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Geriatric Assessments and Association with VACS index among HIV-Infected Older Adults in San Francisco

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Abstract

Objectives—To perform geriatric assessments in older HIV-infected adults in San Francisco and examine the association with age and the Veterans Aging Cohort Study (VACS) index scores.

Methods—A cross-sectional study was conducted from 2012-2014 among HIV-infected patients ≥ 50 years at two San Francisco-based HIV clinics. We evaluated four health domains: 1) physical health and function (Activities of Daily Living [ADL], Instrumental ADL [IADL], falls, gait speed, 2) social support (physical and perceived support, loneliness), 3) mental health (depression, anxiety, post-traumatic stress disorder) and cognition, and 4) behavioral and general health (antiretroviral adherence and quality of life). Contingency table and rank-sum analyses examined associations between these domains with age and VACS index scores.

Results—359 patients completed assessments (median age 57; 85% male; 57% Caucasian; 72% >high school education). On functional assessment, 39% reported dependence with ≥1 IADL, and 40% reported falls in the previous year. 58% experienced loneliness, 60% the lowest levels of perceived social support, 55% depression, and 12% PTSD. 40% had possible mild cognitive impairment. 30% reported poor or fair quality of life. Older age was associated with lower CD4

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counts, balance problems, slower gait, lower anxiety, poorer general health, and higher antiretroviral adherence. VACS Index score was associated with dependence in ≥1 IADL and antiretroviral adherence.

Conclusion—In a large sample of older HIV-infected adults, multiple significant aging-related conditions were identified. Integrating geriatric assessment tools into HIV/AIDS clinical care may help target interventions to optimize clinical care and quality of life for older HIV-infected individuals.

Keywords

functional status; geriatrics; HIV; mental health; social support

INTRODUCTION

In the United States the life expectancy of people with HIV-infection has increased, an effect largely mediated by the use of effective antiretroviral therapy, leading to durable reductions in HIV-related morbidity and mortality.[1] Over 50% of all HIV-infected adults in the United States will be 50 years of age or older by the end of 2015,[2] and in cities such as San Francisco, this threshold was reached much earlier.[3,4] Older HIV-infected adults frequently face multimorbidity, polypharmacy and may experience functional impairment and geriatric conditions, such as frailty, at an earlier age than the traditional geriatric cut off of age 65.[5,6] In addition, older HIV-infected adults face a high burden of psychiatric co-morbidities (e.g., depressive and neurocognitive disorders) and social issues (e.g., isolation, loneliness), which can contribute to poor clinical outcomes and highlight the need for tailored clinical and social services.[7,8,9] As a result, new strategies are required for providing integrated HIV and geriatric care to meet the long-term and complex needs of older adults with HIV.

Studies have shown that geriatric assessments, such as frailty and functional status, performed in middle aged individuals with HIV infection may predict outcomes, such as mortality, and are associated with quality of life - similar to what has been reported in older HIV-uninfected populations.[10-12] Utilizing geriatric assessments in combination with traditional HIV assessments in HIV care settings could help providers address the medical complexity experienced by older HIV-infected adults and identify the most vulnerable patients in need of additional intervention. Other tools such as the Veterans Aging Cohort Study (VACS) Index, a prognostic tool based on both HIV and comorbid condition markers, can also be used to identify adults at the highest risk of morbidity and mortality.[13] The VACS index has been associated with fragility fractures, cognitive impairment, and exercise capacity.[13-16] However, less is known about its association with other geriatric conditions, such as functional status.[17]

The objective of this study, known as the “Silver Project,” was to perform a comprehensive assessment of the physical, cognitive, psychological, social and behavioral health in a large sample of HIV-positive older adults in the outpatient clinical setting. We used a combination of geriatric and other assessments tailored to address psychosocial issues that have been described in older HIV-positive adults. We hypothesized that both age and VACS index would be associated with geriatric conditions identified from the assessments.

METHODS

Patients and setting

The “Silver Project” was a demonstration project designed to enhance the routine care provided in HIV medical home settings to the growing population of persons 50 years and older living with HIV/AIDS in San Francisco. The project was conducted at two clinical sites: 1) 360: the Positive Care Center at the University of California San Francisco (UCSF 360), an outpatient HIV practice that serves privately insured and marginally insured HIV-positive individuals and 2) the UCSF Positive Health Program (Ward 86) located at San Francisco General Hospital, a city-funded hospital-based safety net clinic serving publicly insured, marginally insured and uninsured HIV-positive individuals. Both clinics have a long history of providing multidisciplinary models of care.

The inclusion criteria were being an HIV-infected patient at one of the two clinical sites, age 50 or older, and English speaking. Between December 2012 and January 2014, eligible patients were consecutively enrolled via self-referral from fliers and provider referrals. Patients received a Safeway gift card for participation in the project. Study protocols at both sites were approved by the UCSF Committee on Human Research.

Geriatric and other assessments

Assessments included questions on a patient's physical, social, mental, and cognitive health as well as general health questions and were chosen based on a literature review and in discussion with experts in HIV and geriatric medicine. A combination of traditional geriatric assessments and assessments tailored to issues faced by aging HIV-positive patients were administered. These included questions on antiretroviral adherence, psychiatric comorbidities like post-traumatic stress disorder (PTSD) related to the stresses of the loss of many friends and partners, and social issues such as social isolation and perceived social support [8,18-20] **(Table 1)**. Psychiatric and social assessments were specifically chosen if they had been previously used in HIV-positive populations. Functional status was measured by self-report of activities of daily living (ADL) and instrumental activities of daily living (IADL). A 4-meter walk test was also conducted as an objective measure of physical performance. All participants had a visit with either a medical assistant (two medical assistants at each clinic), nurse (one RN at UCSF 360), or volunteer pre-medical student (two students at UCSF 360) in which assessments were conducted (**Figure 1**). Participants had the option of self-administered surveys performed on a tablet or computer or having the questions read out loud by study staff. Even if the participant chose to self-administer questions, the medical assistant or other team member was available to clarify any questions. The cognitive assessment was performed on paper and administered by a Silver Project team member. All team members who conducted study visits were trained in how to conduct the cognitive assessment and 4-meter walk test, both of which were supervised by a RN (author RZ) at UCSF 360 or by a NP with re-assessment by a MD (author MG) at Ward 86. Study participants also had chart reviews performed to obtain medication data and to ascertain the lab values which were used in calculating the VACS Index, using labs which occurred within 6 months of the visit date, an interval which has been used in other studies[21]. The majority of labs, especially at the UCSF 360 site, were within a one month window. The VACS index

was originally validated as a prognostic tool in HIV-infected individuals to predict all-cause mortality risk incorporating age, sex, race, routinely monitored indicators of HIV disease (CD4 count and HIV-1 RNA), and general indicators of organ system injury [hemoglobin, liver fibrosis (Fib4), renal function (eGFR), and Hepatitis C status] in a weighted manner.[13] The VACS index has subsequently been shown to predict other outcomes such as hospitalization and is associated with fragility fractures and markers of inflammation.[16,21,22]

All data were captured or manually entered into an electronic database. To improve care coordination and follow up, data were also entered directly into the electronic medical record and the results forwarded to primary care providers for review. Patients with abnormal findings on assessment were reviewed by multidisciplinary care teams at their respective clinical sites with primary care providers present whenever possible. Recommendations from the multidisciplinary care teams were distributed to primary care providers for further action (**Figure 1).**

Statistical Analysis

Contingency table analyses compared the distribution of participant characteristics and assessment results by age group, and chi-square or Fisher exact tests measured two-sided statistical significance. Results of each assessment were categorized into clinically meaningful categories (**Table 1**). For the medication data and VACS index analyses, the non-parametric rank-sum statistics based on Wilcoxon scores and the Kruskal Wallis exact p-value measured the association between the categorical age groups or VACS Index scores and the continuous number of medications or assessment results. All statistical analyses were performed using SAS® software, version 9.3.[23]

RESULTS

A total of 359 patients underwent assessments, 162 from the UCSF 360 site and 197 from the UCSF/SFGH Ward 86 site. Overall, 85% of patients identified as male, 66% reported their sexual orientation as homosexual, and close to 60% were White (**Table 2**). Patients were highly educated with 72% having completed at least some college education; however, half were receiving disability and over half were making less than $20,000 annual income. Of those who knew when they first tested HIV-positive, the majority (85%) had been infected with HIV for 10 or more years. Overall, with regards to specific HIV disease markers, patients generally had well controlled HIV: 82% had an undetectable viral load and half had a CD4 T cell count of at least 500 cells/mm^3.

The median age of the participants was 56 (range 50-80). Two-thirds (68%) of participants were 50-59 years old (**Table 2**) and one-third were age 60 or older. Compared to those in the age group of 50-59 years, patients age 60 years or older were more likely to be White (p=0.001), have graduate level education (p=0.004), and were more likely to be retired (p<0.001). Patients age 60 or older were more likely to have an annual income of $40,000-80,000 with fewer making >80,000 dollars a year (p=0.02). Although no difference in reported alcohol use by age group were seen, a trend existed towards lower binge drinking rates in the older age group (21% 60-80 years vs 31% 50-59 years, p=0.06). Similarly, a trend towards less methamphetamine use was seen in the older age group (9% vs 16%,

p=0.08). Patients in the older age group were more likely to have CD4 counts below 500 cells/mm^3 than those age 50-59 years (p=0.0003).

Geriatric and other assessments

Overall, study participants were found to be experiencing a significant burden of aging related conditions across domains, with 41% reporting a fall in the past year, close to 60% endorsing at least mild symptoms of loneliness, 50% reporting low social support and 34% meeting criteria for possible mild cognitive impairment (**Table 3**).

In the physical domain, patients in the older age group (60 or older) had higher frequencies of problems with balance (47% vs 33% in the 50-59 year group; p=0.01; **Table 3**). Frequencies of ADL dependencies were similar in the two groups (12.5% vs 12%), but patients in the older age group had lower frequencies of IADL dependencies that were of borderline significance (32% vs 42%; p=0.05). In addition, patients age 60 or older had slower gait speed compared to those aged 50-59 (p=0.03). Patients in the older age group had lower anxiety symptoms (p=0.02). Patients in the older age groups also reported better adherence to antiretroviral agents using a 5-point Likert scale (p=0.02). Although more patients in the older age group reported “good” health related quality of life, fewer reported “very good” or “excellent” health related quality of life than those aged 50-59 years (P=0.04).

When the associations between the VACS index scores (which indicates higher mortality risk) and specific assessments were examined, greater dependence with IADLs was associated with higher VACS scores (p=0.003; **Table 4**). Across other domains, including the social and cognitive and mental health domains, no statistically significant associations between specific assessments and the VACS index were seen. Better self-reported adherence was associated with lower VACS index scores (p=0.003).

DISCUSSION

This is one of the first studies to have evaluated a wide range of geriatric assessments among HIV-infected individuals in the outpatient clinical setting and provides a comprehensive overview of the health needs faced by the aging HIV-positive population. We observed a high burden of clinically-concerning deficits in older HIV-infected adults across multiple domains, including functional impairment, falls, depression and social isolation. Our study results are similar to others that have reported evidence of clinical aging in middle-aged HIV-infected adults,[6,24,25] but ours represents the most comprehensive evaluation of these factors in a large sample. Our findings highlight the importance of systematically providing functional, social and mental health support for the aging HIV-infected population.

Our results add to the growing body of work on understanding functional deficits in older HIV-infected adults. Specifically, 41% of our participants reported at least one fall in the previous year which is similar to a previously published fall rate of 30%.[26] Although little is known about reasons for the high prevalence of falls in this population, the clinical implications may be significant, especially considering the higher rates of osteoporosis in HIV-infected populations. Additionally, clinicians can take practical steps, such as

identifying and treating inciting factors like peripheral neuropathy, which could help prevent falls.[27] Our findings aide in the understanding of functional impairment in the current treatment era, and are consistent with other studies that have suggested there is a significant burden among older adults who need assistance with daily tasks, especially tasks like managing medications and shopping.[28,29]

Our study also contributes to the literature regarding the prevalence of mental health conditions in aging HIV-positive populations, supporting studies such as the Research on Older Adults with HIV (ROAH) which reported high rates of depression[9], and also adds to our understanding about other mental health conditions such as anxiety and PTSD. Our study is one of the first that examined PTSD in older adults, specifically in the context of patients who are long term survivors of HIV, a concern that has frequently been raised by patient advocacy groups.[18] Although not as common as depression and anxiety, 12.5% of our patients reported PTSD type symptoms which lends support for pursing further research in this area and in HIV survivorship.[30] Depression has been shown to be linked to loneliness in HIV-infected adults[31] and our study adds to the existing knowledge about social support and perception of it in this population.

By including study participants in their fifties as well as those 60 and over, we were able to characterize differences between younger (ages 50-59) patients and those with ages closer to more traditional geriatric cut points (ages 60-80). Consistent with general geriatrics knowledge some measures of physical function domain were more common with older age, such as problems with balance and slower gait speed.[32] Although the prevalence of falls was not different in the two groups, adults age 60 or older reported more problems with balance which could lead to an increased risk of falls. Interestingly, there was a borderline statistically significant result of the older age group having less dependence with IADLs, the reason for which is not entirely clear and warrants more investigation. Older adults also had lower rates of anxiety, which may be consistent with the concept of resiliency shown among older adults.[33] Finally, prior studies have reported how older (age ≥50) HIV+ adults, when compared to younger adults (≤50), were more likely to have undetectable viral loads,[34] largely as a result of improved adherence. Here, we present data that this trend holds true across older adults and is supported by our finding that adults age 60 or older report better antiretroviral adherence rates than their younger counterparts.

We also examined the association of the VACS Index, which has been correlated with measures of inflammation,[22] low lean mass,[35] and neurocognitive performance,[15] to our geriatric assessments. Interestingly, functional dependence, defined as needing assistance in one or more IADLs, was associated with higher VACS index scores. This is one of the first reports of an association between the VACS index score and functional impairment and adds to the growing data on the utility of the VACS index as a prognostic tool.[15,17,35] Although we did not see an association with cognitive impairment, a possible explanation might be the differences in assessment of cognitive impairment as prior studies used more detailed neuropsychological testing[15] than the MOCA which was used in this study. We also observed that lower VACS index scores were associated with better medication adherence; since the VACS index incorporates HIV viral loads, which are expected to reflect adherence, this might be expected.

Our results are subject to several limitations. First, this was a cross-sectional survey and we did not measure changes in these assessments over time. Second, our study was predominately male and based in one city and thus these findings may not be generalizable to HIV-infected women or those living outside of San Francisco. However, we included participants from two different clinical sites with a different socioeconomic mix and the patients in this study reflect the overall demographics of the larger population in San Francisco living with HIV.[3] Third, we did not collect information on health insurance and could not examine the associations between insurance type and health assessments. Fourth, since our study was conducted among patients in outpatient settings, we did not include patients not engaged in HIV care or patients residing in long-term care facilities. Additionally, the majority of patients were infected with HIV for more than 10 years, and results may not extend to more recently infected older adults. Prior research supports this as different patterns in comorbidities have been identified in those who have aged with HIV compared to those who are infected with HIV at older ages.[36] Work examining the utility of these assessments in women and other populations of HIV-positive adults is needed. Another possible limitation is the use of self-reported functional status, as self-report of functional status may be predictive of outcomes such as mortality in HIV-negative populations, [37] but only objective measures of physical function have been studied with outcomes in HIV-positive populations.[10,11] Although we included adherence to antiretroviral medications and the association between polypharmacy and age, we did not examine adherence to other chronic medications or perform a more detailed evaluation of types of other chronic medications, both of which are important issue for the aging HIV-positive population. While our findings add support to current guidelines recommending integration of geriatric and HIV medicine principles,[38] next steps should include developing interventions to address the complex medical needs we found and understanding if the same interventions designed to work in older HIV negative populations have utility for the aging HIV population.

In this report we described comprehensive results from geriatric assessments which examined different health domains in a large sample of older HIV-infected individuals. Our data add to the growing body of evidence that older HIV-infected adults are facing increasing medical, psychiatric and social complexity and help to provide insight into how this complexity varies in different age groups of older adults. Our findings also expand the use of the VACS index as a prognostic tool. Altogether, our findings highlight the importance of taking a comprehensive approach to identify health issues facing older HIV-positive patients and the critical need to develop interventions to improve the quality of life and address the multifaceted needs of older HIV-infected patients.

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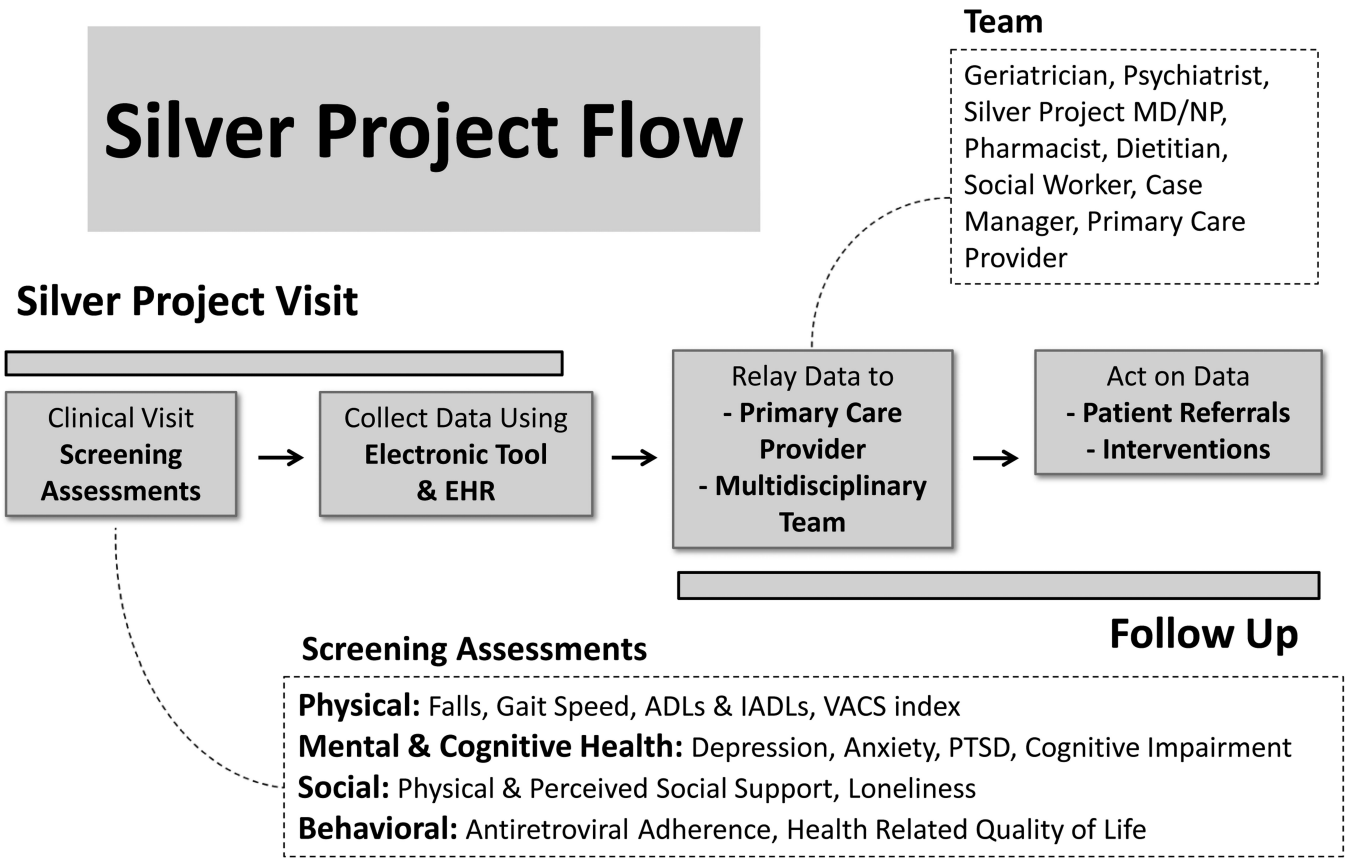

Figure 1.
The Silver Project protocol overview.

Table 1

Summary of assessments categorized by clinical domains, Silver Project, San Francisco.[a]

Physical Health Domain:	Mental Health and Cognitive Domains:
Falls and balance problems: Self-report of fall(s) in the past year *-Analyzed as number participants reporting ≥1 fall in past year* Self-report of balance problem, independent of fall status *-Analyzed as number of participants who reported a problem with balance*	**Depression:** PHQ-9 (Patient Health Questionnaire-9)[4,5], with scores from 0- 27, with higher scores indicating higher degree depressive symptoms *-Analyzed using standard cut-points of mild (5-9), moderate (10-14), severe (15-27) depressive symptoms*
Functional status: Activities of Daily Living (ADLs) – self report of ADLs such as dressing and bathing based on Katz Index[1], with scores from 0-6, with higher scores indicating higher dependence *-Analyzed as dependent with ≥1 ADL (score ≥1)*	**Anxiety:** GAD-7 (Generalized Anxiety Disorder 7)[6], with scores from 0-21, with higher scores indicating higher degree of anxiety symptoms *-Analyzed as mild (5-9, moderate (10-14), severe (15-21) anxiety symptoms*
Instrumental Activities of Daily Living (IADLs) – self report of IADLs such as cooking and shopping based on Lawton Scale[2], with scores from 0-8, with higher scores indicating higher independence *-Analyzed as dependent with ≥1 IADL (score ≤7)* **Gait Speed:** 4 meter walk (time in seconds) *-Analyzed using the 4 meter walk time categories from the Short Physical Performance Battery[3]*	**Post-Traumatic Stress Disorder (PTSD):** Breslau 7 item PTSD screen, with scores from 0-7 with higher scores indicating more PTSD symptoms[7] *-Analyzed as score ≥4 indicative of PTSD* **Cognitive:** Montreal Cognitive Assessment (MOCA): with scores from 0-30[8] *-Analyzed as score <26 indicating possible mild cognitive* impairment
Social Domain:	**Behavioral & General Health Domain:**
Physical social support: Lubben Social Network Scale (LSNS-6), with scores from 0-30, with higher scores indicating more social networks/support[9] *-Analyzed as scores ≤12 indicative of low support* **Perception of social support[b]:** Social Provisions Scale, with scores from 0-48, with higher scores indicating lower perceived social support[10] *-Analyzed as mild (36-47), moderate (48-53), severe (54-60) perception of low social support* **Loneliness[c]:** UCLA 8 item Loneliness Scale, with scores from 8-32, with higher scores indicating more feelings of loneliness (any score ≥17)[11,12] *-Analyzed as mild (17-20), moderate (21-24), severe (25-32) feelings of loneliness*	**Adherence to Antiretroviral Medication:** Self-report of adherence on five point Likert Scale[13] (poor, fair, good, very good, excellent) *-Analyzed by categorical response* **Health Related Quality of Life:** Self-report of General Health on five point Likert Scale[14] (poor, fair, good, very good, excellent) *-Analyzed by categorical response*

[a] All references for assessments utilized are listed below.

[b] 12 item scale instead of original 24 item scale was used and score categories based on number of SD from mean scores in communication with original authors of scale.

[c] Mean score 18 (SD 5), categories generated based on unpublished results in communication with original author.

Table 2

Participant characteristics, overall and by age group, Silver Project, San Francisco.

Characteristic	Age group			p-value[a]
	Overall N (%) 359 (100)	50-59 years N (%) 244 (68)	60-80 years N (%) 115 (32)	
Gender				0.82
Male	305 (85.0)	205 (84.0)	100 (87.0)	
Female	45 (12.5)	32 (13.1)	13 (11.3)	
Male to female transgender	6 (1.7)	5 (2.1)	1 (0.9)	
Female to male transgender	3 (0.9)	2 (0.8)	1 (0.9)	
Sexual orientation				0.12
Homosexual	234 (65.6)	150 (62.0)	84 (73.0)	
Heterosexual	80 (22.4)	63 (26.0)	17 (14.8)	
Bisexual	33 (9.2)	22 (6.2)	11 (3.1)	
Other	10 (2.8)	7 (2.9)	3 (2.6)	
Race/Ethnicity				
Latino	38 (10.7)	27 (11.2)	11 (9.7)	0.67
Black	107 (30.0)	78 (32.2)	29 (25.2)	0.18
White	204 (57.1)	124 (51.2)	80 (69.6)	**0.001**
Education				**0.004**
< High school	44 (12.3)	36 (14.8)	8 (7.0)	
High school or GED	58 (16.2)	41 (16.8)	17 (14.8)	
Some college/college degree	185 (51.5)	130 (53.3)	55 (47.8)	
Some graduate/graduate degree	72 (20.0)	37 (15.2)	35 (30.4)	
Employment status				**<0.0001**
Employed (full or part time)	60 (16.8)	46 (19.0)	14 (12.2)	
Unemployed	48 (13.5)	39 (16.1)	9 (7.8)	
Retired	55 (15.4)	11 (4.6)	44(38.3)	
Receiving disability	180 (50.4)	135 (55.8)	45 (39.1)	
Other	14 (3.9)	11 (4.6)	3 (2.3)	
Annual income				**0.02**
<$10,000	98 (29.3)	70 (30.6)	28 (26.4)	
$10,000-20,000	121 (36.1)	84 (36.7)	37 (34.9)	
$20,001-40,000	48 (14.3)	32 (14.0)	16 (15.1)	
$40,001-80,000	27 (8.1)	11 (4.8)	16 (15.1)	
>$80,000	41 (12.2)	32 (14.0)	9 (8.5)	
Current cigarette smoker[b]	109 (30.6)	79 (32.3)	30 (26.0)	0.20
Current alcohol use[c]	212 (59.4)	145 (59.7)	67 (58.8)	0.87
Binge drinking[d]	96 (27.8)	72 (31.0)	24 (21.2)	0.06

Characteristic	Age group			p-value[a]
	Overall N (%) 359 (100)	50-59 years N (%) 244 (68)	60-80 years N (%) 115 (32)	
Cocaine use[e]	42 (11.8)	27 (11.1)	15 (13.3)	0.56
Crack use[e]	37 (10.9)	28 (11.5)	11 (9.7)	0.62
Methamphetamine use[e]	48 (13.5)	38 (15.6)	10 (8.9)	0.08
> 10 years HIV-infected	262 (85.1)	179 (84.8)	83 (85.6)	0.87
CD4 T cell count (cells/mm^3)				**0.0003**
0-199	38 (10.9)	30 (12.7)	8 (7.1)	
200-349	63 (18.1)	30 (12.7)	33 (29.5)	
350-499	66 (19.0)	41 (17.4)	25 (22.3)	
≥500	181 (52.0)	135 (57.2)	46 (41.1)	
HIV viral load <40 copies/mL	292 (82.0)	193 (79.8)	99 (86.8)	0.10
Median (Interquartile range) number of medications (including antiretrovirals[f])	11.0 (8-15)	11.0 (7-14)	12.0 (8-16)	0.19[g]
Median (Interquartile range) number of antiretroviral[f] medications	3.0 (2-3)	3.0 (2-3)	3.0 (2-3)	0.80[g]

[a] Chi-square or Fisher's exact p-value for comparison between age groups (50-59 vs. 60 or older), statistically significant p-values are bolded.

[b] Defined as current smoking status of smoking cigarettes some or all days of the week.

[c] Defined as answering yes to at least occasional current use of alcohol.

[d] Defined as five or more standard drinks at one time in the past years for men or four or more standard drinks at one time in the past year for women.

[e] Defined as any use of cocaine, crack, methamphetamine in the past 30 days.

[f] Combination formularies counted as one.

[g] Wilcoxon rank sum and Kruskal-Wallis test of significance.

Table 3

Geriatric assessment results overall and by age group, Silver Project, San Francisco.

Geriatric Assessment[a]	Age group			p-value[b]
	Overall N (%) 359 (100)	50-59 years N (%) 244 (68)	60-80 years N (%) 115 (32)	
Physical Domain				
Fall in the past year	145 (40.7)	94 (38.5)	51 (45.5)	0.21
Problems with balance	134 (37.6)	81 (33.3)	53 (46.9)	**0.01**
Dependent in ≥1 Activity of Daily Living (ADL)	43 (12.2)	29 (12.0)	14 (12.5)	0.90
Dependent in ≥1 Instrumental Activity of Daily Living (IADL)	136 (38.9)	100 (42.4)	36 (31.6)	0.05
Gait speed 4 meter walk (seconds)				**0.03**
0.01-4.81	247 (70.0)	174 (72.5)	73 (64.6)	
4.82-6.20	75 (21.3)	51 (21.3)	24 (21.2)	
6.21-8.70	23 (6.5)	13 (5.4)	10 (8.9)	
8.71-18.99	8 (2.3)	2 (0.8)	6 (5.3)	
Social Domain				
Loneliness				0.35
None (<17)	150 (42.1)	95 (39.3)	55 (48.3)	
Mild (17-20)	85 (23.9)	59 (24.4)	26 (22.8)	
Moderate (21-24)	78 (22.0)	55 (22.7)	23 (20.2)	
Severe (25-32)	43 (12.1)	33 (13.6)	10 (8.8)	
Perceived social support				0.49
Normal (<36)	174 (50.0)	122 (51.7)	52 (46.4)	
Mild (36-47)	147 (42.2)	98 (41.5)	49 (43.8)	
Moderate (48-53)	27 (7.8)	16 (6.8)	11 (9.8)	
Low physical social support	180 (50.1)	120 (49.2)	59 (51.3)	0.71
Cognitive and Mental Health Domain				
Cognitive impairment	121 (33.7)	84 (34.4)	37 (32.2)	0.67
Depressive symptoms				0.72
None (<5)	161 (45.4)	105 (43.6)	56 (49.1)	
Mild (5-9)	99 (27.9)	69 (28.6)	30 (26.3)	
Moderate (10-14)	52 (14.7)	38 (15.8)	14 (12.3)	
Severe (15-27)	43 (12.1)	29 (12.0)	14 (12.3)	
Anxiety				**0.02**
Normal (<5)	179 (50.6)	110 (45.3)	69 (62.2)	
Mild (5-9)	108 (30.5)	84 (34.6)	24 (21.6)	
Moderate (10-14)	44 (12.4)	31 (12.8)	13 (11.7)	
Severe (15-21)	23 (6.5)	18 (7.4)	5 (4.5)	
PTSD symptoms	44 (12.5)	34 (14.2)	10 (9.0)	0.17

Geriatric Assessment[a]	Age group			p-value[b]
	Overall N (%) 359 (100)	50-59 years N (%) 244 (68)	60-80 years N (%) 115 (32)	
Behavioral and General Health Domain				
Self-rated general health				**0.04**
Poor	19 (5.3)	13 (5.4)	6 (5.3)	
Fair	87 (24.4)	62 (25.6)	25 (21.9)	
Good	114 (32.0)	65 (26.9)	49 (43.0)	
Very good	102 (28.7)	76 (31.4)	26 (22.8)	
Excellent	34 (9.6)	26 (10.7)	8 (7.0)	
Medication Adherence				**0.02**
Poor/fair	40 (11.2)	35 (14.6)	5 (4.4)	
Good/very good	116 (32.5)	78 (32.6)	38 (33.6)	
Excellent	196 (54.9)	126 (52.1)	70 (60.9)	

[a] Measurements for each outcome in the table are described in Table 1.

[b] P-value for comparison between age groups (50-59 vs. 60 or older), statistically significant p-values are bolded.

Table 4

Association of Veterans Aging Cohort Study (VACS) index score categories with geriatric assessments, Silver Project, San Francisco.

	VACS Score categories								
	< 35		35-49		50-69		≥70		p-value
	N	Mean or (%)	N	Mean or (%)	N	Mean or (%)	N	Mean or (%)	
Physical Domain									
Fall in the past year[a]	90	(40.5%)	30	(42.3%)	11	(34.4%)	11	(55.0%)	0.52
Activity of Daily Living[b]	221	0.21	71	0.28	31	0.35	19	0.47	0.27
Instrumental Activity of Daily Living[b]	219	7.12	70	6.87	32	6.41	18	6.11	**0.003**
Gait speed, 4 meter walk (seconds)[b]	222	4.41	69	4.67	32	4.69	19	4.89	0.20
Social Domain									
Loneliness[b]	221	18.05	72	18.35	32	16.84	20	18.35	0.59
Perceived social support[b]	216	36.53	70	36.20	32	34.97	19	35.45	0.65
Low physical social support[b]	224	13.04	72	13.03	32	12.25	20	12.00	0.92
Cognitive and Mental Health Domain									
Cognitive impairment[b]	224	26.33	72	25.86	32	25.66	20	25.45	0.67
Depressive symptoms[b]	223	6.76	72	7.22	31	6.39	18	8.94	0.73
Anxiety[b]	220	5.00	72	6.38	31	5.00	20	6.55	0.53
PTSD symptoms[b]	220	0.88	70	1.19	31	0.35	19	0.32	0.20
Behavioral and General Health Domain									
Self-rated general health[a]									0.44
Poor/fair	62	(27.8%)	21	(29.2%)	11	(34.4%)	8	(44.4%)	
Good	67	(30.0%)	27	(37.5%)	12	(37.5%)	5	(27.8%)	
Very good/excellent	94	(42.2%)	24	(33.3%)	9	(28.1%)	5	(27.8%)	
Medication Adherence[a]									**0.003**
Very poor/poor/fair	14	(6.3%)	15	(21.4%)	6	(18.8%)	5	(26.3%)	
Good/very good	74	(33.5%)	23	(32.9%)	7	(21.9%)	5	(26.3%)	
Excellent	133	(60.2%)	32	(45.7%)	19	(59.4%)	9	(47.4%)	

[a] Chi-square test of significance for categorical variables.

[b] Wilcoxon rank sum and Kruskal-Wallis test of significance for continuous variables. P-values <0.05 are bolded.