, our findings have implications for clinical practice. Understanding the distinct patterns of risk prevalent in their patient population can help providers tailor their messages and treatment approaches to better fit their patients' issues. Another important consideration is that the risk profiles may be associated with different health outcomes. Rather than utilizing a "one size fits all" plan for prevention and treatment, tailoring interventions to address the different patterns of risk may be more effective. For example, because of their problematic substance use and co-occurring mental health issues, youth in Class 2 and Class 4 may have poorer health outcomes and more difficulty with retention in care than those in Classes 1 and 5. Several studies in adults with HIV infection have found co-occurring substance use and mental health diagnoses can interfere with HIV treatment [44–46]. These youth may need special efforts to sustain their engagement in care and interventions to help them adhere to medical treatment. Prevention interventions for these youth may need to include a significant mental health intervention component as well as substance use treatment.

The high levels of substance use and mental health issues in our study population point to the importance of having integrated treatment programs [47, 48] for YLH in which mental health services, substance use counseling and/or treatment, and medical care are part of a single, coordinated treatment program. Providing integrative treatment is beneficial to both YLH as well as society since this type of treatment program has been shown to increase

retention in care, increase utilization of mental health and substance abuse services, and increase adherence to medication and primary care appointments [49–51].

Notwithstanding the significance of our findings, our study had some limitations. Because our analyses are based on cross-sectional data, we cannot make causal inferences. Furthermore, we cannot identify changes that may have occurred in behavior as individuals live with and manage their HIV infection. In order to allow us to assess a wide range of risk behaviors, we measured the behaviors of interest broadly so our descriptions are not as detailed as they could have been. Although the majority of data were collected via self-report, we used computer assisted self-interviews which have been demonstrated to increase the reliability and validity of self-report data [52]. One recent study in the ATN found that the use of computer assisted self-reporting of drug use had high rates of concordance with toxicology results in youth with HIV infection [53]. Our participants had at least one clinical care visit during the study period; youth with undiagnosed HIV infection or otherwise not engaged in the medical system are not represented in our sample. It is possible that these youth may have different patterns of risk behaviors from those identified in the current sample and their intervention needs may also differ. It is also important to note that while LCA is a powerful tool for identifying subgroups and clustering data, the approach may be subject to bias in that there is no gold standard to apply when assessing and selecting models and evaluating validity. The best way to validate an LCA model is through replication, but due to the large sample sizes required for conducting these analyses, validation studies are seldom feasible.

Conclusions

In conclusion, in this article we report on one of the largest national samples of adolescents and young adults with HIV infection engaged in medical care in the U.S. Our participants were recruited from 15 different clinical care sites across the U.S. We identified distinct patterns of risk behaviors among these youth which point to the importance of tailoring clinical and preventive interventions to the unique needs of specific subgroups of YLH. Clearly, adolescents and young adults with HIV infection do not represent a monolithic population. The profiles identified here can serve as a starting point for crafting tailored messages and prevention programs that could be integrated in routine clinical practice. Future longitudinal studies with more in-depth assessments of key variables are needed for further refinement of the identified classes. This would establish a more detailed foundation for the development of clinical and preventive interventions of greater salience to the diverse population of YLH/AIDS.

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Fig. 1.

Conditional probabilities of engaging in risk behaviors for each latent class. *Notes:* Class 1 (in *solid black*) = low overall risk (LOR); Class 2 = high risk substance use (HRS); Class 3 = high risk sexual behavior (HRSB); Class 4 = high risk sexual behavior and substance use (HRSBS); Class 5 = past pregnancy risk (PPR). Higher probability (%) indicates a greater risk of engagement in risk behavior

Table 1

Sample characteristics

	Male <i>n</i> (%)	Female <i>n</i> (%)	Total <i>n</i> (%)
Total	1,147 (67.0)	565 (33.0)	1,712 (100.0)
Age (years)			
Mean (std. dev.)	20.5 (2.5)	19.5 (3.0)	20.2 (2.7)
Median (min.–max.)	21 (12–24)	20 (12–24)	20 (12–24)
Current gender			
Male	1,083 (95.2)	8 (1.4)	1,091 (64.5)
Female	14 (1.2)	544 (98.2)	558 (33.0)
Transgender	41 (3.6)	2 (0.4)	43 (2.5)
Race/ethnicity			
Non-Hispanic White	92 (8.0)	48 (8.5)	140 (8.2)
Non-Hispanic Black/African American	761 (66.3)	407 (72.0)	1,168 (68.2)
Hispanic	237 (20.7)	87 (15.4)	324 (18.9)
Non-Hispanic other	57 (5.0)	23 (4.1)	80 (4.7)
Marital status			
Single	950 (83.6)	432 (78.3)	1,382 (81.9)
Living with partner	117 (10.3)	72 (13.0)	189 (11.2)
Married	9 (0.8)	22 (4.0)	31 (1.8)
Other	60 (5.3)	26 (4.7)	86 (5.1)
Currently in school			
Yes	561 (49.3)	303 (54.7)	864 (51.1)
No	354 (31.1)	178 (32.1)	532 (31.4)
No, I have graduated	223 (19.6)	73 (13.2)	296 (17.5)
Currently employed			
Yes	421 (37.1)	136 (24.5)	557 (33.0)
No	713 (62.9)	418 (75.5)	1,131 (67.0)
Self-identified sexual orientation			
Straight	295 (26.0)	468 (84.3)	763 (45.1)
Gay	644 (56.7)	7 (1.3)	651 (38.5)
Bisexual	154 (13.6)	57 (10.3)	211 (12.5)
Other	42 (3.7)	23 (4.1)	65 (3.8)
Self-reported route of HIV infection			
Perinatal	199 (18.1)	232 (43.9)	431 (26.5)
IV drug use	4 (0.4)	2 (0.4)	6 (0.4)
Sex with a man	787 (71.7)	255 (48.2)	1,042 (64.1)
Sex with a woman	54 (4.9)	0 (0.0)	54 (3.3)
Other/don't know	53 (4.8)	40 (7.6)	93 (5.7)
Length of time since HIV diagnosis			
Less than one year	442 (38.8)	79 (14.1)	521 (30.7)
One year or more	696 (61.2)	480 (85.9)	1,176 (69.3)

	Male <i>n</i> (%)	Female <i>n</i> (%)	Total <i>n</i> (%)
Detectable viral load (full sample)	722 (62.9)	391 (34.1)	1,148 (67.3)
Detectable viral load (on ART 6 months)	115 (50.9)	107 (47.3)	226 (34.9)

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Table 2

Risk behaviors used in the LCA

	Male N = 1,147	Female N = 565	Total N = 1,712
Weekly or daily substance use in past 90 days, <i>n</i> (%)			
Tobacco	421 (36.9)	155 (27.6)	576 (33.8)
Marijuana	372 (32.7)	105 (18.7)	477 (28.1)
Alcohol	302 (26.5)	68 (12.1)	370 (21.8)
CRAFFT score			
2, <i>n</i> (%)	701 (61.5)	251 (44.7)	952 (55.9)
Ever been pregnant or ever gotten someone pregnant			
Yes, <i>n</i> (%)	107 (9.4)	228 (40.6)	335 (19.7)
Ever been to jail			
Yes, <i>n</i> (%)	386 (33.9)	159 (28.5)	545 (32.1)
Number of sexual partners in the past 90 days			
Mean (std. dev.)	4.1 (19.3)	1.4 (2.8)	3.2 (16.0)
One or more, <i>n</i> (%)	897 (78.8)	380 (68.4)	1,277 (75.4)
Number of unprotected sexual acts in the past 90 days with:			
HIV negative/unknown partner			
Mean (std. dev.)	4.3 (13.0)	6.8 (17.2)	5.0 (14.4)
One or more, <i>n</i> (%)	265 (41.3)	115 (43.7)	380 (42.0)
HIV positive and/or negative/unknown partner			
Mean (std. dev.)	8.3 (23.2)	8.5 (20.9)	8.4 (22.6)
One or more, <i>n</i> (%)	378 (49.3)	141 (47.5)	519 (48.8)
Number of unprotected sexual acts while using alcohol or marijuana in the past 90 days			
Mean (std. dev.)	13.5 (32.5)	29.3 (82.0)	17.9 (51.9)
One or more, <i>n</i> (%)	115 (10.7)	42 (7.9)	157 (9.8)
For females only			
Number of male sexual partners in the past 90 days (female sex with male)			
Mean (std. dev.)		1.3 (2.8)	
One or more, <i>n</i> (%)		363 (65.6)	
Number of female sexual partners in the past 90 days (female Sex with female)			
Mean (std. dev.)		0.1 (0.4)	
One or more, <i>n</i> (%)		45 (8.1)	
For males only			
Number of female sexual partners in the past 90 days (male sex with female)			
Mean (std. dev.)	0.4 (1.7)		
One or more, <i>n</i> (%)	170 (15.0)		
Number of male sexual partners in the past 90 days (male sex with male)			
Mean (std. dev.)	3.7 (19.3)		
One or more, <i>n</i> (%)	778 (68.8)		

Table 3

Latent class model fit information

Number of latent classes	BIC	AIC
Two	1102.9	988.6
Three	957.4	783.2
Four	906.7	672.7
Five	903.0	609.1
Six	933.6	579.9

Table 4
Differences among latent classes on demographic, HIV-related and mental health variables

	Class 1 (LOR) n (%)	Class 2 (HRS) n (%)	Class 3 (HRSB) n (%)	Class 4 (HRSBS) n (%)	Class 5 (PPR) n (%)
Overall	563 (33.0)	400 (23.4)	282 (16.5)	304 (17.8)	157 (9.2)
Age (years)					
12–17	191 (33.9)	34 (8.5)	34 (12.1)	12 (3.9)	10 (6.4)
18–24 [‡]	372 (66.1)	366 (91.5)	248 (87.9)	292 (96.1)	147 (93.6)
OR (95 % CI)	1.00	5.53 (3.73–8.18)	3.75 (2.51–5.58)	12.49 (6.84–22.83)	7.55 (3.89–14.66)
Wald Chi square, <i>p</i> -values [‡]	Ref.	72.9, <0.001	42.1, <0.001	67.3, <0.001	35.6, <0.001
Birth gender					
Male [‡]	343 (60.9)	306 (76.5)	231 (81.9)	229 (75.3)	35 (22.3)
Female	220 (39.1)	94 (23.5)	51 (18.1)	75 (24.7)	122 (77.7)
OR (95 % CI)	1.00	2.09 (1.57–2.78)	2.91 (2.05–4.11)	1.96 (1.44–6.67)	0.18 (0.12–0.28)
Wald Chi square, <i>p</i> -values [‡]	Ref.	25.4, <0.001	36.2, <0.001	18.0, <0.001	64.8, <0.001
Currently employed					
No [‡]	377 (67.7)	285 (71.4)	160 (56.9)	203 (67.0)	113 (72.4)
Yes	180 (32.3)	114 (28.6)	121 (43.1)	100 (33.0)	43 (27.6)
OR (95 % CI)	1.00	1.19 (0.90–1.58)	0.63 (0.47–0.85)	0.97 (0.72–1.31)	1.26 (0.85–1.86)
Wald Chi square, <i>p</i> -values [‡]	Ref.	1.5, 0.22	9.3, 0.002	0.04, 0.84	1.3, 0.26
Self-reported route of HIV infection					
Perinatal	262 (49.3)	74 (19.4)	40 (15.0)	26 (8.7)	29 (19.7)
Non-perinatal [‡]	269 (50.7)	308 (80.6)	227 (85.0)	273 (91.3)	118 (80.3)
OR (95 % CI)	1.00	4.05 (2.99–5.50)	5.53 (3.79–8.06)	10.23 (6.61–15.83)	3.96 (2.55–6.16)
Wald Chi square, <i>p</i> -values [‡]	Ref.	80.6, <0.001	79.1, <0.001	108.9, <0.001	37.6, <0.001
Self-identified sexual orientation					
Straight	337 (60.7)	165 (41.5)	64 (22.9)	75 (24.7)	122 (79.2)
Gay/bisexual/other [‡]	218 (39.3)	233 (58.5)	215 (77.1)	229 (75.3)	32 (20.8)
OR (95 % CI)	1.00	2.18 (1.68–2.84)	5.19 (3.75–7.20)	4.72 (3.46–6.45)	0.41 (0.27–0.62)
Wald Chi square, <i>p</i> -values [‡]	Ref.	34.0, <0.001	97.5, <0.001	95.4, <0.001	17.3, <0.001

	Class 1 (LOR) n (%)	Class 2 (HRS) n (%)	Class 3 (HRSB) n (%)	Class 4 (HRSBS) n (%)	Class 5 (PPR) n (%)
Length of time since HIV diagnosis					
<1 year [‡]	135 (24.1)	143 (35.8)	101 (36.1)	119 (39.1)	31 (19.7)
1 Year	425 (75.9)	256 (64.2)	179 (63.9)	185 (60.9)	126 (80.3)
OR (95 % CI)	1.00	1.76 (1.33–2.33)	1.78 (1.30–2.43)	2.03 (1.50–2.74)	0.78 (0.50–1.20)
Wald Chi square, <i>p</i> -values [‡]	Ref.	15.4, <0.001	13.1, 0.003	21.1, <0.001	1.3, 0.25
Currently taking anti-retroviral medication					
No [‡]	163 (29.0)	201 (50.3)	133 (47.2)	163 (53.6)	71 (45.2)
Yes	400 (71.0)	199 (49.8)	149 (52.8)	141 (46.4)	86 (54.8)
OR (95 % CI)	1.00	2.48 (1.90–3.24)	2.19 (1.63–2.95)	2.84 (2.12–3.79)	2.03 (1.41–2.91)
Wald Chi square, <i>p</i> -values [‡]	Ref.	44.2, <0.001	26.9, <0.001	49.7, <0.001	14.5, <0.001
Consider suicide in the past 12 months					
No	494 (89.0)	326 (81.7)	245 (87.2)	234 (77.2)	136 (87.7)
Yes [‡]	61 (11.0)	73 (18.3)	36 (12.8)	69 (22.8)	19 (12.3)
OR (95 % CI)	1.00	1.81 (1.26–2.62)	1.19 (0.77–1.85)	2.39 (1.64–3.49)	1.13 (0.65–1.96)
Wald Chi square, <i>p</i> -values [‡]	Ref.	10.1, 0.002	0.6, 0.44	20.4, <0.001	0.2, 0.66
Wanted mental health service					
No	381 (68.5)	225 (56.4)	183 (65.1)	146 (48.5)	99 (63.1)
Yes [‡]	175 (31.5)	174 (43.6)	98 (34.9)	155 (51.5)	58 (36.9)
OR (95 % CI)	1.00	1.68 (1.29–2.20)	1.17 (0.86–1.58)	2.31 (1.73–3.08)	1.28 (0.88–1.85)
Wald Chi square, <i>p</i> -values [‡]	Ref.	14.6, 0.001	1.0, 0.32	32.4, <0.001	1.7, 0.20
Global severity index					
Below clinical score	486 (86.3)	239 (59.9)	192 (68.1)	138 (45.4)	124 (79.0)
Above clinical score [‡]	77 (13.7)	160 (40.1)	90 (31.9)	166 (54.6)	33 (21.0)
OR (95 % CI)	1.00	4.23 (3.09–5.78)	2.96 (2.09–4.19)	7.59 (5.46–10.56)	1.68 (1.07–2.64)
Wald Chi square, <i>p</i> -values [‡]	Ref.	81.5, <0.001	37.5, <0.001	1,451, <0.001	5.0, 0.02

LOR low overall risk, HRS high risk substance use, HRSB high risk sexual behavior, HRSBS high risk sexual behavior and substance use, PPR past pregnancy risk

[‡]Probability modeled is the noted category of each dichotomized outcome in relation with five latent classes

[†] *P*-values are pairwise *p*-values from the Logistic regression which are used to compare the odds between Class 2–5 and Class 1 respectively for a specific characteristic. “Ref.” is the reference group. For example, *p* < 0.001 for age in Class 2–5 indicates that participants in Class 2–5 are more likely to be older when compared with Class 1