

**Computer-Mediated Social Support in the Multicenter AIDS Cohort Study**

by

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### **Abstract**

**Background:** Social support is a critical component of healthy living, affecting mental health, chronic disease outcomes, and immune function. Social support is an area of concern for older adults, especially older gay and bisexual men (MSM); older MSM are more likely to live alone and bear a disproportionate percentage of the HIV disease burden. Some studies have evaluated the use of computer-mediated communication (CMC) to provide support to older adults, but research about the utilization and effectiveness of computer-mediated social support for older MSM remains limited.

**Methods:** 1066 MSM completed a survey of healthy aging which included the Social Provisions Scale. We asked participants how they primarily communicated with the people they received the most support from and considered any medium other than in person to be CMC. Participants also reported their degree of social support satisfaction. We utilized logistic regression analysis for binary outcomes, linear regression for continuous variables and ordinal logistic regression for outcomes with more than two response categories.

**Results:** Of the 912 participants in the analytic sample, 224 (24.6%) reported computer-mediated social provisions (CMSP). We detected no relationship between age and CMSP (Adjusted Odds ratio (AOR) = 1.00, 95% confidence interval (CI) = 0.98, 1.02), but found that HIV+ participants had higher odds of reporting CMSP (AOR = 1.54, CI = 1.09, 2.20). We also found that participants

reporting CMSP were more likely to report lower social provisions scores ( $\beta_1 = -1.03$ , CI = -1.89, -0.18) and less likely to report feeling neutral or satisfied about the support they received compared to dissatisfied (AOR = 0.52, CI = 0.35, 0.76).

**Discussion:** Results of this study suggest that a significant proportion of older MSM are primarily obtaining their social support via CMC, and that these people are more likely to be HIV+. However, the results also suggest that CMC may not be as effective an avenue for obtaining social support as in-person communication. The results of this study suggest that social support and the support-seeking behavior of older MSM is an important public health problem to investigate further.

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## Preface

In addition to the readers listed on page ii, Ron Stall, PhD (University of Pittsburgh Graduate School of Public Health), Michael Plankey, PhD (Division of Infectious Diseases, Department of Medicine, Georgetown University Medical School), and Sabina Haberlen, PhD (Johns Hopkins Bloomberg School of Public Health) were instrumental to the completion of this project.

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Data in this manuscript were collected by the Multicenter AIDS Cohort Study (MACS). MACS (Principal Investigators): Johns Hopkins University Bloomberg School of Public Health (Joseph Margolick, Todd Brown), U01-AI35042; Northwestern University (Steven Wolinsky), U01-AI35039; University of California, Los Angeles (Roger Detels, Otoniel Martinez-Maza, Otto Yang), U01-AI35040; University of Pittsburgh (Charles Rinaldo, Lawrence Kingsley, Jeremy Martinson), U01-AI35041; the Center for Analysis and Management of MACS, Johns Hopkins University Bloomberg School of Public Health (Lisa Jacobson, Gypsyamber D'Souza), UM1-AI35043. The MACS is funded primarily by the National Institute of Allergy and Infectious Diseases (NIAID), with additional co-funding from the National Cancer Institute (NCI), the National Institute on Drug Abuse (NIDA), and the National Institute of Mental Health (NIMH). Targeted supplemental funding for specific projects was also provided by the National Heart, Lung, and Blood Institute (NHLBI), and the National Institute on Deafness and Communication Disorders (NIDCD). MACS data collection is also supported by UL1-TR001079 (JHU ICTR) from the National Center for Advancing Translational Sciences (NCATS) a component of the

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## 1.0 Background

Social support—the perception and actuality that one is both cared for and needed—is a critically important component of health and healthy living. Studies have demonstrated that social support plays a key role in mental and emotional health by both decreasing loneliness and also buffering the impact of stressors.<sup>1-3</sup> But social support also has important implications for physical health, and has been found to be associated with improved outcomes for those at risk for cardiovascular incidents and even decrease all-cause mortality.<sup>4-6</sup> Social support is an area of particular concern among older adults, especially among men who have sex with men (MSM). MSM over the age of 45 are much more likely to be single or to live alone than their heterosexual peers.<sup>7,8</sup> As these people age, loneliness and social isolation may seriously affect health and healthy living.<sup>3,8,9</sup>

Older MSM (over the age of 50) bear a disproportionate percentage of the HIV disease burden (801 per 100,000 among those 45-55, compared to 441 per 100,000 among those 25-34); both survey data and modeling studies demonstrate that MSM continue to be the group with the highest rates of HIV prevalence and that prevalence rates among older adults are increasing.<sup>10-12</sup> While this news is the result of advances in highly effective antiretroviral therapies that have allowed people to live many years with HIV, it also presents new challenges for clinicians and public health practitioners. Chronically HIV-positive older adults are at elevated risk for poor cardiovascular and pulmonary health and for many types of cancers compared to their HIV-negative peers.<sup>13</sup> Additionally, older HIV-positive adults (compared to HIV-negative adults) are more likely to be socially isolated and to have lower levels of social support, often due to perceived or actual stigma and rejection as well as fear of disclosing HIV status.<sup>13</sup> There is also a wealth of

research demonstrating that decreased social support is related to reduced medication adherence, lower CD4 counts, and increased viral load in HIV-positive individuals.<sup>14-17</sup> Lower levels of social support have been demonstrated to increase inflammatory markers<sup>18</sup>, and a growing body of research suggests that systemic inflammation is the main driver of HIV comorbidities.<sup>18-20</sup> Because social support reduces treatment adherence and increases inflammation, social support for older HIV-positive adults is an important topic to investigate.

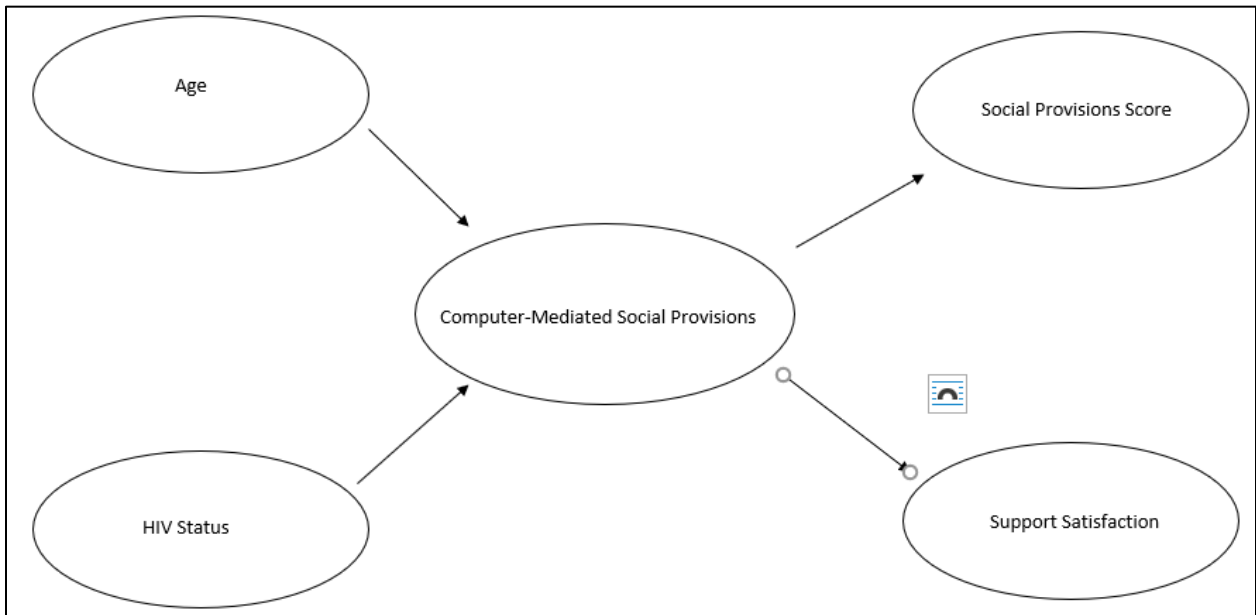
Geographic isolation and decreased mobility may make the Internet and other methods of electronic communication an attractive avenue for older adults to obtain social support.<sup>3,9,21,22</sup> According to the 2018 PEW Internet survey, nearly 90% of adults over 50 are using the Internet, and over 60% of those adults are using social media; however, some groups of adults may be more likely to use the Internet than others. The sense of anonymity provided by the Internet may draw those who feel emotionally upset by a stigmatized condition such as HIV to use it.<sup>22,23</sup> Interestingly, a 2013 survey conducted by the PEW Research Center found that a significant proportion (69%) of gay men reported they used the Internet to make new friends.<sup>24</sup> MSM are using the Internet at least as much as their heterosexual peers, and older MSM are no less likely to use the Internet than younger MSM, according to one study.<sup>25</sup> However, this study only focused on health-information seeking behavior, but there is evidence that MSM may use the internet for other purposes, such as social support. Other studies examining Internet use among MSM and HIV-positive individuals have focused exclusively on formal support networks such as online support groups, or social media, which users may or may not be using as a form of social support. Few studies have evaluated the impact of the Internet and electronic communication as sources of informal support for older MSM.

Finally, while some have argued for the Internet and other forms of computer-mediated communication (CMC) as a useful platform for connecting individuals,<sup>21,26</sup> there is also substantial evidence that suggests social support obtained via CMC may not be as effective as support obtained in person. The Cues Filtered Out (CFO) theory posits that CMC provides users fewer social cues—such as body language and positioning and tone of voice—and that reduced social cues may result in greater difficulty sending and receiving messages.<sup>27,28</sup> Further, this theory suggests that depersonalized forms of communication (e.g. text based communication) may not be as effective for communicating empathy and support. While CFO was developed before the advent of video chat avenues that allowed for communication most similar to face-to-face interactions, there is evidence that CFO remains relevant in the current landscape of electronic communication.<sup>29</sup> One study of conflict management randomly assigned people to discuss an emotionally charged topic either face-to-face or over video chat and found that those who managed conflict over video chat reported less physiological arousal and rated their partners more positively than those who had their discussion face-to-face.<sup>30</sup>

Additional research supports this theory; a study of soldiers returning from combat asked participants to report the person they received the most informal support from, the amount of support from this person, and the method (on or offline) they communicated with this person. The study found that those who sought support online following a traumatic event experienced more distress than those who sought support in person, even when controlling for the amount of support received.<sup>31</sup> In a study utilizing an experimental approach, researchers randomized college students to receive identical supportive messages either in person or via an online messaging platform and found that students who received the computer-mediated support experienced more uncertainty and worry.<sup>32</sup> Computer-mediated support may also not be as effective for HIV-positive

individuals; a study of users of the POZ online forum found that community integration was positively related to self-care behavior but that, beyond a threshold, online informational and emotional support were negatively correlated to self-care behavior.<sup>33,34</sup>

Older, HIV-positive MSM are at elevated risk for poor health status and are more likely to be socially isolated.<sup>7</sup> The current literature is mixed surrounding the best way to provide social support, with some studies arguing for computer-mediated support and others cautioning that such support may not be as effective.<sup>15,33</sup> Therefore, the purpose of the current study was to examine, in a large cohort of older HIV-positive and HIV-negative MSM, patterns of support-seeking behavior and the benefits of social support obtained via CMC. We hypothesized that there would be no difference in utilization of CMC to obtain social support based on age and HIV status. Second, we hypothesized that those who obtained social support online would be less satisfied with the support received and would report lower levels of social support.



**Figure 1: Conceptual Model**

## **2.0 Methods**

### **2.1 Sample**

Participants for this study were recruited from the Multicenter AIDS Cohort Study (MACS), a long-standing cohort study of HIV/AIDS in men who have sex with men (MSM). The MACS began recruiting and enrolling participants in 1984 and began seeing participants biannually for blood work, physical exams, medical and behavioral histories, and other assessments at clinic sites in Baltimore, Chicago, Los Angeles, and Pittsburgh. The MACS database now represents over 100,000 person-years of data.

Data for this study was collected as part of a longitudinal survey of Healthy Aging and Resiliency among Men Who Have Sex with Men that was collected across six consecutive participant visits (April, 2016 to April, 2019). MACS participants who were at least 40 years old by the start of the first administration of the Healthy Aging survey (April 1, 2016) and who had ever reported sex with men were eligible to complete the survey. The data for this survey was collected at one visit, from October 1, 2017 to March 31, 2018. Of the 2,329 participants enrolled and active in the MACS, 1,461 were eligible to complete the survey. Of all the eligible participants, 1,127 were seen during the recruitment window and asked to complete the survey. Of these participants, 1,066 (94%) consented and completed the survey.

## **2.2 Measures**

### **2.2.1 Social Provisions (SP)**

The social provisions scale developed by Cutrona and Russell was utilized because of its demonstrated validity and strong discriminant validity in a variety of study populations.<sup>1</sup> The social provisions scale captures both overall support but also captures six sub-scales which measure specific components of social support, such as attachment (emotional closeness from which one derives a sense of security), social integration (a sense of group belonging), and guidance (advice or information). The social provisions scale provides 24 statements (such as “there is a trustworthy person I could turn to for advice if I were having a problem”) which participants rank on a Likert scale from “strongly agree/agree/disagree/strongly disagree.” Due to large amounts of missing data from the full scale, we utilized the 10-item short form (SPS-10), which retains five of the original six sub-scales and includes only positively worded items such as the example above.<sup>35</sup> The SPS-10 has been validated, demonstrated to have strong psychometric properties, and utilized in other studies of social support.<sup>36,37</sup> SPS-10 scores were calculated by adding the scores for each item together to create a possible score of 10 to 40, with higher scores indicating greater amounts of social support. The 24-item social provisions scale as well as the guidance, attachment, and reliable alliance sub-scales were also utilized for sensitivity analyses.

### **2.2.2 Support Satisfaction**

Participants were also asked in a separate item to rank their satisfaction with the support they received on a 5-point Likert scale with responses ranging from “very satisfied” to very



dissatisfied.” Due to a very small number of people (1.2%) indicating being “very dissatisfied” with the support they received, we recoded this variable to include only three categories: satisfied, neutral, or dissatisfied.

### **2.2.3 Computer-Mediated Social Provisions (CMSP)**

To determine the medium through which participants obtained social provisions, following the social provisions scale, participants were asked “regarding the people you trust and depend on, how do you primarily communicate with these people?” Participants were presented with several possible communication mediums, and responses were re-coded into either “in person” or “computer mediated” (which included Skype, Facetime, or videochat, over the phone, video gaming platforms, text or messenger, or email).

## **2.3 Covariates**

Participants were asked to rank how often they used a personal cell phone or computer to access the internet. Response categories ranged from “never” to “daily” for each type of device. These items were adapted from a 2014 version of the Pew Internet Survey.<sup>38</sup> To create a general Internet use variable, we converted response categories to scores with more frequent use indicating higher scores, and summed the scores for the two items to create a single score that we called “Internet use”. Participants were also asked whether they had access to a smart phone or a cell phone that is not a smart phone.

Several other variables were included as covariates. Age was collected and analyzed as a continuous variable. HIV status was determined by antibody tests either at baseline or any later visit. Participants were also asked to self-report their race/ethnicity, and responses were recoded into non-Hispanic White, non-Hispanic Black, Hispanic (which included White, Hispanic, Black, Hispanic, and other Hispanic), and other (which included American Indian or Alaskan native, Asian or Pacific Islander, and other). Education was coded as less than high school, high school degree or some college, and college degree or more. Participants also completed the Center for Epidemiologic Studies Depression Scale (CES-D), with scores ranging from 0 to 60. Scores greater than 15 were considered indicative of high depression symptoms and a binary variable was created to represent high symptoms (scores 16-60) or low symptoms (scores 0 to 15).<sup>39</sup> Participants also reported whether or not there was someone in their lives who they considered to be a primary partner, who they may or may not be legally married to.

## **2.4 Missing Data**

Only participants with complete data for primary predictors and primary outcomes were included in the analysis. For Aim 1 (examining correlates of primary social provisions source), of the 1066 participants who completed the survey, 912 (85.6%) completed the question about social provisions source. We conducted chi-square testing and determined that participants who did not complete the survey did not differ by age ( $p=0.07$ ) or HIV status ( $p=0.08$ ) but did differ by income, education, and depression.

IRB stipulations required the addition of response options “not applicable” and “prefer not to say” for each item of the social provisions scale. Therefore, only participants who answered all

items of the scale without endorsing “not applicable” or “prefer not to say” for any items were included in the analysis of Aim 2 (examining associations between primary social provisions source and social provisions score and support satisfaction). Of the 1066 participants who completed the survey, 819 (76.8%) completed all items of the SPS-10. Participants with missing values did not differ by age ( $\chi^2=1.62$ ,  $p=0.44$ ), but participants with incomplete data for the SPS-10 were more likely to be HIV-positive (OR=1.47, CI=1.10, 1.96), Black (compared to white, OR=2.26, CI=1.63, 3.15), and have higher levels of depression (OR=1.72, CI=1.25, 2.39). Additionally, 701 (65.8%) completed all 24 items of the social provisions scale, and 891 (83.5%), 874 (82.0%), and 906 (85.0%) participants completed the reliable alliance, attachment, and guidance sub-scales, respectively.

## 2.5 Analytic Plan

We described our data with frequencies and percentages for categorical variables, and means and standard deviations for continuous variables. We conducted chi-square testing for categorical variables and t-tests for continuous variables to begin detecting differences by primary outcomes. We selected and included covariates a priori based on reviews of the literature and theoretical importance. We also screened all models for multiple collinearity among covariates. For descriptive tests and all bivariate and multivariable testing, significance was defined at the  $p<0.05$  level. All analysis was conducted with Stata version 15.1.

For Aim 1, we created a logistic regression model with age and HIV status as predictor variables and CMSP entered as the outcome variable. We also included race/ethnicity, education, access to a smartphone, Internet use, partner status, and depression as covariates.

For Aim 2, we created two separate regression models. To examine the association between social provisions source and social provisions score, we created a linear regression model with CMSP entered as the predictor variable and social provisions score as the outcome variable. We included age, race/ethnicity, education, depression, and partner status as covariates. The distribution of SPS-10 scores was skewed to the left, however, multiple linear regression estimates are robust to violations of normality in the event of normal distributions of residuals.<sup>40</sup> Examination of Kernel density and normal probability graphs of outcome residuals indicated approximate normality and that OLS regression would be an appropriate test. Due to missing data in the SPS-10 variable, we also conducted sensitivity analysis with the reliable alliance, attachment, and guidance subscales.

To examine the association between CMSP and support satisfaction, we created an ordinal logistic regression model with support satisfaction as the outcome variable and CMSP as the predictor variable. Again, we included age, race/ethnicity, education, depression, and partner status as covariates. We conducted likelihood ratio tests of model fit to ensure that all models met the proportional odds assumption.

### 3.0 Results

**Table 1: Sample Characteristics by Social Provisions Source; Healthy Aging and Resiliency in the Multicenter AIDS Cohort Study, 2017-2018**

Independent Variables	Total N (%)	Social Provisions Source		p	Test Statistic
		In Person	Computer-Mediated		
Age [mean (SD)]	60.7 (8.5)	61.06 (8.59)	60.36 (8.60)	0.15	0.99
HIV Status				<0.001	16.56
HIV-	470 (52)	381 (56)	89 (40)		
HIV+	442 (48)	307 (44)	135 (60)		
Race, Ethnicity				0.006	13.30
White, non-Hispanic	654 (72)	513 (75)	141 (64)		
Black, non-Hispanic	152 (17)	104 (15)	48 (22)		
Hispanic	80 (9)	56 (8)	24 (11)		
Other	18 (2)	10 (1)	8 (4)		
Education				0.012	9.57
Less than HS	21 (2)	11 (2)	10 (5)		
HS degree or some college	290 (32)	211 (31)	79 (36)		
College degree or more	593 (66)	461 (68)	132 (60)		
Income					16.29
0 to less than \$30K	274 (31)	192 (29)	82 (39)		
\$30K to less than \$60K	238 (27)	175 (26)	63 (30)		
>\$60K	319 (36)	266 (40)	53 (25)		
Married or Partnered?				<0.001	60.62
Yes	430 (48)	375 (55)	55 (25)		
No	473 (52)	307 (45)	166 (75)		
Depression Symptoms				<0.001	13.84
High	185 (21)	120 (18)	65 (29)		
Low	717 (79)	561 (82)	156 (71)		
SPS-10 [mean (sd)]		35.0 (5.0)	32.6 (6.6)	<0.0001	5.12
SPS-10				0.001	13.45
Low	251 (33)	174 (30)	77 (43)		
Medium	261 (34)	203 (35)	58 (34)		
High	253 (33)	210 (36)	43 (24)		
Support Satisfaction				<0.001	27.98
Satisfied	671 (77)	534 (81)	137 (64)		
Neutral	135 (15)	86 (13)	49 (23)		
Dissatisfied	49 (6)	27 (4)	22 (10)		
Own a phone?				0.015	8.40

**Table 1 Continued**

Smartphone	748 (83)	574 (84)	174 (78)		
Cellphone	123 (14)	89 (13)	34 (15)		
No	31 (3)	17 (3)	14 (6)		
Media Use [mean (sd)]	8.5 (2.1)	8.6 (2.1)	8.1 (2.5)	0.001	3.23

Count (column percentage); percentages may not add due 100 due to rounding

p values determined by chi-square tests for categorical variables and t-tests for continuous variables

High depression defined as CES-D score >15

Media Use was determined by adding responses to a series of Likert scales, with higher scores indicating greater amounts of media and internet use

The sample consisted of 1,066 individuals. As shown in in Table 1, the majority were non-Hispanic White (72%), hereafter referred to as “White.” Forty-eight percent of the sample was HIV-positive, and 52% of the sample was HIV-negative. The sample mean age was 60.7 (SD=8.5). Most participants reported at least a high school degree or some college (32%) or a college degree or more (66%). Approximately a third of the sample (31%) reported making less than \$30,000 annually. One-fifth of the sample (21%) was considered having High depression symptoms by using a CES-D score cut-off of 15.

### 3.1 Aim 1

**Table 2: Bivariable and multivariable associations between independent variables, covariates, and computer-mediated social provisions, Healthy Aging and Resiliency in the Multicenter AIDS Cohort Study, 2017-2018**

(Aim 1, N=912)

Independent variable/covariate	Computer-Mediated Social Provisions			
	OR (95% CI)	p	AOR (95% CI)	p
Age	0.99 (0.97, 1.00)	0.32	1.00 (0.98, 1.02)	0.96
HIV Status				
HIV -	Reference			
HIV+	1.88 (1.38, 2.56)	<0.001	1.54 (1.09, 2.20)	0.01
Race, Ethnicity				
White, non-Hispanic	Reference			
Black, non-Hispanic	1.73 (1.18, 2.54)	0.005	1.05 (0.67, 1.66)	0.82
Hispanic	1.56 (0.93, 2.60)	0.09	1.05 (0.57, 1.95)	0.87
Other	2.91 (1.12, 7.51)	0.03	2.55 (0.89, 7.29)	0.08
Education				

**Table 2 Continued**

Less than HS	Reference			
HS degree or some college	0.42 (0.17, 1.03)	0.06	0.52 (0.19, 1.44)	0.20
College degree or more	0.31 (0.13, 0.75)	0.009	0.47 (0.17, 1.31)	0.15
Married or Partnered?				
Yes	Reference			
No	3.69 (2.62, 5.18)	<0.001	3.43 (2.41, 4.90)	<0.001
Depression Symptoms				
Low	Reference			
High	1.93 (1.36, 2.73)	<0.001	1.46 (0.99, 2.16)	0.06
Own a Cellphone?				
No	Reference			
Smartphone	0.46 (0.21, 1.04)	0.06	0.38 (0.16, 0.95)	0.04
Cellphone	0.37 (0.18, 0.76)	0.007	0.46 (0.19, 1.14)	0.09
Internet Use	0.90 (0.84, 0.96)	0.001	0.99 (0.90, 1.09)	0.80

Approximately one-quarter (24.6%) of participants reported primarily obtaining computer-mediated social provisions. In bivariate analysis, age was not related to CMSP, but being HIV-positive was related to higher odds of reporting CMSP (Odds Ratio (OR): 1.88, 95% confidence interval (CI): 1.38, 2.56, Table 2). Additionally, being any race/ethnicity other than White was related to higher odds of reporting CMSP. Having a college degree or more was related to decreased odds (OR = 0.31, CI = 0.13, 0.75) of reporting CMSP, as was earning more than \$60,000 annually (OR = 0.46, CI = 0.37, 0.73). Participants reporting High depression symptoms were more likely (OR = 1.93, CI = 0.24, 2.73) to report CMSP. Participants reporting not having a primary partner were more likely to report CMSP (OR=3.69, CI=2.62, 5.18). Both ownership of a cellphone and increased Internet use were associated with decreased odds of reporting CMSP (OR=0.37, CI=0.18, 0.76, OR=0.90, CI=0.84, 0.96, respectively).

In multivariable analysis, being HIV-positive remained significantly associated with higher odds of reporting CMSP when controlling for all other variables in the model (Adjusted odds ratio (AOR): 1.54, CI: 1.09, 2.20, Table 2). Only reporting not having a primary partner was also associated with increased odds of reporting CMSP (AOR=3.43, CI=2.41, 4.90). Interestingly,

ownership of a smartphone was significantly associated with decreased odds of reporting CMSP (AOR=0.38, CI=0.16, 0.95).

### 3.2 Aim 2

**Table 3: Bivariable and multivariable associations between independent variables, covariates, and SPS-10 score, Healthy Aging and Resiliency in the Multicenter AIDS Cohort Study, 2017-2018 (H3, N=819)**

Independent variable/covariate	SPS-10 Score			
	$\beta_1$ (95% CI)	p	$\beta_1$ (95% CI)	p
<b>Social Provisions Source</b>				
In Person	Reference			
Computer-mediated	-2.38 (-3.29, -1.47)	<0.001	-1.03 (-1.89, -0.18)	0.02
Age	0.03 (-0.01, 0.08)	0.14	-0.02 (-0.07, 0.03)	0.40
<b>HIV Status</b>				
HIV -	Reference			
HIV+	-1.54 (-2.30, -0.78)	<0.001	-0.55 (-1.29, 0.19)	0.15
<b>Race, Ethnicity</b>				
White, non-Hispanic	Reference			
Black, non-Hispanic	-2.16 (-3.17, -1.14)	<0.001	-0.25 (-1.31, 0.81)	0.64
Hispanic	-1.67 (-2.98, -0.36)	0.01	0.44 (-0.92, 1.79)	0.53
Other	-0.04 (-2.88, 2.79)	0.98	1.09 (-1.43, 3.60)	0.40
<b>Education</b>				
Less than HS	Reference			
HS degree or some college	2.20 (-0.18, 4.58)	0.07	1.47 (-0.91, 3.84)	0.23
College degree or more	4.29 (1.95, 6.62)	<0.001	2.43 (0.04, 4.83)	0.04
<b>Married or Partnered?</b>				
Yes	Reference			
No	-2.88 (-3.62, -2.13)	<0.001	-2.06 (-2.80, -1.32)	<0.001
<b>Depression Symptoms</b>				
Low	Reference			
High	-5.57 (-6.46, -4.68)	<0.001	-5.13 (-6.05, -4.20)	<0.001

In bivariate analysis, reporting CMSP was significantly associated with decreased SPS-10 score ( $\beta_1 = -2.38$ , CI: -3.29, -1.47; Table 3). Both Black ( $\beta_1 = -2.16$ , CI = -3.17, -1.14) and Hispanic ( $\beta_1 = -1.67$ , CI = -2.98, -0.36) race/ethnicity were related to decreased SPS-10 scores when compared to being white. Having a college degree or more was significantly associated with



increased SPS-10 scores ( $\beta_1 = 4.29$ , CI = 1.95, 6.62). High depression symptoms was significantly associated with decreased SPS-10 scores ( $\beta_1 = -5.57$ , CI = -6.46, -4.68). Additionally, reporting not having a primary partner was associated with decreased SPS-10 scores ( $\beta_1 = -2.88$ , CI = -3.62, -2.13). In sensitivity analysis, results were similar except that reporting CMSP was not significantly associated with decreased support scores in any of the three models (results not shown). However, reporting CMSP was trending towards significance ( $p < 0.075$ ) in all three models, and may not have reached statistical significance due to the small effect size.

In multivariable analysis, reporting CMSP remained significantly associated with decreased SPS-10 scores when controlling for all other variables in the model ( $\beta_1 = -1.03$ , -1.89, -0.18). Additionally, both reporting not having a primary partner and high depression symptoms were related to decreased SPS-10 scores ( $\beta_1 = -2.06$ , CI = -2.80, -1.32,  $\beta_1 = -5.13$ , CI = -6.05, -4.20, respectively). Reporting having obtained a college degree or more was associated with increased SPS-10 scores ( $\beta_1 = 2.43$ , CI = 0.04, 4.83).

**Table 4: Bivariate and multivariate associations between independent variables, covariates, and support satisfaction, Healthy Aging and Resiliency in the Multicenter AIDS Cohort Study, 2017-2018 (H4, N=863)**

Independent variable/covariate	Support Satisfaction			
	OR (95% CI)	p	AOR (95% CI)	p
Social Provisions Source				
In Person	Reference			
Computer-mediated	0.40 (0.28,0.57)	<0.001	0.52 (0.35, 0.76)	0.001
Age	0.99 (0.98,1.02)	0.87	0.99 (0.97, 1.01)	0.58
HIV Status				
HIV -	Reference			
HIV+	0.64 (0.46,0.87)	0.005	0.71 (0.49, 1.02)	0.06
Race, Ethnicity				
White, non-Hispanic	Reference			
Black, non-Hispanic	1.03 (0.69,1.57)	0.86	1.46 (0.88, 2.42)	0.15
Hispanic	1.06 (0.60,1.90)	0.82	1.42 (0.72, 2.83)	0.31
Other	0.49 (0.18,1.32)	0.16	0.74 (0.25, 2.24)	0.60
Education				
Less than HS	Reference			
HS degree or some college	1.32 (0.54,3.25)	0.54	0.94 (0.28, 3.21)	0.92
College degree or more	1.40 (0.58,3.38)	0.45	0.86 (0.25, 2.95)	0.81
Married or Partnered?				
Yes	Reference			
No	0.49 (0.35,0.67)	<0.001	0.58 (0.40, 0.84)	0.004
Depression Symptoms				
Low	Reference			
High	0.23 (0.16,0.32)	<0.001	0.22 (0.15, 0.32)	<0.001

In bivariate analysis, reporting CMSP was related to decreased odds of reporting feeling either neutral or satisfied about one's social support (OR = 0.40, CI = 0.28, 0.57, Table 4). Being HIV-positive was also related to decreased odds of reporting higher levels of support satisfaction (OR = 0.64, CI = 0.46, 0.87). High depression symptoms was related to decreased odds of reporting higher levels of support satisfaction (OR = 0.23, CI = 0.16, 0.32). Reporting not having a primary partner was associated with decreased odds of reporting higher levels of support satisfaction (OR = 0.49, CI = 0.35, 0.67).

In multivariable analysis, reporting CMSP remained significantly associated with decreased odds of reporting higher levels of support satisfaction when adjusting for all other variables in the model (AOR = 0.52, CI = 0.35, 0.76, Table 4). Both reporting not having a primary

partner and high depression symptoms were associated with lower odds of reporting higher levels of support satisfaction (AOR = 0.58, CI = 0.40, 0.84, AOR = 0.22, CI = 0.15, 0.32, respectively).

## 4.0 Discussion

### 4.1 Key Findings

HIV-positive adults had 54% higher odds of reporting CMSP compared to their HIV-negative peers when adjusting for a number of covariates. Importantly, age was not related to odds of reporting CMSP. Additionally, reporting CMSP was associated with a statistically significant decrease in SPS-10 scores. Finally, reporting CMSP was associated with a 48% decrease in the odds of reporting being either neutral or satisfied about the social support one received.

### 4.2 Implications

That HIV status was significantly associated with increased odds of reporting CMSP while ownership of a smartphone and increased Internet use were not suggests that obtaining computer-mediated social provisions is a specific concept unrelated to increased media use. In fact, that ownership of a smartphone was actually related to *decreased* odds of reporting CMSP suggests that computer-mediated social provisions is a separate concept entirely, perhaps related to access to people to talk to in person. For instance, a mixed-methods study of the reasons HIV-positive people turn to online support networks found that many participants used these sites to mostly to obtain social support; when asked about online communities, one participant said, “I just moved to where I live and this is my social life for now.”<sup>41</sup> Additionally, the findings of this study indicate that it is important to move beyond the amount of Internet and media use and to focus on

motivations for use; a study of sexual minority youth found that they used social networking sites at comparable rates to their heterosexual peers, but that motivations for social networking use varied and predicted both positive and negative health outcomes.<sup>42</sup>

Previous studies have suggested that living with a stigmatized condition such as HIV may make the Internet and electronic communication attractive avenues for obtaining social support<sup>21-24,43</sup>, and the findings of this study suggest that this may indeed be the case. This study also adds to the literature by exploring the use of electronic communication to obtain informal social support, which has yet to be explored in other studies. Our study demonstrates that the findings of other studies examining formal support networks apply to informal networks as well, and that older, HIV-positive MSM may be more likely to utilize electronic communication to obtain social support because of internalized stigma or homophobia, experiences of discrimination, geographic isolation, or increased likelihood of living alone compared to heterosexual peers.<sup>7,8,23,24</sup> In addition to future research, the findings of this study indicate that, despite advances in education surrounding HIV, HIV-positive people may still face barriers to obtaining the support they need. Further, there appears to be a need to target HIV-positive people for connection to similar peers as well as in-person support services.

That reporting CMSP was related to decreased SPS-10 scores and decreased support satisfaction supports previous work indicating that support obtained via electronic communication is less effective than support obtained in person and refutes studies suggesting the opposite.<sup>27,31-33,44</sup> While the effect size of CMSP on SPS-10 scores was admittedly small, that the effect remained statistically significant in the presence of strong predictors of social support (e.g. depression and marital/partner status) suggests that obtaining social support via electronic communication may still be an important concept to focus further research and intervention on. Also, support source

significantly impacted support satisfaction, which is itself an important concept and has been related to improved mental health, improved quality of life, and improved cardiovascular health.<sup>45,46</sup> Because of the importance of both social support and support satisfaction for health outcomes, it may be important to tailor interventions to increase in-person social support.

The development and increased utilization of telemedicine is an interesting area to further explore the concepts in this study. Studies of telemedicine generally hold constant the standard of care and vary only the medium through which that care is delivered. Interestingly, recent research of telemedicine has generally found either no difference between telemedicine and traditional medicine in terms of patient satisfaction, outcomes, and provider satisfaction.<sup>47-49</sup> While the findings from studies of telemedicine seem contradictory to the findings of the current study, it is possible that while convenience and cost generally improve patients' satisfaction with telemedicine convenience may not be of primary concern when seeking social support<sup>48</sup>; rather, people may be more interested in the perception that they are cared for and listened to, which is much more difficult to communicate via electronic communication.<sup>26,27,32</sup>

The results of the current study, therefore, have important implications for public health practitioners interested in the health of older MSM. As these adults are more likely to live alone, to be geographically isolated, and to be HIV-positive, connecting them to in-person sources of social support may be especially important.<sup>7-9</sup> It is important to consider moving beyond formal methods of social support (e.g. support groups, chat rooms, etc.) and to further investigate the informal support networks of older MSM. HIV-positive participants may be an important population to target with interventions, as they were more likely to report CMSP in this study; however, CMSP was associated with decreased support scores and support satisfaction

independent of HIV status, suggesting that all older MSM could benefit from improved access to in-person support.

### **4.3 Limitations**

There are some notable limitations to the current study. The cross-sectional nature of this study limits our ability to draw conclusions about temporality. For example, it is possible that those with low levels of social support or support satisfaction may turn to electronic communication to attempt to increase support, rather than using electronic communication to obtain social support causing low levels of support or support satisfaction. Although the cross-sectional approach of this study is a limitation, the ability to control for a large number of covariates limits the possibility that the findings of this study are due to a spurious or unmeasured variable. Further, the conceptual frameworks as well as experimental approaches of previous studies of computer-mediated communication provide evidence for a particular causal pathway.<sup>27,32,33</sup>

Additionally, there were large amounts of missing data for the SPS-10, and chi-square as well as logistic regression testing suggest that patterns of missingness were related to some of the variables in our models (e.g. race/ethnicity, HIV-status, and depression symptoms). It is possible that the results of this study were biased by patterns of missing data. However, sensitivity analyses with the guidance, reliable alliance, and attachment subscales—all with smaller amounts of missing data and differing patterns of missingness—displayed similar results to those from the primary analysis, increasing our confidence that the results of this study were not due to bias from missing values.

This study was based largely on self-reported survey data which has its own set of biases and limitations. While participants completed surveys on their own and were assured of their confidentiality, the sensitive nature of some of the questions involved may nonetheless have elicited social desirability bias and influenced answers.<sup>50</sup> Finally, while this study presents a helpful starting point, the results of this study are not generalizable to all older adults or even to other members of the older LGBT community. It is also possible that the results of this study may be unique to participants of the MACS and may not be generalizable to older MSM in other areas of the country.

#### **4.4 Future Research and Directions**

Since age was not related to reporting CMSP in this study, future studies of electronic communication and social support should expand their focus to include older adults rather than examining the behavior of adolescents and young adults, as has been the practice of most previous studies of electronic communication and media use.<sup>9,33,51-55</sup> Additionally, it is important to further explore factors that are related to the use of electronic communication to obtain social support, especially factors related to HIV.

Qualitative studies—such as focus groups or interviews—could be a very helpful way to explore the aspects of electronic communication that are attractive to some people as means of obtaining social support. In the context of HIV, qualitative studies could help to untangle aspects of stigma, internalized homophobia, or experiences of discrimination that may draw HIV-positive people to electronic communication. Qualitative work could also reveal other reasons for using



electronic communication to obtain social support, such as geographic isolation, living alone, immobility or frailty, or perhaps even simply convenience.

In the absence of or in addition to qualitative work, the use of previously used and validated scales of HIV stigma, experiences of discrimination, and internalized homophobia could be helpful measures to further examine the relationship between HIV status and CMSP.<sup>56-61</sup> Further, geocoding, spatial modeling, or multilevel modeling could be useful approaches to examine contextual factors—such as geographic isolation, access to people and services, and interactions with issues of mobility and frailty—that may also be related to CMSP.<sup>62-66</sup> Additionally, the two approaches above would be useful expansions of this work to other groups of LGBT individuals as well as to older heterosexual adults. It would be useful to compare MSM and other LGBT individuals to heterosexual peers, as older LGBT adults may be more likely to live alone, to be geographically isolated, and to experience stigma or discrimination, regardless of HIV status.<sup>7,8,24</sup>

Finally, this study is not able to explore the possibility that CMSP is better than having no social provisions at all. It is possible that, for individuals who report no or very little social provisions and support, augmenting their existing support with support through electronic communication could improve their perceived support, support satisfaction, and health outcomes. However, in this study we were only able to make comparisons among people reporting some level of social provision. Longitudinal studies would also be useful tools to determine the stability of social-support-seeking behavior over time as well as to provide evidence for a causal pathway.

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