Does social isolation predict hospitalization and mortality among HIV+ and uninfected older Veterans?

S. Ryan Greysen, MD, MHS, MA[1], **Leora I. Horwitz, MD, MHS**[2], **Kenneth E. Covinsky, MD, MPH**[3,4], **Kirsha Gordon, MS**[5], **Michael E. Ohl, MD, MSPH**[6], and **Amy C. Justice, MD, PhD**[2,5]

[1]Division of Hospital Medicine, University of California San Francisco

[2]Division of General Internal Medicine, Yale University School of Medicine

[3]Division of Geriatrics, University of California San Francisco

[4]San Francisco VA Medical Center, San Francisco, CA

[5]West Haven VA Medical Center, West Haven, CT

[6]Division of Infectious Diseases, University of Iowa School of Medicine

Abstract

Background and Objectives—Aging, HIV, and social isolation may affect acute care utilization and outcomes. Our objectives were to compare levels of social isolation in aging Veterans with and without HIV and determine associations with hospital admission and mortality.

Study Design, Participants, and Setting—The Veterans Aging Cohort Study (VACS) is a longitudinal study of HIV+ and uninfected Veterans at eight VA Medical Centers nationally. We analyzed data for 1,836 Veterans age 55 enrolled in VACS from 2002–2008.

Measurements—We created a Social Isolation Score (SIS) using baseline survey responses about: relationship status, number of friends/family and frequency of visits, and involvement in volunteer work, religious or self-help groups, or other community activities. We compared scores by age and HIV status and used multivariable regression to assess effects of social isolation scores on hospital admission and all-cause mortality.

Results—Mean SIS was higher for HIV+ patients with increasing difference by age (p=.01 for trend). Social isolation was also more prevalent for HIV+ (59%) compared to uninfected patients (51%; p<.001). In multivariable regression analysis of HIV+ and uninfected groups combined, adjusted for demographic and clinical features, isolation was independently associated with increased risk of incident hospitalization (HR=1.25, 95% CI=1.09–1.42) as well as risk of all-

cause mortality (HR=1.28, 95% CI=1.06–1.54). Risk estimates calculated for HIV+ and uninfected groups separately were not significantly different.

Conclusions—Social isolation is associated with increased risk of hospitalization and death among both HIV+ and uninfected older Veterans. Despite similar effects in both groups, the population level impact of social isolation may be greater in those who are HIV+ because of the higher prevalence of social isolation, particularly among the oldest patients.

Keywords

Social isolation; aging; HIV/AIDS; hospitalization; mortality; outcomes of care

Background

Social isolation is common among aging adults and has important effects on healthcare and health outcomes.[1,2] Numerous studies have demonstrated increased overall risk for mortality[3,4] and geriatric morbidity such falls,[5] cognitive and functional decline,[6,7] especially among those with chronic conditions such as coronary artery disease,[8,9] cancer,[10] and diabetes.[11] Currently, there is less information about isolation among adults aging with Human Immunodeficiency Virus (HIV), yet recent advances in anti-retroviral therapy have transformed HIV to a chronic condition with increased life expectancies and "graying" of the infected population.[12,13] Additionally, the incidence of new HIV infections in older adults has increased dramatically in the last decade.[14] These trends suggest a need for more information not only about effects of isolation on mortality for the growing number of older adults living with chronic HIV infection but also a need to understand possible effects on acute care utilization given longer life expectancies in this population.

Compared to the aging population with other chronic conditions, adults living with HIV/ AIDS may be at particularly high risk for social isolation as they age. Many have lost friends or partners who were also infected but did not survive the early years of the epidemic.[15,16] Social networks and support may also be inhibited by the stigma attached to HIV. This stigma is especially strong for populations who are disproportionately infected such as African-Americans and Hispanics,[17,18] as well as men who have sex with men (MSM).[19] Furthermore, HIV infection itself intensifies many normal aging processes and increases the incidence and severity of frailty.[20,21,22] Thus, HIV+ individuals may be at higher risk for isolation and frailty leading to increased overall risk for hospitalization and death when compared to an uninfected cohort. Currently, comparisons on the prevalence and effects of social isolation between HIV+ and uninfected aging patients are lacking. Specifically, current studies have yet to examine how components of social isolation, such as limited engagement with friends, family, or community, may differentially affect acute care utilization and mortality among HIV+ and uninfected older adults.

The Veterans Aging Cohort Study (VACS) dataset presents a unique opportunity to study the prevalence and effects of social isolation on inpatient admission and outcomes of care in an aging population in a multi-site, longitudinal cohort of Veterans and to compare these effects for HIV+ patients with uninfected patients. Our objectives were to compare levels of social isolation in aging Veterans with and without HIV and determine associations with incident hospital admission and all-cause mortality.

Methods

Study design and sample

VACS is an observational cohort of HIV+ and un-infected patients designed to examine the role of social, medical, and psychiatric factors on aging and clinical outcomes. Participants

are enrolled prospectively from infectious disease and general medicine clinics at eight VA Medical Centers (Atlanta, GA, Baltimore, MD, Bronx, NY, New York City, NY, Houston, TX, Los Angeles, CA, Pittsburg, PA, Washington, DC). Uninfected patients are matched to the infected group by age, race, and site. A full description of VACS recruitment, enrollment rates, study instruments, study measures collected, and quality control is described elsewhere.[23] Briefly, VACS collects socio-demographics, comorbidities, and measures of health behaviors and beliefs from patient surveys, administrative and clinical data sources through the VA national electronic medical record. Institutional review boards at all sites approved the study, and all Veterans provided written informed consent. For the present study, we analyzed a sample of patients from VACS 8 with full data available who were 55 years of age or older when they completed the VACS baseline survey between June 1, 2002 and September 30, 2008 (Table 1).

Measurements

Social Isolation—Social isolation has been defined as a state of lacking social engagement, belonging, and contact with others.[24] Given the lack of consensus in prior literature on how best to measure social isolation in different populations, we created a Social Isolation Score (SIS) that would be well-suited to study both HIV+ and uninfected older adults by leveraging strengths of the VACS dataset designed to study these populations. First, we identified domains for this score from the VACS 8 baseline survey that captured key concepts of isolation from our review of the existing literature: frequency of visits by close friends,[1,2] frequency of visits by family, [1,2] number of close friends and family combined,[1,2,25] use of self-help groups in the past year,[19] volunteer work or involvement with a community organization,[26] attendance of religious events,[27] relationship status,[28] and living alone.[29] Next, for each domain, we chose one question from the VACS 8 baseline survey that best represented the concept and assigned one point for each response indicating isolation and zero points for each response indicating lack of isolation. For questions with multiple responses, we assigned 1 point for the most-isolated response, 0 points to the least-isolated response, and 0.5 points for any response in-between. The final Social Isolation Score contains 8 variables with a range of possible scores from 0–8 in 0.5 increments (Table 2). Finally, we used the Spearman test to assess construct validity and found significant correlation between SIS components ($p<0.05$ for 23 out of 28 unique combinations).

Clinical outcomes—Our primary outcomes of interest were: (1) incident admission for acute inpatient care at any VA medical center and (2) all-cause mortality between study enrollment on June 1, 2002 and September 30, 2010 to allow at least 2-year follow-up after the last enrollment date. To account for variations in length of follow up time, we used time-to-event analyses for both outcomes. Since data for the social isolation score were derived from the baseline survey, we abstracted information on the first hospitalization to occur any time after enrollment in VACS 8. Dates of death were used to determine time-to-death within the study and to conduct survival analyses.

Potential confounders—Covariates included age (continuous), race and ethnicity (white/ non-Hispanic vs. non-white and/or Hispanic), and income (<$25,000/year vs. $25,000/ year) (Table 1). We identified the 5 most-frequent comorbidities from participant ICD-9 codes at the time of enrollment (Hypertension, Dyslipidemia, Diabetes, Hepatitis C, and Coronary Artery Disease) and calculated a sum total of comorbidities for each participant. Alcohol abuse was assessed using the Alcohol Use Disorders Identification Test (AUDIT-C)[30,31] and we used the Beck Depression Inventory (BDI) to assess for depressive symptoms. Finally, we calculated a sum total of hospitalizations to any VA medical center during the study dates for each participant.

Analyses

We suspected social isolation would be higher in HIV+ participants *a priori* based on previous evidence of lower levels of social support in this population. We therefore stratified our descriptive analysis of baseline characteristics and incidence rates for outcomes by HIV status. We then calculated SIS for each patient in the dataset, mean SIS score for all patients, as well as prevalence of social isolation by HIV status. To further explore differences in SIS prevalence and mean scores by HIV status, we graphed unadjusted odds ratios for isolation (SIS 4) for HIV+ vs. uninfected participants by age in 5 year brackets from 55–75 and over 75 (Figure 1).

We then examined relationships between SIS and time-to-outcomes using Cox multivariable regression models. Initially, we stratified Cox regressions by HIV status; however, we noted that point estimates and effect sizes for HIV+ and uninfected groups in these analyses were very similar. We therefore created a single combined multivariable model with all subjects using the same independent variables from the stratified analysis and an HIV interaction term. The interaction tests for HIV*SIS were non-significant in all combined analyses (for hospital admission HR=0.82, 95% CI= 0.63–1.06; for mortality HR=0.77, 95% CI= 0.55–1.09). We therefore concluded that the effects of SIS on each group (HIV+ and uninfected) were not significantly different and present results of the combined Cox regressions. Finally, we used the variance of inflation test to ensure there was no collinearity between predictor variables. All regressions were performed with age, race, income, HIV status, number of comorbidities, depression, and alcohol abuse as covariates. All analyses were performed using SAS version 9.2.

Results

Complete data were available for 1,836 Veterans aged 55 or older. Ages ranged from 55–91 years (mean=61); 54% were uninfected and 46% were HIV+; 99% were male; 68% were non-white and/or Hispanic; 76% reported an annual income of less than $25,000 (Table 1). Most patients (72%) had 1 or more comorbid condition and most patients screened negative for depression (76%) and alcohol abuse (75%).

Social Isolation Scores (SIS) for the entire sample ranged from 0–8 with a mean of 3.88 (Std dev 1.22). We also calculated SIS for HIV+ and uninfected patients separately (Table 2). As shown in Table 2, mean scores for 5 out of 8 SIS components were higher for HIV+ patients; however, only 2 of these (number of friends and family and relationship status) were significantly different. The overall mean SIS for HIV+ patients (3.99) was significantly higher than for uninfected patients (3.80; p<0.001) and the odds of being isolated were significantly higher for HIV+ patients in all age brackets (except 60–64) with a trend towards increasing odds of isolation with increasing age (Figure 1). The overall prevalence of isolation (SIS 4) was also greater for HIV+ patients (59%) than uninfected patients (51%; p<.001).

With respect to incident hospitalization, 805 Veterans (43%) had at least one admission to a VA Medical Center between 2002 and 2008 (Table 1). Overall, incidence of hospitalization was higher in HIV+ patients (113 per 1000 person-years) compared to uninfected patients (70 per 1000 person-years; p<.001) and mean time-to-admission was shorter in HIV+ patients compared to uninfected patients (1.8 years vs. 2.2 years; p=.001). After adjusting for age, race/ethnicity, income, number of comorbidities, depression, substance abuse, and HIV status, isolation was independently associated with increased risk of incident hospitalization (HR=1.25, 95% CI=1.09–1.42) in combined analyses of HIV+ and uninfected patients (Table 3).

Similar to incident hospitalization, we found that incidence of mortality was higher for HIV + patients in our cohort (56 per 1000 person-years) than for uninfected patients (33 per 1000 person-years; p-value p<.001) and time to death was shorter for HIV+ compared to uninfected patients (3.9 years vs. 4.8 years, p-value p<.001). After adjusting for age, race/ethnicity, income, number of comorbidities, depression, substance abuse, and HIV status, isolation was independently associated with increased risk of all-cause mortality during the study period (HR=1.28, 95% CI=1.06–1.54) in combined analyses of HIV+ and uninfected patients (Table 3 and Figure 2).

Discussion

We found that while social isolation has similar effects on hospitalization and death for both HIV+ and uninfected individuals, those with HIV are at substantially higher risk of being socially isolated. While the effects of social isolation on mortality have been well-documented among older adults,[32] ours is the first study to include a large number of older HIV+ individuals. Additionally, our study presents novel findings on the effects of social isolation on acute care utilization (incident hospitalization) in this population and suggests a need to reframe current paradigms about hospitalization in HIV+ older adults. Existing studies of hospitalization in HIV+ patients focus on acute presentations or specific complications of HIV infection[33] but, in the current era of potent anti-retroviral therapies, HIV+ patients are frequently admitted for (and die from) chronic conditions that characterize the aging population as a whole.[34] Rather than focusing on HIV-related comorbidities, our findings suggest a need to understand aging HIV+ patients' risks for hospitalization and mortality in the broader context of their social lives and to increase preventative efforts for those with low social support. While we found that social isolation affects these outcomes for both HIV+ and uninfected patients in our cohort, our finding that the prevalence of social isolation is higher among HIV+ older adults, particularly at older ages, underscores the need to prioritize such efforts for this population.

Our findings that social isolation is more prevalent among HIV+ compared to uninfected older adults with increasing difference by age (figure 1) may be explained by several factors. First, older adults with HIV are significantly more economically and politically marginalized than uninfected counterparts at all ages which may predispose them to social isolation.[35,36] Second, it may be that increased stress levels associated with long-term HIV survival[37] and intensified geriatric syndromes in HIV+ patients such as cognitive impairment further inhibit their ability to establish and maintain social ties.[38] Third, low social support itself is a predictor for delay in HIV testing[39] and treatment[40] thus placing older, more isolated individuals at risk for worsening health and compounding isolation.[41] Fourth, many older adults with HIV experience a heightened sense of loneliness which may lead to anxiety, depression, and further withdrawal from social networks that can have protective effects on isolation.[42, 43] Moreover, the relatively young age for half of our sample (53% under age 60) likely attenuates the overall difference in prevalence of isolation seen between HIV+ (59%) and uninfected in this study (51%); this overall difference seem likely to increase as this population continues to age. Finally, given recent research showing important effects of loneliness on overall health,[44, 45] disability and mortality,[46] our findings underscore the need to study overlapping effects of social isolation and loneliness for aging populations.

Our findings also have several important health policy implications. First, our study focused on patients in the VA system for who access to care is not an issue; the health effects and associated costs of isolation may be even greater for patients outside this system. Second, while the number of older, HIV+ patients is rising, the number of providers in HIV medicine and geriatrics remains very small.[47] Thus, efforts to address social isolation in older, HIV+

adults will also need to engage hospitalists, emergency medicine physicians, and others in acute care specialties as well as leverage non-physician resources such as case management and community-based organizations.[48] Third, there is also growing evidence that interventions to address social isolation through activities such as support groups, social activities, home visits, and Internet engagement can reduce isolation in older adults.[49] While these interventions will have associated costs in terms of time, effort, and funding, they may be less expensive than high rates of acute care utilization and may result in better outcomes as well. Fourth, socio-economic status likely plays an important role in mediating social isolation as well as outcomes we report. While further study is needed to explore this relationship as well as possible effects on overall quality of life, we recommend that clinicians prioritize screening for social isolation among their most vulnerable patients first: the oldest and poorest with the worst quality of life may be most likely to be clinically affected by social isolation. Finally, as HIV+ individuals age, high levels of social isolation may place additional strain on an over-burdened system of nursing homes skilled nursing facilities.[50, 51] Previous studies have shown that living alone[52,53], fewer family contacts,[53, 54] and fewer non-kin social supports[52] are all correlated with NH placement; however, a more comprehensive assessment of isolation factors such as those contained in our SIS has not been studied. This is an important area for future aging research with a specific focus needed for HIV+ patients given their increased risk for isolation as they age.

Our study has several limitations. First, this is a longitudinal study using observational data so we cannot make inferences about causality between social isolation and inpatient admission or mortality. Second, we used data from baseline surveys to create our social isolation score and thus considered components of this measure to have "fixed effects" on overall social isolation. Third, we did not adjust for severity of illness in our final analysis because when we included scores from a validated HIV morbidity and mortality prediction tool (the VACS Risk Index)[55] in our models, we found that differences in our outcomes of interest were no longer significant. Given that social isolation may well mediate poor disease control and overall severity of illness,[56] we felt that inclusion of these risk index scores in our models would be over-adjustment. Indeed, the causal pathways between social isolation and outcomes remain unknown and represent an important area for future research. Fourth, while we carefully selected items for our Social Isolation Scale based on current literature on this topic and tested for construct validity, we did not perform more formal psychometric testing for internal and external validity. Our scale also differs from one of the most rigorously-validated instruments to assess social isolation (the Lubben Social Network Scale or LSNS-6 which focuses on closeness and redundancy of social contacts among family and friends) in that our score incorporates forms of social engagement beyond family and friends such as community volunteering, self-help groups, and religious activity which are not captured in the LSNS-6. Finally, our sample of Veterans is predominantly male and non-white so our results may not be generalizable to women and whites.

In conclusion, we found that social isolation is associated with increased risk of hospitalization and death among both HIV+ and uninfected older Veterans. Despite similar effects in both groups, the population level impact of social isolation may be even greater in those who are HIV+ because of the higher prevalence of social isolation, particularly among the oldest patients. As the "graying" of HIV+ population is projected to accelerate in the coming decades, a broader understanding of social isolation and the application of geriatric principles of inpatient care for this population is needed.

Acknowledgments

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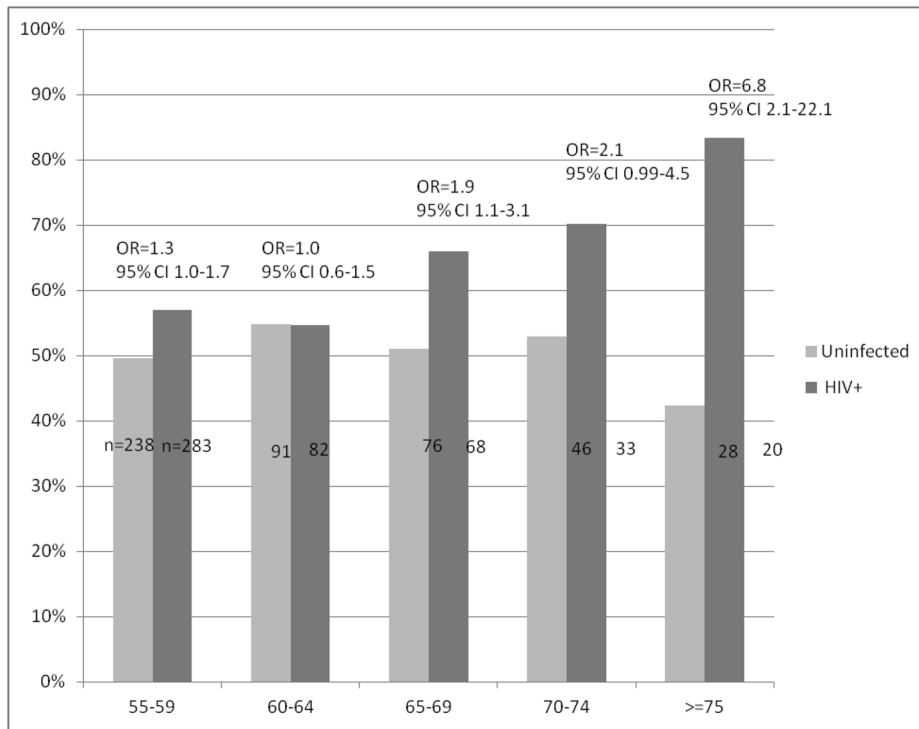
Figure 1. Percent of Veterans Isolated (SIS ≥ 4) by Age and HIV Status
* Odds ratios are unadjusted and demonstrate the likelihood of isolation (SIS ≥ 4) for HIV+ vs. uninfected patientsin each age bracket
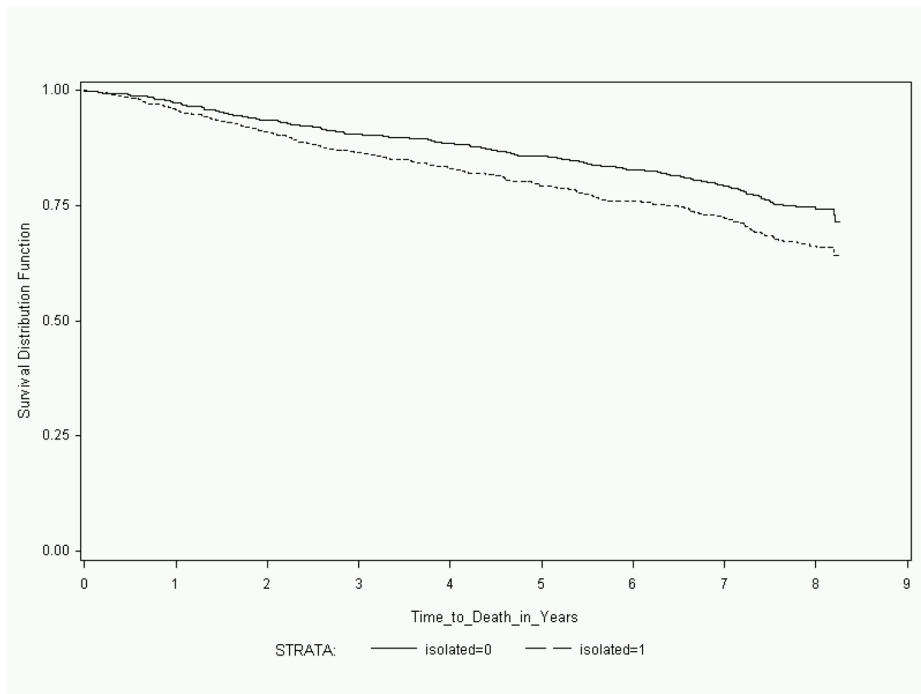
Figure 2.
Survival Analysis for Socially-Isolated vs. Non-Isolated Veterans

Table 1

Patient Characteristics

N=1836	Overall		HIV +		Uninfected		p-value
	No.	%	No.	%	No.	%	
Demographics							
Age							<0.01
55–59	977	53	497	59	480	49	
60–64	316	17	150	18	166	17	
65–69	252	14	103	12	149	15	
70–74	134	7	47	6	87	9	
75	90	5	24	3	66	7	
Race / ethnicity							
Non-White and/or Hispanic	1244	68	599	71	645	65	0.01
White / non-Hispanic	592	32	248	29	344	35	
Reported household income *							
<$25,000	1304	71	654	77	650	66	<0.01
$25, 000	438	24	160	19	278	19	
Clinical Characteristics							
Beck Depression Inventory							0.05
Negative screen	1401	76	628	74	773	78	
Positive screen	435	24	219	26	216	22	
Alcohol Abuse							0.33
Negative screen	462	25	643	76	731	74	
Positive screen	1374	75	204	24	258	26	
Comorbidities **							
Hypertension	999	54	330	38	669	67	<0.01
Dyslipidemia	572	31	179	21	393	39	<0.01
Diabetes	570	25	149	17	321	32	<0.01
Hepatitis C	327	18	231	27	96	10	<0.01
Coronary Artery Disease	237	13	73	8	164	16	<0.01

N=1836	Overall		HIV +		Uninfected		p-value
	No.	%	No.	%	No.	%	
Number of Comorbidities							<0.01
0	523	28	317	37	206	21	
1	696	37	318	37	378	38	
2	485	26	183	21	302	30	
3–5	155	8	42	5	113	11	
Hospitalizations							<0.01
0	1031	56	422	50	609	62	
1	341	19	177	21	164	17	
2–4	327	18	177	21	150	15	
5–7	76	4	43	5	33	3	
>7	54	3	28	3	26	3	

*
missing data for 94 (5%)

**
most frequent comorbidities by ICD-9 codes at time of VACS 8 enrollment

Table 2

Components for Social Isolation Scale

Total N=1836	All No.	%	HIV+ No.	%	Uninfected No.	%	Social Isolation Score (p-value)
Visits from Close Family							
Less than once a month	324	17	155	18	169	17	1
A few times a week to monthly	1037	56	587	58	550	66	0.5
Daily	475	26	205	24	270	27	0
Mean Score	0.46		0.47		0.45		(0.16)
Visits from Close Friends							
Less than once a month	393	21	166	20	227	23	1
A few times a week to monthly	951	52	426	50	525	53	0.5
Daily	492	27	255	30	237	24	0
Mean Score	0.47		0.45		0.49		(<0.01)
Number of Close Family or Friends							
None	183	10	100	12	83	8	1
One	200	11	104	12	96	10	0.5
More than one	1453	79	643	76	810	82	0
Mean Score	0.15		0.18		0.13		(<0.01)
Use of Self-help or Support Group in last year							
No	1430	78	640	76	790	80	1
Yes	406	22	207	24	199	20	0
Mean Score	0.78		0.76		0.80		(0.03)
Volunteer Work or Involvement with a Community Organization							
Little or none of the time	1181	64	515	61	666	67	1
Some or a good bit of the time	387	21	197	23	190	19	0.5
Most or all of the time	268	15	135	16	133	14	0
Mean Score	0.75		0.72		0.77		(<0.01)
Frequency of Attendance to Religious Events							

Total N=1836		All		HIV+		Uninfected		Social Isolation Score (p-value)
		No.	%	No.	%	No.	%	
Never		477	26	231	27	246	25	1
< twice yearly to 2–3 times a month		969	53	443	52	526	53	0.5
Every week to every day		390	21	173	20	217	22	0
	Mean Score		0.52		0.53		0.51	0.22
Relationship Status								
Single (incl. separated, divorced, etc)		1257	68	683	81	574	58	1
Married or living with partner		579	32	164	19	415	42	0
	Mean Score		0.68		0.81		0.58	(<0.01)
Living Alone								
Yes		115	6	60	7	55	6	1
No		1721	94	787	93	934	94	0
	Mean Score		0.06		0.07		0.06	0.18
Mean Social Isolation Scores			3.88		3.99		3.80	<0.001

Table 3

Effects of Social Isolation Score (SIS) on Inpatient Admission and All-cause Mortality

Effects of Social Isolation Score (SIS) on:	N=1836	
	Hazard Ratio	**(95% CI)**
Inpatient admission during study period		
SIS 4	1.25	1.09 – 1.42
HIV +	1.67	1.46 – 1.91
Age (continuous, per year increase)	1.01	1.00 – 1.02
Number of Table 1 comorbidities (continuous, per unit increase)	1.33	1.24 – 1.42
Non-white race/ethnicity	1.44	1.24 – 1.67
Income <$25,000 / year	1.57	1.34 – 1.86
Depression screen +	1.13	0.97 – 1.32
Alcohol abuse screen +	0.98	0.84 – 1.14
Risk of death during study period		
SIS 4	1.28	1.06 – 1.54
HIV +	2.02	1.67 – 2.46
Age (continuous, per year increase)	1.05	1.04 – 1.07
Number of Table 1 comorbidities (continuous, per unit increase)	1.13	1.03 – 1.25
Non-white race/ethnicity	1.25	1.02 – 1.53
Income <$25,000 / year	1.38	1.08 – 1.77
Depression screen +	1.18	0.95 – 1.46
Alcohol abuse screen +	1.17	0.94 – 1.46

[*] Hazard Ratios are adjusted for all variables listed above