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## STUCK IN THE MIDDLE: LONGITUDINAL HIV-RELATED HEALTH DISPARITIES AMONG MEN WHO HAVE SEX WITH MEN AND WOMEN (MSMW)

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### Abstract

**INTRODUCTION**—Men who have sex with men and women (MSMW) have been shown in cross-sectional studies to suffer HIV-related health disparities above and beyond those found among men who have sex with men only (MSMO). We conducted a secondary data analysis over a 7-year time frame of participants in the Multicenter AIDS Cohort Study (MACS), a longstanding prospective cohort study, to examine whether MSMW had persistently higher rates of depression symptoms, polydrug use, and (among HIV positive MSM) HIV viral load levels compared with MSMO.

**METHODS**—Men were behaviorally defined as bisexual if they reported sexual activity with at least one male and one female partner between study waves 38–50. We used generalized mixed modeling with repeated measures to test differences in CES-D score, polydrug use, and viral load

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between sexually active MSMO (n=111) and MSMW (n=1514), adjusting for age, income, and race/ethnicity, and recent seroconversion.

**RESULTS**—MSMW were significantly more likely than MSMO to have higher CES-D scores, polydrug use, and viral load levels (all p-values <.01). Outcome trajectories did not differ significantly over time between these groups. Black and Hispanic HIV positive MSMW had higher viral load levels relative to White HIV positive MSMW (p-values<.01).

**DISCUSSION**—Compared with MSMO, MSMW in the MACS suffer from profound and persistent HIV-related health disparities across biological, behavioral, and psychosocial domains. Further qualitative and quantitative research contextualizing the pathways underlying these disparities is recommended for intervention development targeting MSMW at risk for HIV acquisition and transmission.

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## INTRODUCTION

Men who have sex with men (MSM) account for 61% of new HIV cases in the United States, with annual incidence rates estimated at 2.39%, leading to HIV prevalence rates approaching 40% by the time one reaches age 40<sup>12</sup>. Syndemics Theory posits that MSM suffer a set of psychosocial health disparities, such as depression and substance use, which are influenced by the stress of enduring sexuality-related marginalization and violence as synergistic epidemics that work together to increase HIV risk<sup>3,4</sup>. To date, this theory has pooled two potentially distinct groups of MSM: men who have sex with men only (MSMO), and men who have sex with both men and women (MSMW). A newly emergent, largely cross-sectional, formative literature is beginning to indicate that men who identify and/or behave bisexually endure psychosocial health disparities and HIV risk behavior in ways distinct from other MSM: they may be more likely to be depressed and/or suicidal<sup>5-9</sup>; to engage in substance use and abuse<sup>9-13</sup>; to suffer violence victimization<sup>14-16</sup>; and to report higher levels of internalized homophobia<sup>17</sup>. These within-MSM differences suggest that MSMW may experience syndemics at a higher rate than MSMO and that, if syndemics function as drivers of HIV acquisition and transmission risk among MSM, they may drive risk among MSMW as well<sup>18</sup>. Little research has been conducted on hypothetical mechanisms of syndemic production among MSMW. However, a growing body of descriptive research demonstrates that bisexuals report low levels of gay/lesbian community attachment; their access to minority community strengths may be impeded by high internalized homophobia, feelings of perceived and endured biphobia and cultural invisibility, and disconnectedness from traditional minority social support structures<sup>19-22</sup>.

MSMW have been found to be less likely to be HIV positive aware than MSMO<sup>12</sup>; their comparatively lower uptake of HIV testing<sup>20</sup> has been linked to higher rates of internalized homonegativity<sup>23</sup>, and they are less likely to disclose their same-gender sexual behaviors to health care providers<sup>24</sup>. Although several studies report on psychosocial health risks among HIV positive MSMW<sup>9,11,17,25-34</sup>, we are not aware of any research that has attempted to differentiate the trajectories of viral load suppression among HIV positive MSMW and MSMO. Given that MSMO and MSMW are conflated in one risk group (MSM) in CDC-supported HIV care data collection and reporting mechanisms, these data do not exist on a national level. Though several studies have conducted longitudinal analyses of bisexual

behavior among men and/or women<sup>35-38</sup>, we are not aware of previous research that reports on HIV-related health risks among bisexually behaving people over time.

This study will explore the psychosocial factors, including depression and substance use, related to longitudinal trajectories of viral load suppression among HIV positive MSMW and MSMO. To address these research questions we conducted a secondary data analysis of behavioral, psychosocial, and biomedical data from participants in the Multicenter AIDS Cohort Study (MACS).

## METHODS

### Sample

The MACS is a longstanding observational cohort study of the natural and treated history of HIV/AIDS among gay and bisexual men in the United States. Beginning in 1984, the MACS has purposively recruited successive cohorts in four cities: Baltimore, Pittsburgh, Chicago, and Los Angeles. Study design and targeted recruitment strategies have been described elsewhere<sup>39-41</sup>. Participants return to MACS sites every six months for a battery of medical and behavioral surveys, physical and neuropsychological examinations, and specimen collection. In 2009-2010 (waves 49 and 50), participants were offered a supplemental survey (the Methamphetamine Sub-Study) about characteristics theorized to be correlated with heightened HIV-related health risks over the life course<sup>4,42</sup>. This analysis considered biomedical, behavioral, psychosocial measures collected from a subsample of men who reported any sex with other men over a period of seven years (waves 38 to 50), under the auspices of the Methamphetamine Sub-Study. A total of 1834 men visited a MACS site at waves 49 and/or 50 and were offered a Methamphetamine Sub-study survey. Over waves 38 to 50, 1 man did not complete any sexual behavior information; 3 men reported highly outlying numbers of sexual partners (999) at a given wave; 95 men reported having no sexual intercourse; and 110 men reported having sexual intercourse only with women. These men were removed from the analysis. Of the remaining 1625 men, 111 (6.8%) reported having sex with at least one man and at least one woman over the 6.5 year period; and 1514 reported having sex only with men. These men were included in longitudinal analyses of HIV-related risk.

### Measures

**Sociodemographics**—Sociodemographic information was obtained from the MACS study database. Age was computed by subtracting the participant's date of birth from date of supplementary survey administration. Race/ethnicity was based on self-report data collected during baseline visits. Educational status and income were self-reported at the date of the supplementary survey administration. Dichotomous variables were created to distinguish white from racial/ethnic minority participants; participants with annual incomes below < \$20,000; and participants under 40 years old at wave 50, which served as the anchor date for age, racial/ethnic minority status, and income (with wave 49 serving as a supplemental anchor date for non-attendees at wave 50).

**HIV viral load**—HIV RNA was measured using the COBAS Ultrasensitive Amplicor HIV-1 monitor assay (Roche Molecular Systems, Branchburg, NJ), sensitive to 50 copies HIV RNA/mL. Assessed using standard laboratory procedures. Values were  $\log_{10}$  transformed for analysis. Additionally, we created dichotomous variables to measure undetectable viral load; and potentially efficient transmitters (viral loads >1500 copies/ml<sup>3</sup>) among HIV positive MSM<sup>43</sup>.

**HIV positive and seroconverter status**—ELISAs with confirmatory Western blot tests were performed on all participants initially and at every semi-annual visit. Seroconversion was defined as a dichotomous outcome between the dates of the last HIV negative visit and the first HIV seropositive visit. Recent seroconversion was used as a covariate for the first three waves of viral load values obtained post-seroconversion.

**Defintion of MSMW/MSMO**—MSMW was defined as self-report of any sexual intercourse (anal, vaginal, or oral) with at least one male and at least one female, and MSMO as any sexual intercourse (anal or oral) with at least one male and no females, during the follow-up period.

**Polydrug use**—The use of marijuana, powder cocaine, crack cocaine, heroin, ecstasy, methamphetamines, and other street or club drugs was collected at each study visit using audio computer-assisted self interviewing (ACASI). A dichotomous variable was created to describe the use two or more of these recreational drugs at least daily, weekly, or monthly.

**Depression**—Severity of depression symptoms was measured using the Center for Epidemiologic Study of Depression<sup>44</sup>. A dichotomous variable was created to assess whether participants had a score of 16 or higher, a cut-off point shown to be associated with moderate or higher levels of depression symptoms. Raw CES-D scores were also used as continuous variables.

### Statistical analysis

Bivariate analyses of sociodemographics were performed by MSMW and MSMO groups based on sexual behavior responses over waves 38-50. Sociodemographics of MSMO and MSMW at wave 50 were then compared using chi-square tests with SPSS v.20. We used repeated measures mixed modeling with appropriate (i.e. gamma; binary) distributions and covariance matrices based on each model's variance components (PROC GLIMMIX in SAS 9.3) to test for differences between MSMW and MSMO. We conducted similar analyses within MSMW to identify demographic groups of bisexual men most at risk for depressive symptomology, polydrug use, and viral load levels (among HIV positive MSMW). We controlled for racial/ethnic minority status, age less than 40 years, and annual income less than \$20,000; choice of covariates was based on previous research<sup>18</sup> and findings from bivariate analyses. For analyses of viral load among HIV positive MSM, recent seroconversion was also included as a covariate. For analyses of CES-D among MSM, HIV status was also included as a covariate<sup>45</sup>.

## RESULTS

### Sociodemographics

In bivariate chi-square analyses, MSMW were significantly more likely at wave 50 than MSMO to be of minority race/ethnicity; to be recruited from Chicago; to be in the new cohort; to be 39 years old or younger; to report earning less than \$20,000 per year; and to have attained a high school degree or less (see Table 1).

### Viral load

There was a significant and positive association between being of racial/ethnic minority status, low income, younger age and recent seroconversion (all  $p$ -values  $<0.0001$ ) with increased HIV viral loads among both HIV positive MSMW and MSMO. HIV positive MSMW had significantly higher mean viral load levels across waves (364.08 copies/mL vs. 234.15 copies/mL;  $p<0.01$ ) although there was no significant difference in trajectory of viral load between MSMW and MSMO (see Tables 2a and 2b). As a result HIV positive MSMW were also 1.3-fold more likely to be potentially efficient HIV transmitters than MSMO overall ( $p<0.01$ ; AOR=1.3, 95% CI: 1.1, 1.6), though trajectories did not significantly differ ( $p=.99$ ) (see Table 2a). HIV positive MSMW were 1.4-fold more likely to have detectable viral load than HIV positive MSMO ( $p<0.01$ ; AOR=1.4, 95% CI: 1.1, 1.7). There was no significant difference in trajectory of viral load suppression between MSMW and MSMO ( $p=.97$ ) (see Table 2a). Table 4 shows that, among HIV positive MSMW, higher proportions of Black MSMW (73.6% vs. 20.5%;  $p<0.0001$ ) and Hispanic MSMW (53.1% vs. 20.5%;  $p<0.01$ ) had detectable viral load levels at a given observation relative to White MSMW. MSMW of lower income (72.0% vs. 22.8%;  $p<0.0001$ ) and younger age (85.7% vs. 43.3%;  $p<0.0001$ ) were also more likely to have detectable levels of HIV. Higher mean viral loads were found, relative to White MSMW, among Black MSMW (1381.97 copies/mL vs. 122.74 copies/mL;  $p<0.0001$ ) and Hispanic MSMW (502.81 copies/mL vs. 122.74 copies/mL;  $p<0.001$ ). MSMW of lower income (1364.27 copies/mL vs. 106.41 copies/mL;  $p<0.0001$ ) and age under 40 (2407.69 copies/mL vs. 376.88 copies/mL;  $p<0.0001$ ) had higher mean viral loads than their higher income and older peers, respectively.

### Substance use

MSMW were 2.8-fold more likely to report polydrug use than MSMO across waves 38-50 (AOR=2.8; 95% CI: 2.2, 3.5) (Table 2a). Trajectories of polydrug use between MSMW and MSMO were not significantly different over time ( $p=.99$ ). Black MSMW reported higher likelihood of polydrug use relative to White MSMW (16.1% vs. 3.1%;  $p<0.0001$ ). MSMW of lower incomes (13.4% vs. 3.2%;  $p<0.0001$ ) and HIV negative MSMW (11.2% vs. 5.0%;  $p<0.0001$ ) also reported higher rates of polydrug use compared to their peers (Table 4).

### Depressive symptomology

MSMW had statistically significantly higher CES-D scores overall than MSMO across waves (11.1 vs. 9.5;  $p<0.0001$ ), but the trajectory of CES-D scores over waves 38-50 ( $p=.74$ ) between MSMW and MSMO were not statistically significantly different (see Tables 2b and 3). Similarly, MSMW were 1.3-times more likely to have a probability of scoring 16 or

higher on the CES-D ( $p < 0.01$ ; AOR=1.3, 95% CI: 1.1, 1.5) compared to MSMO; trajectories of CES-D scores were not significantly different between the groups ( $p = .79$ ). Hispanic MSMW reported higher likelihood of depressive symptomology than White MSMW (55.4% vs. 27.7%;  $p < .0001$ ). MSMW of lower income (39.8% vs. 31.5%;  $p < .05$ ) and HIV negative status (39.7% vs. 32.9%;  $p < .05$ ) also reported higher rates of depressive symptomology compared to their peers (Table 4).

## DISCUSSION

Our report marks the first time that trajectory analyses of HIV-related health risks among MSMW have been conducted quantitatively over an extended timeframe with bisexually behaving adult men. Our study demonstrates that bisexually behaving men face worrisome and persistent disparities related to syndemic burden including depression symptoms and polydrug use<sup>4,46</sup>. Particularly concerning are the comparatively high levels of HIV viral load, which have profound consequences for MSMW both for individual health and for HIV transmissibility. Least-square mean differences in viral load have clinically significant implications: mean viral load for younger MSMW over this 7-year span exceeded the threshold (1500 copies/ml<sup>3</sup>) indicated for potential sexual transmissibility<sup>43</sup>. We can conceive of HIV-positive MSMW within the MACS cohorts as a model sample: they are motivated enough to keep coming to a research study every six months and receive viral load tests as well as direct linkages to HIV care clinics tied to each MACS site, and closely enough affiliated with the larger gay community to have been effectively recruited via convenience methods targeting MSM. Given this conservative sample, this raises significant concern: what implications does this have for other MSMW who are less attached to gay communities and to biobehavioral research initiatives? Because this MACS sample likely excludes MSMW who are less gay-affiliated and, therefore, less likely to receive minority sexuality-related support and relevant health services, it is likely that findings derived from this unique sample understate psychosocial, behavioral, and biomedical disparities among MSMW in the U.S.<sup>39</sup> These findings provide support showing HIV-positive MSMW deserve dedicated attention in public health research, planning, and practice focused on HIV prevention and care.

Researchers have coined the term “biphobia” to distinguish the marginalization that bisexuals experience from the homophobia experienced by gays and lesbians<sup>47,48</sup>. Syndemics Theory for MSM posits that the attachments that gay men form with each other can help to buffer negative effects of syndemics, such as the homonegativity they face from the dominant heteronormative culture. However, there are few cities in the United States with community resources and infrastructure specific to bisexuals; this may severely limit their ability to connect with like-minded individuals<sup>49</sup>. When bisexual men reach out to either straight or gay/lesbian communities for support and camaraderie, it is possible that they do not receive messages of acceptance in return; or that they have a greater likelihood of experiencing acceptance from either community when they shelter their choices of sexual partners from others<sup>19-22</sup>. According to Syndemics Theory, a lack of ability to connect with others from the same marginalized group and to gain acceptance may correspond with increased feelings of depression and unhealthy behaviors in order to escape, to fit in, or to subtly self-destruct. There is substantial evidence that MSMW are likelier than MSMO to

use substances; use substances concurrently with sex; and engage in sex work<sup>10-13,15,18,27,50-54</sup>. Unfortunately, all of these behaviors could further serve to leave MSMW feeling even more alienated, as they confer further discrete stigmas of their own.

Our findings of disparate rates of depression and polydrug use among MSMW underscore the extension of the concept of syndemics to this population; and provide preliminary evidence that, among HIV positive MSM, viral load suppression may be extended to the concept of syndemics. Differences in viral load and some psychosocial syndemic conditions among MSMW compared to MSMO, coupled with the strong association between syndemic conditions and HIV risk, suggest that interventions structured to alleviate depression and substance use may yield distal effects such as slowing HIV acquisition and transmission. Interventions designed to facilitate disclosure of MSMW behavior to clinicians are likely necessary; there is evidence that, in this population, lack of such disclosure may impede HIV-related service provision and uptake<sup>24</sup>. Such approaches may include cultural competency trainings among HIV care clinicians as well as behavior disclosure among HIV positive MSMW. Our findings suggest that interventions incorporating social support, mental health, substance use treatment, and HIV care may be most efficiently directed to MSMW of lower income and younger age, particularly those who are Black and Hispanic.

Our results are subject to several important limitations. First, the MACS sample, while a groundbreaking cohort study of the natural history of HIV infection among MSM, does not reflect a representative sample for MSMW (or MSMO) in general. The proportion of MSMW among MSM in the MACS over this 7-year span was less than 7%, much lower than both general population-based and MSM-centered probability samples that have used similar proximal windows to identify bisexual behavior retrospectively<sup>55-58</sup>. This indicates that the convenience sampling procedures used in MSM-targeted recruitment techniques did not serve to enroll bisexual men with any great success, though the sociodemographic differences we found between MSMW and MSMO were similar to those found in other studies<sup>12,51,59</sup>. For these reasons, a study of bisexually behaving men in MACS may not furnish results that are generalizable to the larger population of bisexually behaving men in the United States. Second, as all cohort studies, participant attrition or missed visits may diminish the ability to generalize results to that missed population, although in our study we found significant differences between the two groups independent of missed visits. Those MSMW who missed visits may be more vulnerable to syndemic burden, therefore our results are likely to be underestimated. Similarly, our use of an endpoint (participation in waves 49 and/or 50) excluded participants who were deceased and who may have presented higher rates of behavioral, psychosocial, and biomedical conditions when alive, potentially limiting this sub-sample to MSM of relatively low to moderate risk. It is likely that the participants who were most vulnerable for polydrug use, depression, and viral load are also those who experienced premature mortality; it is therefore probable that the effect sizes that we provided are underestimated. Thirdly, no qualitative data was collected to contextualize our formative epidemiology. Finally, our recall window for bisexual behavior was fairly wide (seven years), including some men who only rarely reported sex with women (or men); though a smaller window might have improved this measure's proximal precision, it would also have resulted in less power to assess health disparities among bisexuals over the life course. Nonetheless, we believe that the significance and consistency of our findings over a



variety of internally and externally validated measures and theoretically linked HIV-related health domains provides strong evidence for their reliability.

There are many avenues of further research that may enlighten these results. Qualitative data collection with MSMW in the MACS would serve to better contextualize disparities in viral load, substance use, and depression among these men. Further quantitative research on this sample might further explore differences in behavioral, psychosocial, and biomedical health outcomes and correlates (such as sexually transmitted infections, high risk sexual behavior, and antiretroviral treatment uptake and adherence) both between MSMW and MSMO and within MSMW, by race and ethnicity, and thereby remediate a major gap in the literature, which has only rarely reported on subgroup differences within MSMW. More sophisticated examinations of factors that might mediate or moderate the pathways between bisexual behavior and HIV-related disparities could help pinpoint relevant intervention loci. Further research into differences in early psychosexual development between MSMO and MSMW, and within MSMW, could provide important information for intervention design. Assessing attitudes that people (including LGBT people) hold regarding MSMW, as well as service providers' cultural competence toward MSMW, is essential for informing social marketing campaigns and professional training curricula, respectively, that increase acceptance and ability to effectively serve men who have sex with men and women. Our results show that syndemic conditions appear to be both profound and persistent among MSMW. Addressing these disparities will be of benefit to MSMW as well as the men and women whom they love.

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Table 1

Sociodemographics at wave 50 by MSMO and MSMW in the MACS

Sociodemographics, n (%)	MSMO (N = 1514)	MSMW (N = 111)	Total (N = 1625)	Chi-square
Race/ethnicity				103.3 ***
White (non-Hispanic)	1090 (72.0)	34 (30.6)	1124 (69.2)	
White (Hispanic)	84 (5.5)	10 (9.0)	94 (5.8)	
Black (non-Hispanic)	254 (16.8)	55 (49.5)	309 (19.0)	
Black (Hispanic)	7 (0.5)	4 (3.6)	11 (0.7)	
American Indian/Alaskan	2 (0.1)	0	2 (0.1)	
Asian/Pacific Islander	6 (0.4)	0	6 (0.4)	
Other	12 (0.8)	1 (0.9)	13 (0.8)	
Other Hispanic	59 (3.9)	7 (6.3)	66 (4.0)	
MACS site				42.4 ***
Baltimore	376 (24.8)	15 (13.5)	391 (24.1)	
Chicago	252 (16.7)	45 (40.6)	297 (18.3)	
Pittsburgh	388 (25.6)	17 (15.3)	405 (24.9)	
Los Angeles	498 (32.9)	34 (30.6)	532 (32.7)	
Cohort				68.6 ***
1984	895 (59.1)	28 (25.2)	923 (56.8)	
1987	107 (7.1)	2 (1.8)	109 (3.7)	
2002	512 (33.8)	81 (73.0)	593 (36.5)	
HIV Status				0.8
Negative	793 (52.4)	63 (56.8)	862	
Positive	721 (47.6)	48 (43.2)	771	
Age				58.2 ***
20-29	29 (1.9)	12 (10.8)	41	
30-39	141 (9.3)	16 (14.4)	157	
40-49	413 (27.3)	47 (42.4)	460	
50-59	587 (38.8)	22 (19.8)	609	
60+	344 (22.7)	14 (12.6)	358	
Income				84.5 ***
< \$10,000	171 (11.3)	43 (38.7)	214 (13.2)	
\$10,000 – \$19,999	174 (11.5)	18 (16.2)	192 (11.8)	
\$20,000 – \$29,999	147 (9.7)	11 (9.9)	158 (9.7)	
\$30,000 – \$39,999	149 (9.8)	9 (8.1)	158 (9.7)	
\$40,000 – \$49,999	129 (8.5)	2 (1.8)	131 (8.1)	
\$50,000 – \$59,999	134 (8.9)	3 (2.7)	137 (8.4)	
\$60,000	513 (33.9)	16 (14.5)	529 (32.6)	
No response	97 (6.4)	9 (8.1)	106 (6.5)	
Education				65.4 ***

Sociodemographics, n (%)	MSMO (N = 1514)	MSMW (N = 111)	Total (N = 1625)	Chi-square
8 <sup>th</sup> grade	9 (0.6)	2 (1.8)	11 (0.7)	
9 <sup>th</sup> – 11 <sup>th</sup> grade	37 (2.4)	15 (13.5)	52 (3.2)	
12 <sup>th</sup> grade/HS degree	129 (8.5)	22 (19.8)	151 (9.3)	
Some college (no degree)	322 (21.3)	31 (27.9)	353 (21.7)	
College degree	317 (20.9)	14 (12.6)	331 (20.3)	
Some graduate work	149 (9.8)	11 (9.9)	160 (9.8)	
Graduate degree	400 (26.4)	13 (11.7)	413 (25.4)	
No response	151 (10.0)	3 (2.7)	154 (9.5)	

MSMO: men who have sex with men only; MSMW: men who have sex with both men and women.

\*\*\*  
P-value <.001

**Table 2a**

Analysis results of the binary outcomes in the MACS (wave 38-50)

Binary Outcome		Detectable viral load <sup>†</sup>		Viral load > 1500 <sup>†</sup>		Polydrug use		CES-D >15	
Predictor Variable	AOR (95% CI)	P	AOR (95% CI)	P	AOR (95% CI)	P	AOR (95% CI)	P	AOR (95% CI)
Wave	-	<.0001	-	0.0003	-	0.1698	-	0.2618	-
MSMW	1.4 (1.1, 1.7)	0.0011	1.3 (1.1, 1.6)	0.0096	2.8 (2.2, 3.5)	<.0001	1.3 (1.1, 1.5)	0.0012	-
Racial/ethnic minority	1.8 (1.6, 2.1)	<.0001	1.8 (1.6, 2.0)	<.0001	1.9 (1.6, 2.3)	<.0001	1.3 (1.2, 1.4)	<.0001	-
Sero-converter	8.4 (4.7, 14.7)	<.0001	8.4 (5.1, 13.0)	<.0001	-	-	-	-	-
Age < 40	1.4 (1.2, 1.6)	<.0001	1.5 (1.3, 1.7)	<.0001	1.0 (0.8, 1.3)	0.9700	1.0 (0.9, 1.2)	0.4249	-
Income < \$20,000	1.7 (1.5, 1.9)	<.0001	1.6 (1.4, 1.8)	<.0001	2.1 (1.7, 2.6)	<.0001	2.4 (2.2, 2.6)	<.0001	-
HIV negative	-	-	-	-	-	-	0.9 (0.8, 1.0)	0.0136	-
Wave * MSMW	-	0.9726	-	0.9902	-	0.9895	-	0.7872	-

AOR: adjusted odds ratio; Undetectable HIV viral load: 40 copies/mL.

<sup>†</sup> only among HIV+ participants.

**Table 2b**

Analysis results of the continuous outcomes in the MACS (wave 38-50)

Predictor Variable	Outcome Variable			
	Log <sub>10</sub> (HIV viral load)		CES-D score	
	Parameter estimate	<i>P</i>	Parameter estimate	<i>P</i>
Wave	-	0.0004	-	0.5450
MSMW	0.07004	0.0039	0.1400	<.0001
Racial/ethnic minority	0.1304	<.0001	0.1000	<.0001
Income < \$20,000	0.1207	<.0001	0.4320	<.0001
Age < 40	0.09415	<.0001	0.1042	<.0001
Sero-converter	0.4721	<.0001	-	-
HIV negative	-	-	-0.02940	0.0593
Wave * MSMW	-	0.9870	-	0.7414



**Table 3**

Least-square means of outcome measures by MSMW/MSMO group (MACS waves 38-50)

Outcome measure	Adjusted means <sup>†</sup>	
	MSMW	MSMO
HIV viral load <sup>‡</sup>	364.08 copies/mL <sup>**</sup>	234.15 copies/mL
Proportion with detectable viral load	0.46 <sup>***</sup>	0.37
Proportion with viral load > 1500	0.30 <sup>**</sup>	0.24
Proportion reporting polydrug use	0.07 <sup>****</sup>	0.03
Proportion with CES-D score >15	0.27 <sup>***</sup>	0.23
CES-D score	11.1 <sup>****</sup>	9.5

\*Group difference P-value &lt;.05

<sup>†</sup>All means adjusted for racial/ethnic minority status, annual income < \$20,000, age < 40, and wave. Means for viral load models further adjusted for recent seroconversion. Means for CES-D models further adjusted for HIV positive status.

<sup>‡</sup>Re-transformed post-analysis from log<sub>10</sub> values

\*\* Group difference P-value <.01

\*\*\* Group difference P-value <.001

\*\*\*\* Group difference P-value <.0001

Within-MSMW (n=111) effects of sociodemographics on depressive symptomology, polydrug use, and viral load (HIV+ n=48)<sup>†</sup>: F-values and adjusted least-squares means estimates.

Table 4

Sociodemographics	CES-D>15 (%)	Polydrug use (%)	Detectable viral load (%)	Viral load (copies/mL)
Wave	F=0.80	F=0.44	F=1.25	F=0.83
Race/ethnicity <sup>‡</sup>	**** F=9.51	F=2.50	**** F=10.63	F=14.83
Black, non-Hispanic	34.4%	16.1% ****	73.6% ****	1381.97 ****
Hispanic	55.4% ****	7.5%	53.1% **	502.81 ****
White, non-Hispanic	27.7%	3.1%	20.5%	122.74
Annual income	F=4.52 *	F=21.88 ****	F=30.28 ****	F=48.13
<\$20,000	39.8% *	13.4% ****	72.0% ****	1364.27 ****
>\$20,000	31.5%	3.2%	22.8%	106.41
Age	F=0.44	F=0.92	F=33.52 ****	F=32.16 ****
<40 years old	38.2%	6.6%	85.7% ****	2407.69 ****
40 years or older	35.7%	8.2%	43.3%	376.88
HIV status	F=4.42 *	F=16.25 ****	--	--
Negative	39.7% *	11.2% ****	--	--
Positive	32.9%	5.0%	--	--

<sup>†</sup> Results for "other race" (n=1) not shown. Race/ethnicity F-value is across groups. Individual group difference P-values adjusted via studentized maximum modulus approach; P-values presented are relative to White, non-Hispanic group. Values for "other" race (n=1) omitted from table.

<sup>‡</sup> Models within HIV positive MSMW adjusted for recent seroconversion.

\* Group difference P-value < .05

\*\* Group difference P-value < .01

\*\*\* Group difference P-value < .001

\*\*\*\* Group difference P-value < .0001