Stigma, Coping, and Alcohol Use Severity Among People Living With HIV: A Prospective Analysis of Bidirectional and Mediated Associations

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Abstract

Background HIV-related stigma is associated with health consequences among people living with HIV, including increased risk for alcohol problems. Theory suggests that maladaptive coping may mediate the relationship between HIV-related stigma and alcohol outcomes, and these variables may be bidirectionally associated over time. However, no studies have examined the temporal relationships among these variables in people living with HIV.

Purpose This study examined prospective bidirectional and mediated associations among HIV-related stigma, maladaptive coping, and alcohol use severity in patients enrolled in the Ontario HIV Treatment Network Cohort study.

Method Patients receiving care for HIV ($N = 1,520$) at one of several clinics completed self-report measures annually. Data were analyzed in a four-wave, cross-lagged panel model.

Results Greater HIV-related stigma at each wave consistently predicted increased maladaptive coping 1 year later. Similarly, maladaptive coping consistently predicted greater subsequent HIV-related stigma. Further, we observed some evidence that maladaptive coping mediated the prospective associations between HIV-related stigma and alcohol use severity in both directions (i.e., stigma to subsequent alcohol use severity and vice versa) although these associations were not observed across all waves.

Conclusion Results suggest that HIV-related stigma and maladaptive coping are bidirectionally associated with one another over time. This study also provides some evidence that coping may be a relevant mediator of these associations, although findings were less consistent for mediated pathways. Future research should examine whether interventions addressing stigma and coping among people living with HIV may help to minimize health risks such as hazardous drinking.

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Introduction

HIV-related stigma is a serious challenge facing people living with HIV. HIV-related stigma has been broadly defined as the devaluation of individuals based on their

HIV status [1], and includes “prejudice, discounting, discrediting, and discrimination directed at people perceived to have AIDS or HIV” [2]. HIV-related stigma is pervasive; for example, in countries with available data, it has been estimated that roughly 50% of individuals hold discriminatory attitudes toward people living with HIV [3]. Further, the concept of HIV-related stigma includes not only discrimination and prejudice experienced by people living with HIV, but also typically includes internal experiences such as fear of what others think, concern over the negative consequences of disclosing one’s HIV status, and negative self-image or self-stigma [4]. HIV-related stigma is associated with poor outcomes among people living with HIV, including poor adherence to antiretroviral therapy [5, 6], barriers to accessing health care associated with actual or perceived discrimination by health care workers [7, 8], and poorer physical and mental health, including increased endorsement of HIV symptoms and depression [9–11].

Although receiving less attention than other health outcomes associated with HIV stigma, a small but growing number of studies have found that alcohol use and problems are elevated among people living with HIV who report experiencing greater stigma [12–14]. Alcohol misuse is a particularly concerning correlate of HIV-related stigma given that heavy drinking among people living with HIV is associated with a wide range of deleterious outcomes. For example, alcohol consumption has been linked with risky sexual behaviors that may increase the likelihood of HIV transmission [15–17]. Also, people living with HIV who use alcohol are approximately 50%–60% less likely to be adherent to antiretroviral therapy than abstainers [18], and heavy drinking is related to increased risk of detectable viral load, impaired liver function, and death [19–21]. Thus, a better understanding of the link between HIV-related stigma and alcohol use is necessary to curb their negative impact on the health and well-being of people living with HIV.

However, few studies have examined the mechanisms linking HIV-related stigma and alcohol outcomes. The self-medication hypothesis points to maladaptive coping as a potentially relevant mediator of this association. A finding in the broader self-medication literature is that individuals who use alcohol to cope with stress (i.e., self-medication) tend to have more alcohol-related problems than those who use alcohol for other reasons, even when controlling for overall level of alcohol use [22–24]. Thus, while other motivations for using alcohol such as drinking for reward-seeking/enhancement reasons or social facilitation reasons are predictive of heavy drinking, the use of alcohol or other substances to cope with stress and negative mood has been established as an important pathway to heavy drinking and alcohol-related problems that is distinct from other motivational pathways [25, 26]. Moreover, research shows that the use of alcohol

and other substances to cope is part of a broader maladaptive coping construct that includes other avoidant coping strategies such as behavioral and mental disengagement [27, 28]. Indeed, maladaptive coping broadly defined in this way has been found to mediate the link between stress (particularly traumatic stress) and alcohol and substance problems [29, 30].

The self-medication model is relevant for understanding relationships between HIV-related stigma and alcohol misuse given that experiencing stigma is perceived as highly stressful [31]. More specifically, individuals experiencing HIV-related stigma may rely on maladaptive strategies to cope with stigma-related stress, and this pattern of maladaptive coping, in turn, may increase the risk for heavy drinking and alcohol-related problems. Indeed, some studies show significant associations between HIV stigma and the use of general maladaptive coping strategies such as avoidance and denial [32, 33]. Further, people living with HIV often endorse using alcohol to cope as one of several motivations for alcohol use, and greater endorsement of using alcohol as a coping strategy correlates uniquely with alcohol problems above and beyond other motives for drinking [34, 35]. Moreover, a recent study by Wray et al. [13] found that drinking alcohol to cope mediated the relationship between perceived discrimination based on sexual orientation and alcohol problems in a sample of HIV-positive men who have sex with men, suggesting that maladaptive coping plays a role in the link between stigma and alcohol problems in this population. Importantly, this study found that the coping-related pathway from discrimination to alcohol problems was distinct from other motivational pathways such as social or sexual reasons for drinking. Yet, this study focused on discrimination based on sexual orientation, not HIV status per se. Also, this study was cross-sectional, which limits the ability to establish the temporal relationships among stigma, maladaptive coping, and alcohol outcomes. No studies to our knowledge have empirically examined maladaptive coping as a mediator of the prospective pathway from HIV-related stigma to alcohol use and related problems (i.e., alcohol use severity).

Furthermore, there is some evidence from prospective research that the relationships among stress, coping, and alcohol outcomes may be reciprocal or bidirectional in nature. For example, Read et al. [36] examined prospective associations among posttraumatic stress (PTSD) symptoms, maladaptive coping, and alcohol-related problems in a sample of trauma-exposed college students. They found that PTSD symptoms were prospectively related to increases in maladaptive coping over time, but also that greater reliance on maladaptive coping strategies predicted subsequent increases in PTSD symptoms. In that study, alcohol problems were found to indirectly predict

subsequent increases in PTSD symptoms, an association that was mediated by increased use of maladaptive coping strategies.

It is possible that similar bidirectional processes may operate with respect to the prospective associations among HIV-related stigma, coping, and alcohol use severity. On one hand, stigma may increase the use of maladaptive coping as individuals struggle to deal with stigma-related distress, which in turn may result in greater alcohol use and problems over time. On the other hand, greater alcohol use severity may also increase reliance on maladaptive coping by limiting motivation and resources to engage in more adaptive coping. In turn, an over-reliance on maladaptive coping strategies could contribute to increased stigma; for example, individuals who are avoidant and use substances to cope may be perceived negatively by others. Further, self-stigma could be heightened by maladaptive coping as individuals may experience guilt or shame about their inability to adjust or cope with their stress in more healthy ways. Thus, it is possible that the associations among HIV-related stigma, coping, and problem drinking are bidirectional, such that each contributes to the escalation of the other over time. However, these bidirectional associations have not been examined prospectively among people living with HIV.

This Study

The goal of this study is to provide the first prospective examination of the associations among HIV-related stigma, maladaptive coping, and alcohol use severity. We use four waves of data from the Ontario HIV Treatment Network Cohort study [37], a large, multisite, longitudinal study of patients receiving health care for HIV in Ontario, Canada. We examine both prospective bidirectional associations among the variables and prospective pathways between stigma and alcohol use severity mediated via maladaptive coping. Given prior evidence for bidirectional associations between stress and coping [36], we hypothesize that HIV-related stigma and maladaptive coping will each predict increases in one another over time. We also hypothesize that increased maladaptive coping will mediate the prospective association between HIV-related stigma and alcohol use severity, consistent with the self-medication hypothesis. Further, we explore the reverse mediational pathway, in which alcohol use severity predicts subsequent increases in maladaptive coping, in turn predicting greater HIV stigma.

Finally, previous analyses of data from this cohort study have found that baseline levels of HIV stigma were higher among heterosexual, female, and non-White participants [1, 38]. However, it is not currently clear whether these individuals may respond differently to HIV stigma and thus may cope in different ways. Accordingly, we also examine gender, sexual orientation, and race as

moderators of the prospective associations among HIV stigma, maladaptive coping, and alcohol use severity.

Method

Participants

Enrollment

Participants consisted of patients receiving medical care for HIV in Ontario, Canada, who were enrolled in the Ontario HIV Treatment Network Cohort Study. All procedures received ethical approval from the Human Subjects Review Committee at the University of Toronto and from the participating sites. A detailed overview of the recruitment methods for this study is provided by Rourke et al. [37]. Eligible patients at the participating sites were identified by a chart review and were invited to participate by a clinician or study interviewer during a routine clinic visit. All participants completed informed consent procedures before being enrolled in the study. Participants who received an extended version of the assessment battery (which included measures of HIV stigma and coping) were included in the present analysis, which consisted of all patients enrolled after October 2007 at one of the four sites in the Greater Toronto Area. The study used a rolling recruitment method, such that new participants were consented and enrolled on a continuous basis. The current analysis used data collected between October 2007 and January 2015. During this time period, a total of 1,956 participants were enrolled in the study. Participants completed a baseline assessment upon enrollment and were invited to complete follow-up assessments annually.

The majority of participants ($n = 1,520$; 78%) were enrolled in the study prior to the end of 2011 and thus were enrolled long enough to provide at least four waves of data (i.e., baseline plus three waves of annual follow-up data). So, we modeled four waves of data in the current analyses. We did not include participants enrolled after 2011 in the analyses as they were enrolled in the study for less than 4 years, and so it would not have been possible for them to provide data at all four waves. Therefore, the sample of interest for the current analyses included all participants enrolled in the study prior to 2011 ($N = 1,520$), all of who were included in our analyses regardless of missing data (through the use of full information maximum likelihood; see Data Analysis).

Sample characteristics

Participants ranged in age from 18 to 85 years old at the baseline assessment, with a mean age of 45.68 years ($SD = 10.32$). The average number of years since receiving a diagnosis of HIV was 11.32 ($SD = 7.21$, Range = 0–29). Of the 1,520 participants included in

the present analyses, 79% ($n = 1,201$) were men and 21% ($n = 312$) were women. Less than 1% reported a different gender identity ($n = 2$ transgendered; $n = 3$ two-spirited; $n = 2$ other). The men in the sample reported their sexual orientation as follows: 70% ($n = 839$) identified as gay, 21% ($n = 254$) identified as heterosexual/straight, 8% ($n = 100$) identified as bisexual, and less than 1% ($n = 8$) identified as other, uncertain, or declined to report sexual orientation. The women in the sample reported their sexual orientation as follows: 96% ($n = 299$) identified as heterosexual/straight, 2% ($n = 6$) identified as bisexual, 2% ($n = 6$) identified as lesbian or gay, and less than 1% ($n = 1$) declined to report sexual orientation.

The racial/ethnic makeup of the sample was 64% ($n = 969$) White, 24% ($n = 369$) Black or African, 6% ($n = 96$) South Asian or South East Asian, 5% ($n = 76$) Latin American, 3% ($n = 48$) Aboriginal, 1% ($n = 18$) Arab or West Asian, 7% ($n = 111$) reported their race as “Other,” and less than 1% ($n = 6$) did not report race/ethnicity (participants endorsing multiple racial/ethnic categories were counted in all applicable categories). Nearly half (44%; $n = 671$) of the sample reported that they were born outside of Canada. Fifty-five percent ($n = 843$) reported an annual household income less than CAD\$50,000, and the modal annual income range was CAD\$10,000–\$20,000 ($n = 345$).

Procedure

A detailed description of the study procedures has been published elsewhere [31]. Assessments were administered by an interviewer using a standardized computer-based questionnaire, from which the measures for the current analyses were derived. Participants completed follow-up assessments annually, which were scheduled around the time of the anniversary of their baseline assessment date. Assessments took approximately 2 hr to complete, and participants were compensated with CAD\$50 for completing each assessment.

Measures

HIV-related stigma

Participants completed a modified version of the HIV Stigma Scale [4], which included 16 items assessing experiences of stigma related to HIV status. The items assess four stigma domains, including enacted stigma (i.e., rejection from others based on HIV status), disclosure concerns (i.e., perceived need to conceal HIV status), negative self-image (i.e., internalized stigma, or guilt, shame, and low self-worth because of HIV status), and concern for public attitudes (i.e., concerns about others’ perceptions based on HIV status). Participants responded to items on a 5-point scale ranging from 1 = *Strongly Disagree* to

5 = *Strongly Agree*. Responses to all items were summed to obtain a total stigma score. The original measure has been shown to have good psychometric properties [4, 39]. Cronbach’s alphas for the HIV Stigma Scale in this sample were 0.80 at Wave 1 (W1), 0.82 at Wave 2 (W2), 0.81 at Wave 3 (W3), and 0.82 at Wave 4 (W4). Data from participants with partial missing data on scale items were excluded from the respective coefficient alpha estimates.

Maladaptive coping

Maladaptive coping was measured with items from the Brief COPE [27], a 28-item measure that assesses a variety of coping styles. We focused on the subset of 12 items that are thought to index maladaptive strategies for coping with distress, including self-distraction, denial, venting, substance use, behavioral disengagement, and self-blame. Participants responded on a 4-point scale from 0 = *I usually don’t do this at all* to 3 = *I usually do this a lot*. Items were summed to derive a total maladaptive coping index [40]. The Brief COPE has good reliability and validity [27, 41] and has been used to assess coping in a range of populations. Cronbach’s alphas for the maladaptive coping index were 0.79 at W1, 0.77 at W2, 0.79 at W3, and 0.75 at W4.

Alcohol use severity

Alcohol use severity was assessed with the 10-item Alcohol Use Disorders Identification Test (AUDIT; [42]). The AUDIT contains items assessing alcohol consumption and harms associated with alcohol use. While the AUDIT is widely used to identify at-risk drinking (commonly defined as AUDIT score ≥ 8), the AUDIT total score (sum of all items, range 0–40) can be used as a continuous measure of alcohol use severity [42]. We used the AUDIT total score in the present analyses. The AUDIT has been shown to have good psychometric properties in numerous studies [43, 44]. Cronbach’s alphas for the total AUDIT scale in the present sample were 0.83 at W1, 0.79 at W2, 0.78 at W3, and 0.80 at W4.

Data Analysis

Descriptive analyses

We first examined the mean levels of stigma, maladaptive coping, and alcohol use severity at each wave for descriptive purposes, as well as relationships among these variables at W1 and demographic characteristics such as age, years since HIV diagnosis, gender, sexual orientation, and race. Given the very small number of participants who did not identify as a man or woman, these participants were excluded from analyses of gender differences (but were included in the main analyses not involving gender). Further, given the relatively low

number of bisexual men in the sample ($n = 100$ at W1), we combined gay and bisexual men into one category that we labeled men who have sex with men (MSM) when examining differences based on sexual orientation. Also, nearly all women (96%) identified as heterosexual or straight, so we did not examine sexual orientation differences within women. Thus, our descriptive analyses of gender and sexual orientation differences consisted of comparisons among three groups: women, MSM, and heterosexual men. Similarly, in examining race differences, we compared participants identifying only as Caucasian ($n = 916$) with those endorsing a different racial category or multiple racial categories ($n = 591$).

Missing data

When a participant was missing responses to a few items on a scale (<20% of items), mean imputation was used to derive a scale score; when greater than 20% of items on a scale were missing, the score for that variable was set to missing. Complete follow-up data were provided by 48% ($n = 734$) of participants at W2, 38% ($n = 582$) at W3, and 31% ($n = 465$) at W4. Our analysis used full information maximum likelihood estimation (FIML), which reduces bias due to missing data in longitudinal research by including all available data and is appropriate even when there is substantial missing data [45, 46]. Participants who had complete observations on all three variables at all four waves ($n = 298$) did not differ from those missing data on one or more variables at any wave ($n = 1,222$) on W1 maladaptive coping or AUDIT scores ($p > .81$), but did report slightly less stigma at W1 ($M = 48.03$, $SD = 11.92$ vs. $M = 50.73$, $SD = 12.00$, $p < .001$). Further, women were more likely to have at least one missing observation than men (88% vs. 79%, $p < .001$).

To examine prospective bidirectional associations among stigma, maladaptive coping, and problematic drinking, we specified a cross-lagged panel model using Mplus version 7.4 [47]. Stigma, maladaptive coping, and AUDIT assessed at each of the four waves were included as observed variables in the model, and all variables at each wave were specified as predictors of all variables at the subsequent wave. Also, all cross-sectional covariances among the variables at each wave were freely estimated. Age and years since HIV diagnosis at W1 were entered as covariates in the model; all follow-up variables (W2–W4) were regressed on each of these covariates and all covariances among the covariates and the W1 variables were freely estimated. A robust estimator (MLR) was used to accommodate non-normality in the variable distributions. Model fit was considered acceptable if the root-mean-square error of approximation (RMSEA) < 0.08, the comparative fit index (CFI) > 0.90, and standardized root-mean-square residual (SRMR) < 0.08.

Model fit was considered good if RMSEA < 0.06, CFI > 0.90, and SRMR < 0.05 [48, 49].

To examine indirect pathways between stigma and alcohol problems mediated via maladaptive coping, we used bootstrapping to calculate bias-corrected 95% confidence intervals (CI) for the prospective indirect pathways mediated via coping. Given that four waves of data were modeled, four such pathways were examined (i.e., Stigma W1 to Coping W2 to AUDIT W3; Stigma W2 to Coping W3 to AUDIT W4; AUDIT W1 to Coping W2 to Stigma W3; AUDIT W2 to Coping W3 to Stigma W4). Indirect pathways were considered to be statistically significant when the 95% CI did not contain zero.

Finally, we also examined differences in the prospective, cross-lagged paths among stigma, coping, and alcohol use severity based on gender, race, and sexual orientation. Multiple-groups analyses were run to compare the fit of models in which all cross-lagged paths were constrained to be equal across gender (women vs. men), race (White vs. non-White), and sexual orientation (MSM vs. heterosexual) against the fit of the corresponding models in which all paths were allowed to freely vary across groups. Scaled chi-square difference tests were calculated to determine whether the cross-lagged paths were significantly different across groups.

Results

Descriptive Statistics

Table 1 shows the means and standard deviations for the stigma, maladaptive coping, and alcohol use severity variables at each wave based on gender and sexual orientation. As shown, at W1, 27% of the sample reported abstaining from alcohol and about 17% of the sample scored above the AUDIT cutoff (8+) for hazardous drinking. There was little change across the waves in mean levels of stigma, maladaptive coping, or alcohol use severity. At W1, the differences between women, heterosexual men, and MSM on stigma ratings were statistically significant, $F(2, 1,456) = 98.41$, $p < .001$, with Tukey's tests showing that MSM reported less stigma than heterosexual men, who reported less stigma than women. Maladaptive coping at W1 also differed significantly, $F(2, 1,486) = 12.12$, $p < .001$, with women and heterosexual men reporting greater use of maladaptive coping strategies than MSM. Also, AUDIT scores at W1 differed based on gender/sexual orientation, $F(2, 1,502) = 26.34$, $p < .001$, with both heterosexual men and MSM reporting greater alcohol use severity than women. Furthermore, race differences were observed on W1 stigma, coping, and AUDIT scores, with Caucasian participants reporting less stigma ($M = 47.48$, $SD = 11.55$ vs. $M = 54.52$, $SD = 11.56$), less maladaptive coping ($M = 9.54$, $SD = 5.61$ vs. $M = 11.12$,

Table 1 Descriptive Statistics for Stigma, Maladaptive Coping, Alcohol Use Variables Across the Four Waves by Gender and Sexual Orientation

			W1	W2	W3	W4
MSM	Stigma	<i>M</i>	47.09	46.43	45.60	45.77
		<i>SD</i>	11.59	11.88	11.55	11.55
	Maladaptive coping	<i>M</i>	9.55	9.81	9.38	9.55
		<i>SD</i>	5.84	5.35	5.52	5.37
	AUDIT	<i>M</i>	4.26	3.93	3.88	3.74
		<i>SD</i>	4.79	4.28	4.25	4.31
Heterosexual men	Hazardous drinkers	<i>n</i> (%)	165 (17.6)	66 (13.2)	54 (13.2)	49 (14.8)
	Abstainers	<i>n</i> (%)	179 (19.1)	89 (17.8)	73 (17.8)	69 (20.8)
	Stigma	<i>M</i>	53.24	52.51	50.74	51.10
		<i>SD</i>	10.95	11.97	11.14	11.34
	Maladaptive coping	<i>M</i>	11.07	10.08	10.05	10.72
		<i>SD</i>	7.00	6.16	6.46	5.71
	AUDIT	<i>M</i>	4.69	3.76	3.54	3.56
		<i>SD</i>	6.55	4.17	4.92	5.28
	Hazardous drinkers	<i>n</i> (%)	59 (23.3)	16 (18.0)	12 (16.2)	9 (14.8)
	Abstainers	<i>n</i> (%)	87 (34.3)	22 (24.7)	27 (36.5)	24 (39.3)
Women	Stigma	<i>M</i>	57.16	56.74	57.77	57.25
		<i>SD</i>	10.70	11.30	10.70	12.00
	Maladaptive coping	<i>M</i>	11.24	11.51	11.54	11.49
		<i>SD</i>	6.23	6.48	6.39	6.15
	AUDIT	<i>M</i>	2.08	2.02	2.04	1.91
		<i>SD</i>	4.02	4.01	3.33	3.60
	Hazardous drinkers	<i>n</i> (%)	24 (7.7)	11 (7.4)	6 (6.2)	6 (8)
	Abstainers	<i>n</i> (%)	140 (44.9)	73 (49.3)	46 (47.4)	33 (44.0)
Total	Stigma	<i>M</i>	50.18	49.22	48.34	48.35
		<i>SD</i>	12.03	12.51	12.26	12.39
	Maladaptive coping	<i>M</i>	10.15	10.19	9.84	10.01
		<i>SD</i>	6.17	5.73	5.84	5.57
	AUDIT	<i>M</i>	3.88	3.54	3.53	3.41
		<i>SD</i>	5.07	4.28	4.25	4.37
	Hazardous drinkers	<i>n</i> (%)	251 (16.5)	95 (12.8)	73 (12.5)	64 (13.6)
	Abstainers	<i>n</i> (%)	411 (27.0)	186 (25.0)	147 (25.1)	127 (26.9)

Possible range of scores on the measures were 16–80 for stigma, 0–36 for maladaptive coping, and 0–40 for AUDIT; hazardous drinkers defined as AUDIT score ≥ 8 . Percentages for hazardous drinkers and abstainers based on the total number of participants with valid AUDIT data at the relevant time point.

MSM men who have sex with men; *AUDIT* Alcohol Use Disorders Identification Test (index of alcohol use severity); *W1* Wave 1; *W2* Wave 2; *W3* Wave 3; *W4* Wave 4.

$SD = 6.86$), and greater alcohol use severity ($M = 4.41$, $SD = 5.23$ vs. $M = 3.04$, $SD = 4.69$) relative to non-Caucasian and mixed-race participants (all $p < .001$).

At W1, stigma was significantly correlated with maladaptive coping ($r = .38$, $p < .001$), and maladaptive coping was significantly correlated with alcohol use severity ($r = .18$, $p < .001$); however, stigma was not significantly correlated with alcohol use severity ($r = -.03$, $p = .209$). Also, age at W1 was negatively correlated with stigma, maladaptive coping, and alcohol use severity at W1 (all $p < .001$). Time since HIV diagnosis was negatively

correlated with stigma and maladaptive coping ($ps < .001$) but not alcohol use severity ($p = .383$).

Prospective Associations

The cross-lagged panel model provided adequate fit to the data, with fit indices approaching or surpassing conventional cutoffs for good fit, scaled χ^2 (27) = 191.88, $p < .001$, RMSEA = 0.063 (90% CI [0.055 to 0.072]), CFI = 0.948, SRMR = 0.037. As shown in Figure 1, there was a significant prospective association between

Fig. 1. Cross-lagged panel model of the prospective associations among HIV-related stigma, maladaptive coping strategies, and alcohol use severity. Assessments were spaced approximately 12 months apart. All paths from each variable at one wave to each variable at the next wave were included in the model; however, no direct paths between HIV-related stigma and alcohol use severity were statistically significant and so these paths were omitted from the figure for clarity. Standardized parameter estimates are shown with standard errors in parentheses. Moreover, only statistically significant covariance estimates are shown in the figure although all covariances were freely estimated among all variables within each wave. Also, all variables at Waves 2, 3, and 4 were regressed on Wave 1 age and time since HIV diagnosis, and all covariances among age, time since HIV diagnosis, and all Wave 1 variables were estimated in the model, but these covariates are not shown in the model for simplicity. Dashed arrows represent paths that were hypothesized but were not statistically significant. * $p < .050$; ** $p < .010$.

HIV-related stigma and maladaptive coping across all waves, such that greater levels of stigma consistently predicted increased maladaptive coping at the next wave. Further, there was consistent support for the reverse prospective association, with maladaptive coping predicting increased stigma across all waves. Thus, the prospective associations among stigma and maladaptive coping showed a clear bidirectional pattern.

Although not shown in Fig. 1, several paths from the covariates in the model (age and years since HIV diagnosis at W1) were statistically significant, including negative paths from age to W3 stigma and W4 alcohol use severity; and negative paths from years since HIV diagnosis to stigma at W2 and W4. These findings suggest that younger and more recently diagnosed participants tended to show greater relative increases in HIV-related stigma at these follow-ups. Of note, none of the direct prospective associations between HIV stigma and alcohol use severity were statistically significant, so these are omitted from Fig. 1.

Prospective Mediation Analyses

Table 2 presents the point estimates and 95% CIs for the prospective indirect associations between HIV-related stigma and alcohol use severity mediated by maladaptive coping. Interestingly, we observed some support for this indirect pathway in both directions. Specifically, the indirect pathway from stigma at W2 to maladaptive coping at W3 to alcohol use severity at W4 was statistically

significant, supporting the hypothesis that maladaptive coping mediates the prospective relationship between HIV-related stigma and alcohol use severity. On the other hand, the indirect pathway from alcohol use severity at W1 to maladaptive coping at W2 to stigma at W3 was also statistically significant, indicating that maladaptive coping also mediates the reverse prospective association (i.e., between alcohol use severity and subsequent stigma). However, these indirect pathways did not replicate across all waves—the 95% CI for the indirect path from stigma at W1 to maladaptive coping at W2 to alcohol use severity at W3 contained zero, as did the indirect path from alcohol use severity at W2 to maladaptive coping at W3 to stigma at W4.

Gender and Sexual Orientation Differences

Finally, we also examined differences in the prospective associations among HIV-related stigma, maladaptive coping, and alcohol use severity based on gender, sexual orientation, and race using multiple-groups analyses. When gender was specified as the grouping variable, the fit of the model was not significantly impacted by constraining the cross-lagged paths to be equal across genders relative to a model in which all paths were allowed to freely vary across genders, Δ scaled χ^2 (18) = 25.07, $p = .123$. This suggests that there were no significant differences in these paths across genders. Similarly, when sexual orientation was specified as the grouping variable, constraining the cross-lagged paths to be equal across

Table 2 Estimates of Prospective Indirect Associations Between HIV-Related Stigma and Problem Drinking Severity Mediated via Maladaptive Coping

Predictor	Mediator	Outcome	Standardized estimate	95% CI ^a
HIV stigma (W1)	Maladaptive coping (W2)	Alcohol use severity (W3)	0.005	[−0.003 to 0.018]
HIV stigma (W2)	Maladaptive coping (W3)	Alcohol use severity (W4)	0.008*	[0.002 to 0.020]
Alcohol use severity (W1)	Maladaptive coping (W2)	HIV stigma (W3)	0.006*	[0.001 to 0.017]
Alcohol use severity (W2)	Maladaptive coping (W3)	HIV stigma (W4)	−0.001	[−0.009 to 0.003]

W1 Wave 1; W2 Wave 2; W3 Wave 3; W4 Wave 4.

^aBased on 10,000 bootstrapped samples.

* $p < .05$, as indicated by a 95% CI that does not contain zero.

groups did not lead to decrements in model fit, Δ scaled χ^2 (18) = 7.73, $p = .982$, suggesting that there were no significant differences in the paths between MSM and non-MSM participants. Finally, when race was specified as the grouping variable, constraining the paths to be equal for White and non-White participants also did not result in a significant decrement in model fit, Δ scaled χ^2 (18) = 16.72, $p = .542$.

Given that gender, sexual orientation, and race were all associated with some of the model variables at W1, we conducted a supplementary analysis to determine whether their inclusion as covariates in the model had any impact on the model estimates. To do so, we included dummy coded variables (MSM vs. heterosexual men; MSM vs. women; Caucasian vs. non-Caucasian) as covariates (along with age and years since HIV diagnosis) and regressed all variables at W2, W3, and W4 on all of these covariates. Only two of the paths from these covariates to the follow-up variables were significant (i.e., relative to MSM, women reported increased stigma at W2, $\beta = .06$, $p = .040$, and heterosexual men reported increased stigma at W3, $\beta = .09$, $p = .004$). The general pattern of the model results was not different when these additional covariates were included; thus, they were excluded from the final model shown in Fig. 1.

Discussion

This study extends previous research on the associations among HIV-related stigma, maladaptive coping, and alcohol use by providing the first examination to our knowledge of prospective bidirectional associations and mediated pathways. Informed by a self-medication perspective, we hypothesized that the experience of HIV-related stigma may lead individuals to engage in a variety of maladaptive strategies to cope with stigma-related distress, including self-medicating with alcohol or other substances as well as other avoidant coping strategies such as behavioral and mental disengagement. This reliance on maladaptive coping strategies, in turn, was

expected to lead to greater severity of alcohol use (i.e., increased alcohol use and related harms as measured by the AUDIT). Our prospective data provided partial support for this hypothesis, as we observed a small but statistically significant indirect association from HIV-related stigma at W2 to increased alcohol use severity at W4 mediated by increased maladaptive coping at W3. This finding is consistent with previous studies demonstrating that maladaptive coping mediates the associations of stigma and discrimination with problematic drinking behavior [13, 50] although this study is the first to provide a fully longitudinal examination of this pathway and to focus on HIV stigma specifically. Thus, findings suggest that maladaptive coping may be one mechanism linking HIV stigma with alcohol outcomes.

However, this same mediated pathway was not statistically significant when examined from W1 to W3; while the prospective association between stigma and subsequent maladaptive coping appears to be robust (replicating across all waves in our analysis), only one of the three prospective associations between maladaptive coping and subsequent alcohol use severity was statistically significant. Thus, maladaptive coping was not as powerful of a predictor of alcohol use severity as expected. One characteristic of the data that may help to explain this pattern of findings is that alcohol use severity was highly stable from one wave to the next (i.e., β s approximately .80). Given that previous AUDIT score was a strong predictor of subsequent AUDIT score, there was relatively little remaining variance in AUDIT scores to be predicted by maladaptive coping. Further, although a non-trivial proportion of participants (12%–17%) exceeded the threshold for hazardous drinking (i.e., AUDIT ≥ 8) at each wave, average AUDIT scores in our sample were relatively low. Perhaps a somewhat restricted range in AUDIT scores led to attenuation in associations with maladaptive coping. Still, despite some inconsistency across waves, it is noteworthy that we observed some evidence for a fully prospective indirect pathway from HIV-related stigma to alcohol use severity mediated by

maladaptive coping despite the long intervals between waves and strong autoregressivity in alcohol use severity. These findings suggest that a self-medication perspective may be important for understanding the far-reaching impact that HIV-related stigma may have on people living with HIV, although future research will be necessary to clarify the consistency of these prospective associations over time.

Furthermore, based on some recent prospective data in the self-medication literature [31], we hypothesized that there may be bidirectional relationships among stigma, coping, and alcohol use severity. Indeed, our results provided consistent evidence for reciprocal associations between HIV-related stigma and maladaptive coping, with each prospectively predicting the other across all waves of the analysis, albeit with modest effect sizes. These findings indicate that not only does experiencing HIV stigma predict the use of maladaptive coping strategies (consistent with self-medication), but that greater use of maladaptive coping strategies, in turn, may contribute to increased stigma. One explanation for this finding is that individuals who more often cope by disengaging or relying on substances may be perceived more negatively by others and by themselves, which might increase risk for further stigmatization and/or exacerbate self-stigma.

Furthermore, there was a significant indirect association between alcohol use severity at W1 and increased stigma at W3 mediated by increased maladaptive coping at W2. This finding is consistent with the results of a recent longitudinal analysis of similar constructs, which found that alcohol-related problems among trauma-exposed college students predicted increased maladaptive coping, which in turn predicted increased stress-related symptoms (specifically, symptoms of PTSD) [36]. Again, we must use caution in interpreting the present findings given that the links in this prospective mediated pathway did not replicate across all waves in our model. Still, the findings point to the importance of future longitudinal research that further explores bidirectional processes in the mediated pathways between stigma, coping, and alcohol outcomes among people living with HIV.

In addition to providing a much-needed examination of prospective associations, a significant strength of this study is that these associations were examined in a large, diverse sample of people living with HIV, which bolsters the generalizability of the results. Notably, although we observed differences in baseline levels of stigma, coping, and alcohol use severity based on gender, sexual orientation, and race, these demographic variables did not moderate the prospective paths in our model. This suggests that the associations among HIV-related stigma, maladaptive coping, and alcohol use severity observed in this study may generalize to people living with HIV from diverse backgrounds. These findings underscore

the potentially broad impact that interventions targeting stigma and coping could have for this population.

There are some limitations to this study that must be considered. Foremost among these is the potential bias introduced by missing data in this study. However, missing data is a ubiquitous problem in longitudinal research, and when state-of-the-art analytic techniques such as those used in the present analyses are applied, we can have some confidence that bias due to missing data is minimized even when there is substantial missing data [45, 46].

Moreover, it is important to note that the statistically significant cross-lagged associations that we observed had small effect sizes (β s = .05–.14), and therefore, we must be careful not to overstate the clinical significance of the findings. Also, while the diverse sample drawn from multiple clinical settings was a strength of the study, there was likely more error variance in the data than would be observed in a more controlled study with a more homogeneous sample; this could have contributed to the small effect sizes and inconsistency in some findings across waves. In this context, even small magnitude associations may be of theoretical and practical importance given that the prospective associations were detected over long follow-up intervals and despite controlling for strong autocorrelations in the data. A related point is that average AUDIT scores were relatively low, which could limit the clinical significance of the alcohol use severity observed in this sample, although it is important to note that 12%–17% of the participants in the sample scored above the AUDIT threshold for hazardous alcohol use across the four waves. Also, endorsement of HIV stigma and maladaptive coping items was low to moderate relative to the maximum possible score that could be obtained on these scales. Still, means for stigma and maladaptive coping were consistent with those that have been observed in other studies of people living with HIV that have used variants of these measures [39, 51, 52].

Finally, in this study, we focused on a relatively limited scope of variables that were most relevant to our goal of examining prospective pathways informed by self-medication theory. However, it is important to note that other relevant variables such as depression, social support, drinking motives, and other substance use may have significant roles in the pathways examined here [53]. Also, an important future direction will be to extend our model to include other health outcomes such as physical symptoms and medication adherence. Further, subsequent studies should examine the extent to which the coping strategies included here may serve adaptive functions for some individuals depending on the nature of the stressor. Also, other adaptive forms of coping should be explored.

In summary, this study provides a prospective examination of the associations among HIV-related stigma,

maladaptive coping, and alcohol use severity. Our finding that HIV stigma and maladaptive coping showed consistent bidirectional associations over time underscores the importance of interventions that address stigma and coping among people living with HIV, particularly those that may help to break the reciprocal cycle of stigma–maladaptive coping associations. Further, our results indicate that maladaptive coping may be a mechanism linking HIV stigma to subsequent alcohol use severity and vice versa, although future research is needed given the inconsistency observed in these prospective pathways. If these prospective associations are replicated and clarified in future studies, an important next step will be to examine whether interventions targeting maladaptive coping strategies may be useful for reducing the risk of hazardous alcohol outcomes associated with experiencing HIV-related stigma.

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Compliance with Ethical Standards

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards Authors Jeffrey D. Wardell, Paul A. Shuper, Sean B. Rourke, and Christian S. Hendershot declare that they have no conflict of interest. Informed consent was obtained from all individual participants included in the study.

Ethical Approval All procedures, including the informed consent process, were conducted in accordance with the ethical standards of the applicable institutional research ethics boards and with the Helsinki Declaration of 1975, as revised in 2000.

References

- Loutfy MR, Logie CH, Zhang Y, et al. Gender and ethnicity differences in HIV-related stigma experienced by people living with HIV in Ontario, Canada. *PLoS One*. 2012; 7(12): e48168.
- Herek GM, Garnets LS. Sexual orientation and mental health. *Annu Rev Clin Psychol*. 2007; 3(1): 353–375.
- UNAIDS. On the fast-track to end AIDS by 2030: focus on location and population. Geneva: UNAIDS; 2015.
- Berger BE, Ferrans CE, Lashley FR. Measuring stigma in people with HIV: Psychometric assessment of the HIV stigma scale. *Res Nurs Health*. 2001; 24(6): 518–529.
- Rintamaki LS, Davis TC, Skripkauskas S, Bennett CL, Wolf MS. Social stigma concerns and HIV medication adherence. *AIDS Patient Care STDS*. 2006; 20(5): 359–368.
- Katz IT, Ryu AE, Onuegbu AG, et al. Impact of HIV-related stigma on treatment adherence: Systematic review and meta-synthesis. *J Int AIDS Soc*. 2013; 16(3 suppl 2): 18640.
- Kinsler JJ, Wong MD, Sayles JN, Davis C, Cunningham WE. The effect of perceived stigma from a health care provider on access to care among a low-income HIV-positive population. *AIDS Patient Care STDS*. 2007; 21(8): 584–592.
- Sayles JN, Wong MD, Kinsler JJ, Martins D, Cunningham WE. The association of stigma with self-reported access to medical care and antiretroviral therapy adherence in persons living with HIV/AIDS. *J Gen Intern Med*. 2009; 24(10): 1101–1108.
- Logie C, Gadalla TM. Meta-analysis of health and demographic correlates of stigma towards people living with HIV. *AIDS Care*. 2009; 21(6): 742–753.
- Rueda S, Gibson K, Rourke SB, Bekele T, Gardner S, Cairney J; OHTN Cohort Study Team. Mastery moderates the negative effect of stigma on depressive symptoms in people living with HIV. *AIDS Behav*. 2012; 16(3): 690–699.
- Vanable PA, Carey MP, Blair DC, Littlewood RA. Impact of HIV-related stigma on health behaviors and psychological adjustment among HIV-positive men and women. *AIDS Behav*. 2006; 10(5): 473–482.
- Simbayi LC, Kalichman S, Strebel A, Cloete A, Henda N, Mqeketo A. Internalized stigma, discrimination, and depression among men and women living with HIV/AIDS in Cape Town, South Africa. *Soc Sci Med*. 2007; 64(9): 1823–1831.
- Wray TB, Pantalone DW, Kahler CW, Monti PM, Mayer KH. The role of discrimination in alcohol-related problems in samples of heavy drinking HIV-negative and positive men who have sex with men (MSM). *Drug Alcohol Depend*. 2016; 166: 226–234.
- Wright K, Naar-King S, Lam P, Templin T, Frey M. Stigma scale revised: Reliability and validity of a brief measure of stigma for HIV+ youth. *J Adolesc Health*. 2007; 40(1): 96–98.
- Kahler CW, Wray TB, Pantalone DW, et al. Daily associations between alcohol use and unprotected anal sex among heavy drinking HIV-positive men who have sex with men. *AIDS Behav*. 2015; 19(3): 422–430.
- Scott-Sheldon LA, Walstrom P, Carey KB, Johnson BT, Carey MP; MASH Research Team. Alcohol use and sexual risk behaviors among individuals infected with HIV: A systematic review and meta-analysis 2012 to early 2013. *Curr HIV/AIDS Rep*. 2013; 10(4): 314–323.

17. Scott-Sheldon LA, Walstrom P, Carey KB, Johnson BT, Carey MP; MASH Research Team. Alcohol use and sexual risk behaviors among individuals infected with HIV: A systematic review and meta-analysis 2012 to early 2013. *Curr HIV/AIDS Rep.* 2013; 10(4): 314–323.
18. Hendershot CS, Stoner SA, Pantalone DW, Simoni JM. Alcohol use and antiretroviral adherence: Review and meta-analysis. *J Acquir Immune Defic Syndr.* 2009; 52(2): 180–202.
19. Fairbairn NS, Walley AY, Cheng DM, et al. Mortality in HIV-infected alcohol and drug users in St. Petersburg, Russia. *PLoS One.* 2016; 11(11): e0166539.
20. Kahler CW, Liu T, Cioe PA, et al. Direct and indirect effects of heavy alcohol use on clinical outcomes in a longitudinal study of HIV patients on ART. *AIDS Behav.* 2017; 21(7): 1825–1835.
21. Canan CE, Lau B, McCaul ME, Keruly J, Moore RD, Chander G. Effect of alcohol consumption on all-cause and liver-related mortality among HIV-infected individuals. *HIV Med.* 2017; 18(5): 332–341.
22. Cooper ML, Frone MR, Russell M, Mudar P. Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *J Pers Soc Psychol.* 1995; 69(5): 990–1005.
23. Corbin WR, Farmer NM, Nolen-Hoekesma S. Relations among stress, coping strategies, coping motives, alcohol consumption and related problems: A mediated moderation model. *Addict Behav.* 2013; 38(4): 1912–1919.
24. Stewart SH, Morris E, Mellings T, Komar J. Relations of social anxiety variables to drinking motives, drinking quantity and frequency, and alcohol-related problems in undergraduates. *J Ment Health.* 2006; 15(6): 671–682.
25. Kuntsche E, Knibbe R, Gmel G, Engels R. Why do young people drink? A review of drinking motives. *Clin Psychol Rev.* 2005; 25(7): 841–861.
26. Merrill JE, Wardell JD, Read JP. Drinking motives in the prospective prediction of unique alcohol-related consequences in college students. *J Stud Alcohol Drugs.* 2014; 75(1): 93–102.
27. Carver CS. You want to measure coping but your protocol's too long: Consider the brief COPE. *Int J Behav Med.* 1997; 4(1): 92–100.
28. Snell DL, Siegert RJ, Hay-Smith EJ, Surgenor LJ. Factor structure of the brief COPE in people with mild traumatic brain injury. *J Head Trauma Rehabil.* 2011; 26(6): 468–477.
29. Ouimette PC, Finney JW, Moos RH. Two-year posttreatment functioning and coping of substance abuse patients with posttraumatic stress disorder. *Psychol Addict Behav.* 1999; 13: 105–114.
30. Flanagan JC, Jaquier V, Overstreet N, Swan SC, Sullivan TP. The mediating role of avoidance coping between intimate partner violence (IPV) victimization, mental health, and substance abuse among women experiencing bidirectional IPV. *Psychiatry Res.* 2014; 220(1–2): 391–396.
31. Hatzenbuehler ML. How does sexual minority stigma “get under the skin”? A psychological mediation framework. *Psychol Bull.* 2009; 135(5): 707–730.
32. Courtenay-Quirk C, Wolitski RJ, Parsons JT, Gómez CA; Seropositive Urban Men's Study Team. Is HIV/AIDS stigma dividing the gay community? Perceptions of HIV-positive men who have sex with men. *AIDS Educ Prev.* 2006; 18(1): 56–67.
33. Lyimo RA, Stutterheim SE, Hospers HJ, de Glee T, van der Ven A, de Bruin M. Stigma, disclosure, coping, and medication adherence among people living with HIV/AIDS in Northern Tanzania. *AIDS Patient Care STDS.* 2014; 28(2): 98–105.
34. Kahler CW, Wray TB, Pantalone DW, et al. Assessing sexual motives for drinking alcohol among HIV-positive men who have sex with men. *Psychol Addict Behav.* 2015; 29(1): 247–253.
35. Elliott JC, Aharonovich E, O'Leary A, Wainberg M, Hasin DS. Drinking motives among HIV primary care patients. *AIDS Behav.* 2014; 18(7): 1315–1323.
36. Read JP, Griffin MJ, Wardell JD, Ouimette P. Coping, PTSD symptoms, and alcohol involvement in trauma-exposed college students in the first three years of college. *Psychol Addict Behav.* 2014; 28(4): 1052–1064.
37. Rourke SB, Gardner S, Burchell AN, et al. Cohort profile: The Ontario HIV Treatment Network Cohort Study (OCS). *Int J Epidemiol.* 2013; 42(2): 402–411.
38. Emlet CA, Brennan DJ, Brennenstuhl S, Rueda S, Hart TA, Rourke SB; OHTN Cohort Study Team. Protective and risk factors associated with stigma in a population of older adults living with HIV in Ontario, Canada. *AIDS Care.* 2013; 25(10): 1330–1339.
39. Bunn JP, Solomon SE, Miller C, Forehand R. Measurement of stigma in people with HIV: A reexamination of the HIV Stigma Scale. *AIDS Educ Prev.* 2007; 19(3): 198–208.
40. Meyer B. Coping with severe mental illness: Relations of the Brief COPE with symptoms, functioning, and well-being. *J Psychopathol Behav.* 2001; 23(4): 265–277.
41. Amoyal NR, Mason ST, Gould NF, et al. Measuring coping behavior in patients with major burn injuries: A psychometric evaluation of the BCOPE. *J Burn Care Res.* 2011; 32(3): 392–398.
42. Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the Alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption—II. *Addiction.* 1993; 88(6): 791–804.
43. Reinert DF, Allen JP. The alcohol use disorders identification test: An update of research findings. *Alcohol Clin Exp Res.* 2007; 31(2): 185–199.
44. Reinert DF, Allen JP. The Alcohol use disorders identification test (AUDIT): A review of recent research. *Alcohol Clin Exp Res.* 2002; 26(2): 272–279.
45. Schafer JL, Graham JW. Missing data: Our view of the state of the art. *Psychol Methods.* 2002; 7(2): 147–177.
46. Graham JW. Missing data analysis: Making it work in the real world. *Annu Rev Psychol.* 2009; 60(1): 549–576.
47. Muthén LK, Muthén BO. *Mplus User's Guide*. 7th ed. Los Angeles, CA: Muthén & Muthén; 2012.
48. Hu L-t, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct Equ Modeling.* 1999; 6: 1–55.
49. Browne MW, Cudeck R. Alternative ways of assessing model fit. In: Bollen KA, Long JS, eds. *Testing Structural Equation Models*. Newbury Park, CA: Sage; 1993: 136–162.
50. Hatzenbuehler ML, Corbin WR, Fromme K. Discrimination and alcohol-related problems among college students: A prospective examination of mediating effects. *Drug Alcohol Depend.* 2011; 115(3): 213–220.
51. Pence BW, Thielman NM, Whetten K, Ostermann J, Kumar V, Mugavero MJ. Coping strategies and patterns of alcohol and drug use among HIV-infected patients in the United States Southeast. *AIDS Patient Care STDS.* 2008; 22(11): 869–877.
52. Holzemer WL, Human S, Arudo J, et al. Exploring HIV stigma and quality of life for persons living with HIV infection. *J Assoc Nurses AIDS Care.* 2009; 20(3): 161–168.
53. Williams EC, Hahn JA, Saitz R, Bryant K, Lira MC, Samet JH. Alcohol use and Human Immunodeficiency Virus (HIV) infection: Current knowledge, implications, and future directions. *Alcohol Clin Exp Res.* 2016; 40(10): 2056–2072.