



Increasing Viral Hepatitis Knowledge Among Urban Ethnic Minority Youth: Findings from a Community Based Prevention Intervention

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Abstract

Viral hepatitis (VH) knowledge among youth is understudied in the United States. There has been a rise in VH cases in the U.S. in the wake of the opioid epidemic. Innovative approaches to preventing the infection are needed especially in urban communities. This study presents preliminary findings from a community-based HIV/AIDS, substance abuse, and VH prevention education intervention for ethnic minority youth in a northeastern urban community. We aimed to evaluate VH knowledge and factors associated with knowledge. Participants in the study completed a baseline survey followed by an exit survey measuring VH knowledge after the intervention. The survey was completed by 691 individuals. Logistic regression analyses were conducted and indicated that there was a significant increase (82.3%) in VH knowledge among youth who participated in the intervention. The development and implementation of VH knowledge interventions can be crucial in alleviating the rise of VH infections in the U.S.

Keywords Viral hepatitis knowledge · Urban youth · Community · Education

Over the last decade, there has been a substantive rise in bloodborne infectious diseases such as viral hepatitis (VH) [1]. This has largely gone unnoticed by the general public due to lack of provider, patient, and community knowledge, as well as conflicting screening guidelines [2]. VH is a group of viruses (e.g., Hepatitis A [HAV], B [HBV], C [HCV], D [HDV], E viruses [HEV]) that are etiologically and epidemiologically distinct and all result in liver inflammation and damage [3, 4]. There are various modes of transmission based on the strain of VH infection. For instance, HAV is

transmitted through fecal–oral route and can be prevented with proper water sanitation and hand washing hygiene [5]. HAV is also one of the most common vaccine-preventable diseases [5]. HBV, however, is a chronic infection and major cause of cirrhosis and liver failure worldwide [4, 6]. In the U.S., HBV vaccines are widely available and both infants and children are recommended to receive the HBV vaccination [6]. The availability of safe and effective vaccines for both HAV and HBV have reduced the morbidity and mortality associated with vaccine-preventable diseases in the U.S. [7]; albeit, HBV has increased among ethnic minority and immigrant populations [8–10].

There is no vaccination for HCV [9]. HCV incidence rates have risen over the past decade, with approximately 2 million people living with HCV in 2016, and an estimated 41,000 new cases over the previous year [11]. Such rates of infection designate HCV as the most common chronic blood-borne infection in the U.S. [12, 13]. HCV is also the leading cause of liver cancer and end-stage liver disease worldwide [14], as well as being a particularly problematic illness among injection drug users [13, 15]. The majority of persons living with HCV (75%) are unaware of their infection [16] due to the difficulty in diagnosing HCV [17].

HDV, known as “delta hepatitis”, is a VH co-infection, occurring among individuals infected with HBV [4, 18].

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HDV is uncommon in the U.S. and preventable through HBV vaccination for people that do not have HBV [19]. Similarly, HEV is rare in the U.S. and frequently diagnosed in developing countries [20]. HEV is spread through the fecal–oral route and preventable with improved water sanitation, and personal and hand hygiene. There is no FDA-approved vaccine for HEV. The HBV, HCV and HDV can all be transmitted by contact with infected blood, unprotected sex with an infected person, or transmission from mother to child [4].

Viral Hepatitis and Youth

Due to this rapidly advancing epidemic of HCV and with more cases of HBV on the horizon, it is imperative for innovative methods to increase awareness of risk and testing for high-risk groups. However, VH knowledge and awareness research is limited in the U.S. The existing research on VH risk supports that youth from low-income, vulnerable backgrounds are at the greatest risk of infection; yet, prevention research and programming is minimal. Those studies that are available on VH knowledge have focused largely on homeless [21, 22] and injecting drug using U.S. youth [23–27]. While these are highly critical populations, there is a need for research examining VH risk and knowledge among low-income ethnic minority youth, in general. Addressing this gap in the literature is crucial. Similar to the HIV/AIDS research, increasing knowledge of risk, including modes of transmission, can be a critical prevention strategy in reducing incidence of VH, overall [28, 29]. To these authors knowledge, there are no evidence-based VH education prevention interventions available for youth in the U.S.

Study Intervention

An educational community-based HIV/AIDS, substance abuse, and VH intervention for ethnic minority youth was provided in a low-income, urban community in north-eastern United States. Participants completed pre- and post-intervention surveys. The educational intervention consisted of a 60–90 min interactive discussion of the epidemiology of VH strains, modes of transmission, care and treatment options, and preventative strategies, followed by a question/answer session. The community-based intervention consisted of providing education to diverse, ethnic minority youth about HIV/AIDS, licit and illicit substance use and VH transmission risk reduction, with a focus on drug injecting practices, sexual risk behavior, and access to HIV and HCV testing and treatment. The curriculum consists of seven, participant-centered face-to-face educational sessions. VH was covered in the following steps (See Table 1).

The United Nations has included the goal of eradicating VH into their agenda of ending epidemics of infectious diseases by 2030 [30]. Drawing on this call to action, it is fundamental to promote universal access to information and education to prevent the spread of infectious diseases including VH. To plan effective measures for VH, it is essential to identify the gaps in VH knowledge in the general population. This study will provide preliminary evidence of: (1) a successful VH education intervention targeting ethnic minority youth; and (2) specific factors that contributed to an increase in VH knowledge among youth participants. This study builds upon the limited literature on VH education among ethnic minority youth and provides suggestions for practitioners and researchers, alike, on how to disseminate VH education to youth in a community setting.

Table 1 Project COPE: viral hepatitis session

Activity	Materials needed	Components	Duration
Viral hepatitis basics	Projector and computer to display PowerPoint	Covers five different strains (HAV, HBV, HCV, HDV, HEV) Discusses symptoms for each discuss modes of transmissions—accounting for similarities between strains and differences (youth participants can volunteer to read modes of transmissions for each viral hepatitis strain)	20 min PowerPoint presentation and handouts provided
Viral hepatitis modes of transmission board	Large trifold poster board	Youth participants are given cards that discuss the modes of transmission that are consistent with (HAV, HBV,HCV,HDV). Youth are asked to pair the modes of transmission underneath the appropriate strain. Youth are asked to work in groups	20 min
Viral hepatitis myth and facts	Red and green cards	Facilitator states a statement about viral hepatitis and youth are asked to say whether it is a fact or myth. For example: is there a vaccine for hepatitis C? myth or fact	10–15 min

Methods

Recruitment and Sample

Data were collected as part of a federally-funded Minority AIDS Initiative (MAI) prevention grant targeting racial-ethnic minority adolescents in low-income, urban community in the northeastern United States. Project C.O.P.E. (Communities Organizing for Prevention and Empowerment), is university-community partnership that provides comprehensive Centers for Disease Control and Prevention and CSAP (Center for Substance Abuse Prevention) evidence-based prevention protocols to youth in an economically deprived, northeastern U.S. community [31].

Students were recruited from health education classes in the local high school in grades 9–12, and summer camp programs throughout the target community. School and camp administration approval were obtained before recruiting students. Students participated in a 50-min baseline and exit questionnaire created by the federal funding agency to answer 100 self-administered questions, in English, which assessed several risk and protective factors associated with HIV/AIDS and substance abuse. Students were exposed to a comprehensive HIV/AIDS, VH, and substance abuse prevention-intervention education curriculum over a 6-week period. Sessions are 60-min in length. For the current exploratory study, student baseline and exit responses were examined to develop a comprehensive understanding of VH knowledge. All study protocols were approved by the Montclair State University Institutional Review Board. Students who returned signed parental informed consent and student assent forms participated in the survey.

As of 2017, 691 youth were interviewed at baseline and exposed to the evidence-based prevention curriculum. Of

these youth, 621 youth responded to the exit survey. Youth participants were predominantly African American/Black (48.1%) and Hispanic (42%). At the time of the investigation, the sample were near evenly split between males (48.1%) and females (51%), with 0.9% identifying as having a gender non-conforming identity, with an average age of 16.30 years ($SD=1.26$). The largest proportion (82%) of adolescents identified as having a non-LGBQ (lesbian, gay, bisexual, queer) identity; however, approximately 18% identified as either bisexual (8.2%), gay or lesbian (2.9%), or queer (7.2%).

Measures

This study used outcome-based measures designed by the federal funding agency to capture information pertaining to HIV/AIDS, VH, and substance abuse knowledge and behaviors. The survey also included questions that explored risk and protective mechanisms—e.g., positive peer behaviors, school importance, sexual activity in the next 3-months, risk perception. VH was designated as the criterion variable of interest in this study. Main predictors of interest were: (a) HIV/AIDS knowledge, (b) sexual activity in the next 3 months, (c) sexual negotiation skills, (d) perception of risk, (e) positive peer networks, and (f) school importance. Several demographic variables were also examined which included: age in years, gender, racial-ethnic group identity, sexual orientation identification, and educational level. Descriptive statistics and associated alpha-levels (α) are found in Table 2. Table 3 displays the demographics for full sample and percentage distribution of accuracy of VH knowledge (in percentages).

Table 2 Ranking of correct VH knowledge questions and differences between pre- and post-test education intervention among youth respondents

Knowledge of VH	Correct answer	Baseline		Exit		X^2 p value (McNemar)
		Respondents ($N=691$)		Respondents ($N=621$)		
		N	%	N	%	
Only people who look sick can spread VH	No	690	92.1	619	95.3	.04
People who have HIV also have VH	No	690	57.4	619	57.5	.98
Birth control pills protect women from getting the VH	No	690	88.7	619	90.3	.05
There are drugs available to treat VH that can lengthen a person's life	Yes	688	76.8	619	82.3	.04
You can be vaccinated for VH A & B, not VH-C	Yes	691	78.9	620	83.4	.23
Young people under age 18 need their parents' permission to get tested	No	685	20.4	620	79.6	.001
Sharing intravenous needles increases a person's risk of becoming infected with VH-C	Yes	683	88.1	619	92.9	.03
You can become infected with VH by having unprotected oral sex	Yes	670	89.2	620	88.1	.67

Bold p values are significant

Table 3 Percentage distribution of accuracy of VH knowledge (in percentages) by respondents' characteristics

Demographic characteristics	Full sample post-test (<i>N</i> =621)	Accuracy of VH knowledge post-test		
		≤ 50%	> 50% and < 100%	100%
Age-group (RC: 11–18=0)				
11–18	96.4	16.8	71.2	12.1
19–24	3.5	10.6	84.3	5.3
Gender (RC: male=0)				
Male	50.1	18.6	70	11.4
Female	49.9	14.4	73.2	12.4
Racial-ethnic group (RC: Hispanic/Latinx =0)				
African American/Black	20.9	18.6	71.4	9.9
Hispanic/Latinx	79.1	17.9	71.1	11.0
Sexual orientation (RC: non-queer =0)				
Non-queer	80.7	16.6	71.7	11.6
Queer (LGBQ)	19.3	19.13	67.1	13.77
Education-level				
Elementary school	5.3	15.8	70.6	13.6
Middle school	76.1	12.8	55.4	10.3
High school	15.3	20.3	73.7	6.0
Completed high school	3.3	14.3	71.5	14.2

Control Variables

Several control variables were used in this study (See Table 2), which included age, gender, racial-ethnic identity, sexual orientation identification, and educational level. *Age in years* was entered as a grouping variable, with largest proportion of youth between 11 and 18 years of age (96.4%), with a mean age of 15.86 years ($SD=1.37$). The age of 11 to 18 was designated as the reference category. *Gender* was near evenly split between males (50.1%) and females (49.9%), with males designated as the reference category (0). *Racial-ethnic group identity* was assessed by asking respondents their identification. Nearly 80% of participants identified as Hispanic/Latinx (79.1%) and approximately 20.9% as African American/Black. Hispanic/Latinx racial-ethnic identification was designated as the reference category (0). *Sexual orientation identification* was assessed by asking respondents to self-disclose their sexual-orientation identification. Responses of Lesbian, Gay, and Bisexual were collapsed into a single LGBQ or queer identity (1) and those non-queer youth identified as “non-queer” (0). Trans* identifying students were not identified in the current sample. Last, educational-level was assessed by asking participants if they were in: Elementary School (0), Middle School (1), High School (2), or had Completed High School (3). The majority of students were between Middle School (76.1%) and High School (15.3%).

Criterion Measure

VH Knowledge was assessed using seven-items that measured participants' VH knowledge. See Table 2 for questions. Responses were recorded using *True* (1) or *False* (0). Accurate knowledge of all seven-items is defined as correct responses on all seven-items (1), while 0 to 7 were recorded as incorrect (0).

Outcome Measures

HIV/AIDs Knowledge was assessed using seven-items that measured participants' HIV knowledge (sample item: Only people who look sick can spread the HIV/AIDS virus.). Responses were recorded using *True* (1) or *False* (0). Accurate HIV knowledge on all eight items was recorded as “1”, while 0 to 7 were recorded as incorrect (0).

Sexual Activity in the next 3-months was assessed using a single question-item that asked participants: In the next 3 months, how likely are you to be sexually active? Responses were recorded using a four-point Likert scale ranging from *Not at all likely* (1) to *Very Likely* (4). At baseline, the overall measure had a mean score of 2.20 ($SD=1.27$) and at exit, a mean score of 2.16 ($SD=1.32$).

Sexual negotiation skills were assessed using six-items that examined participants' perceived ability to engage in sexual negotiation (sample items: I could say no if someone pressured me to have sex when I did not want to.). Responses were recorded using a four-point Likert scale ranging from

Strongly Agree (4) to *Strongly Disagree* (1), with responses totaled to reflect greater ability to engage in sexual negotiation. At baseline, the overall measure had a mean score of 20.25 ($SD=3.64$; Cronbach's $\alpha = .81$) and at exit, a mean score of 20.91 ($SD=3.58$; Cronbach's $\alpha = .81$).

Perception of risk was assessed using five-items that measured participants' perception of sexual risk (sample item: How much do you think people risk harming themselves physically if they have sex without a condom or dental dam?) and substance use risk (sample item: How much do people risk harming themselves physically or in other ways when they smoke marijuana once or twice a week?). Item responses were recorded using a four-point Likert scale ranging from *no risk* (1) to *greater risk* (4) and summed to reflect greater perceived risk. CFA was done to establish support for the factor structure of the *perception of risk* measure at baseline. At baseline, participants responded with a mean score of 17.33 ($SD=2.57$; Cronbach's $\alpha = .75$) and at exit, a mean score of 17.64 ($SD=3.10$; Cronbach's $\alpha = .75$).

Positive Peer Networks was assessed using seven-items that measured participants' perceived degree that they engaged with friends who did not engage in health compromising behaviors (sample items: How many of your friends do the following: smoke cigarettes? drink alcohol? and have been arrested?). Item responses were recorded using a five-point Likert Scale from *None* (1) to *All of my friends* (5) and summed to reflect greater peer support. At baseline, participants responded with a mean score of 1.87 ($SD=.78$; Cronbach's $\alpha = .75$) and at exit, a mean score of 1.80 ($SD=.80$; Cronbach's $\alpha = .77$).

School Importance was assessed using four-items that measured participants' perceptions of school importance (sample items: What I am learning in school is important for later life. My schoolwork is meaningful and important). Item responses were recorded using a four-point Likert Scale from *Strongly Disagree* (1) to *Strongly Agree* (4) and summed to reflect greater school importance. At baseline, participant's responded with a mean score of 14.73 ($SD=2.91$; Cronbach's $\alpha = .71$) and at exit, a mean score of 14.83 ($SD=2.99$; Cronbach's $\alpha = .72$).

Statistical Analyses

Following multiple imputation (MI), using a chained MI approach, age in years, gender, racial-ethnic group identity, sexual orientation identification, and educational level were examined for differences between groups on main analytic variables. No significant differences were present between VH knowledge and demographic variables. No differences were identified between sexual activity in the next 3-months and demographic variables. There were noted differences in HIV/AIDS knowledge and sexual orientation identification ($F[32, 128] = 2.38, p = .00$) and

HIV/AIDS knowledge and racial-ethnic group identity ($F[15, 128] = 1.72, p = .04$). Additional differences were identified between: school importance and gender ($F[1, 128] = 6.02, p = .014$), school importance and racial-ethnic group identity ($F[15, 128] = 5.98, p = .000$), school importance and sexual orientation identification ($F[8, 128] = 2.68, p = .00$), sexual negotiation and sexual orientation identification ($F[8, 128] = 3.20, p = .002$), perception of risk and educational level ($F[1, 128] = 3.30, p = .03$), and positive peers and ethnic group identity ($F[15, 128] = 1.70, p = .04$). Based on these analyses, demographic variables were included as controls in subsequent analyses.

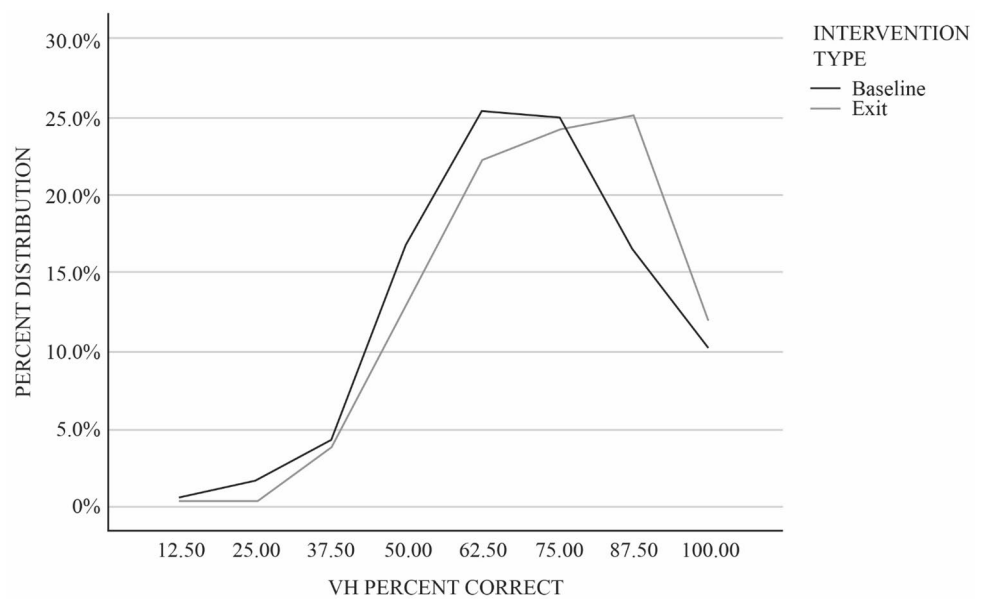
Next, cross tabulations were conducted to show the distribution of the sample across demographic variables, with associated accuracy of VH knowledge. Variation was assessed between baseline and exit-surveys on the percent correct on VH knowledge questions (see Fig. 1). Binary logistic regression analyses were also conducted at the 95% level of significance to identify the probability of accurate (100%) VH knowledge by respondents' HIV knowledge, sexual activity, sexual negotiation skills, risk perception, and school importance, controlling for demographic variables. Accurate knowledge (1) in the model is measured as correct responses to all seven-questions, while 0 to 6 were considered inaccurate (0). Analyses were conducted using STATA v.15 [32].

Results

Baseline Knowledge

Table 2 shows baseline and exit responses to each individual VH knowledge question. At baseline, 92% of respondents indicated correctly when put forward the statement: *Only people who look sick can spread Viral Hepatitis (VH)*; 57.4% answered correctly when put forward the statement: *People who have HIV also have VH*; 88.7% responded correctly when put forward the statement: *Birth control pills protect women from getting the VH*; 76.8% responded correctly when put forward the statement: *There are drugs available to treat VH that can lengthen a person's life*; and 78.9% responded correctly when put forward the statement: *You can be vaccinated for HAV, HBV, not HCV*. The majority of students did not respond correctly (20.4%) with regard to: *Young people under age 18 need their parents' permission to get a VH*. Yet, 88.1% knew that sharing intravenous needles increases a person's risk of becoming infected with *HCV*, and 89.2% were aware that you can become infected with VH by having unprotected oral sex.

Fig. 1 Percentage distribution of accuracy of VH knowledge (in percentages) among youth ($N=621$)



Changes in Knowledge Post-intervention

The 6-week educational intervention improved knowledge of VH (Table 2) for several of the VH knowledge questions. For instance, 88.7% of students at baseline did responded correctly with regard to: *Birth control pills protect women from getting the VH*; however, at exit 90.3% responded correctly ($p < .05$). Similarly, 76.8% of students responded correctly at baseline when given the statement: *There are drugs available to treat VH that can lengthen a person's life*; whereas, 82.3% responded correctly at exit ($p < .04$). After learning about access to VH testing, a significant proportion (79.6%, $p < .001$) of students were able to respond accurately to statement: *Young people under age 18 need their parents' permission to get a VH*, when compared to baseline (20.4%). A significant difference was also present between

those youth exit (92.9%) and those at baseline (88.1%) who responded accurately to the statement: *Sharing intravenous needles increases a person's risk of becoming infected with Hepatitis C*.

See Fig. 1. Despite several questions that showed no change, there was a noted significant percent change overall ($t[1301] = -4.14$, $p = .001$, 95% CI $[-5.91, -2.11]$) in the number of students who responded accurately between baseline ($M_{\text{percentage}} = 68.55$, $SD = 17.89$) and exit ($M_{\text{percentage}} = 73.57$, $SD = 16.96$), with a larger-sized effect, $d = .75$. Among those with 100% accuracy post-test, most were between 11 and 18 years of age (12.1%), Hispanic/Latinx (11%), LGBTQ or queer (13.77%), and beyond high school (14.2%) (see Table 3).

Table 4 shows the results of the binary logistic regression model for accuracy of VH Knowledge Percent correct.

Table 4 Logistic regression predicting VH knowledge by respondent's HIV knowledge, sexual activity, sexual negotiation skills, risk perception, and school importance

	Baseline		Exit	
	Respondents ($N=691$)		Respondents ($N=612$)	
	Beta (SE)	OR	Beta (SE)	OR
Step 1				
HIV percent correct	.06 (.02)	1.06	.10 (.02)*	1.25
Step 2				
Sexual activity in the next 3-months	.09 (.11)	1.09	.18 (.10)**	1.23
Sexual negotiation skills	.06 (.08)	1.06	.20 (.08)**	1.23
Risk perception	.23 (.10)*	1.26	.19 (.11)**	1.24
Positive peer networks	.19 (.05)*	1.20	.08 (.05)	1.08
School importance	.02 (.07)	1.02	.13 (.07)*	1.26
Controls	Yes		Yes	

* $p < .05$, ** $p < .01$

The results showed that while HIV/AIDS Knowledge Percent correct was not necessarily an important indicator of VH knowledge pre-test; however, it was significantly associated with VH knowledge post-test (odds ratio [OR] = 1.25). At Step 2, both sexual activity in the next 3-months and sexual negotiation skills were not significantly associated with VH Knowledge at baseline; however, at exit, these variables were significant predictors of VH Knowledge Percent Correct. Risk Perception was significantly associated with VH Knowledge Percent Correct at both baseline (OR = 1.26) and exit (OR = 1.24). Interestingly, Positive Peer Networks was only associated with VH Knowledge Percent Correct at baseline (OR = 1.20). School Importance was positively associated with VH Knowledge Percent Correct at exit (OR = 1.26). Importantly, HIV/AIDS percent correct continued to have a significant relationship with VH Knowledge Percent Correct, even when variables were added into the logistic regression model at Step 2, which highlights the importance of HIV/AIDS knowledge in the development of VH knowledge. *Controls* were maintained for all analyses.

Discussion

The aim of this article is to identify factors associated with accurate VH knowledge among ethnic minority youth who participated in a community-based prevention intervention program. The infusion of VH within an HIV/AIDS and substance abuse prevention intervention appeared to be associated with youth's ability to retain VH information and increase VH knowledge. This could be due to the similar modes of transmission that HIV and VH share, making it more relatable to youth who are already involved in a comprehensive HIV/AIDS education program.

While differences were present on baseline and exit survey outcomes on questions related to VH knowledge and there was a significant difference overall between the number of correctly answered VH questions at exit, it should be noted that there were questions that youth did not display a difference in VH knowledge. For instance, no difference was shown in students' knowledge of whether people who have HIV also have VH. Similarly, no change in knowledge was identified in students' awareness of engaging in unprotected sex and being infected with VH. The limited knowledge change in these specific areas could be due to deeply ingrained VH myths and skepticism [33, 34], as well as the recentness of this topic being broadly discussed in the U.S. mainstream narrative [11, 35]. At present there is limited research examining VH knowledge among youth in the U.S. [23] and the broader conversation outside of scholarly research is nascent, which means that the public's health-based literacy on this topic is also limited [36]. On-going

support and re-education may be necessary to reinforce VH knowledge.

Nonetheless, findings are encouraging in relation to the association with key variables predictive of VH knowledge. For instance, greater HIV knowledge at exit was also associated with greater VH knowledge. Prior research supports that individuals with greater VH knowledge displayed both more HIV knowledge and perceived less stigma about both VH and HIV [37]. In the same study, participants were also motivated to adhere to both VH and HIV treatment [37]. In addition, sexual negotiation skills and risk perception, were predictive of VH knowledge. Research findings in the HIV [28] and VH literature [38–41] have identified similar outcomes. This is particularly important as primary prevention of VH is one of the best modes of preventing transmission of VH [42], because no vaccine is available for HCV. Similarly, sexual activity in the next 3-months was also predictive of VH knowledge. This is an important finding as it indicates that youth who were likely to engage in sexual activity also had greater VH knowledge, presenting as a protective factor for these young people.

Limitations

This study has several limitations. Our population consisted of a convenience sample of ethnic minority youth in community-based organizations and schools. Likewise, we measured the impact of the educational intervention immediately following the discussion, so we cannot comment as to whether the improvement in knowledge was durable, though other studies of brief educational interventions have shown sustainability of knowledge from one to 18 months later [43]. Despite limitations, this study contributes significantly to the limited literature on VH knowledge and education among urban ethnic minority youth in the U.S and draws attention to the importance of exposing youth to activities on VH increased their VH knowledge including modes of transmission. Therefore, increasing knowledge and sharing resources about VH testing sites and clinics may be the first step in curtailing the epidemic.

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Compliance with Ethical Standards

Conflict of interest No potential conflict of interest was reported by the authors.

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