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East Tennessee State University

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Submitted in partial fulfillment of Honors

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Lauren Brooks, BS; Lamis Ibrahim, MD; Foster Levy, PhD; Jonathan Moorman, MD, PhD; Felix Sarubbi, MD

Division of Infectious Diseases, Department of Internal Medicine and Department of Biological Sciences, James H. Quillen VA Medical Center and East Tennessee State University, Johnson City, TN

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Brief Description:

Although the AIDS epidemic in America began approximately three decades ago, much remains to be learned about the epidemiology of human immunodeficiency virus (HIV) infections in rural America. This study compared profiles of HIV patients at the James H. Quillen Veterans Affairs Medical Center (VAMC) in Mountain Home, TN to those seen at a university-based community HIV care clinic (COM) in Johnson City, TN.

Key Points:

1. The typical patient demographic profile in the COM includes Caucasian males whose major risk factor for HIV infection is men having sex with men (MSM).

2. Compared to the COM, the VAMC patient profile was significantly older, more male, more heterosexual, more African-American, and had more users of cocaine and alcohol.

3. Co-infection with hepatitis C was significantly greater in the VAMC population in the univariate analysis. This is likely a reflection of the higher incidence of cocaine use among VAMC patients.

4. Two indicators of disease progression were tracked. Host CD4 cells increased from first to last clinic visit in both populations, but the rate of increase was significantly greater in COM patients. Viral loads showed significant and similar rates of decrease in both patient populations.

Key Words:

HIV; rural America; rural VAMC; co-morbidities; co-infections; habits posing potential health risks

In the United States, HIV was first described in 1981. At that time, HIV seemed to be localized to certain large urban areas with apparent sparing of persons in rural areas. However, as early as 1988, rural physicians noted that HIV/AIDS was spreading from urban to rural areas.[1] Regardless of where studies were conducted throughout rural America, one finding remained constant: HIV/AIDS spread to rural areas in "two 'waves.'" [2] The first wave consisted of individuals with HIV/AIDS who located from urban to rural areas to receive social support, especially from family, and/or to seek work, other educational opportunities, and even end-of-life support.[2-4] During the late 1980s, Southern Appalachia family, church, and community responses to a 32-year-old homosexual white man were unexpectedly and unpredictably kind. This community response was not uncommon but shared by a number of other patients, though certainly not all. However, this particular study cites family and community support as more important factors of preparing a community for HIV/AIDS than attempts at education.[3] By 1995, it was proposed that this "returning home" phenomenon may be universal, at least among homosexuals.[5] Whatever the reason, it is this phenomenon that was largely responsible for the first wave of AIDS in rural America.

The second, or "'*home grown*,'" wave in the United States is largely composed of individuals who became infected with HIV while living in rural areas.[2] Locally acquired infections tend to be transmitted mostly via sexual activity—especially heterosexually—, but other associated factors may include drug use and prevalence of sexually transmitted diseases.[1, 2, 6, 7] This home grown group largely consists of young, non-white women.[2, 4, 6]

While the spread of HIV/AIDS to rural areas was noted not long after the AIDS epidemic began, little research has been conducted on the "face" of HIV in rural America. As recently as five years ago, a study noted that “little information is available on the burden of HIV disease, including HIV infection without AIDS, in…rural communities.” [7] Because most of the research on HIV infection in rural America has focused on separate regions instead of the nation as a whole, it is nearly impossible to derive generalizations concerning the demographic characteristics associated with local rural HIV infections, as these infections tend to be highly region-specific. That is, not all rural areas are similar. For example, studies have been conducted on HIV/AIDS populations within the University of North Carolina Hospitals,[4] the Appalachian Region,[3, 7] the US-Mexico Border,[5, 7] the Mississippi Delta, the Southeast Region,[7] and an American Indian population in the rural Southwest.[8] A multi-state HIV/AIDS study including participants from rural areas and small cities in Georgia, Florida, South Carolina, and Delaware has also been conducted.[2] One reason these are all focused on the southern United States is that this region “accounts for the largest overall burden of [HIV/AIDS], particularly in rural areas.” [2] However, in addition to studies in this region, a study was conducted that focused on examining where HIV-infected people in America live and, specifically, how many live in rural America.[1] Regional variances are observed among these studies.

Although many community HIV/AIDS clinics in America adhere to standards of care, treatment of veterans with HIV/AIDS who seek care at a Veterans Affairs Medical Center is regulated by a number of protocols established by the Department of Veterans Affairs (VA). While the U.S. Armed Forces have tested all personnel on active duty for HIV/AIDS since 1985, and found that, for over two decades, incidence of HIV among military men and women has remained stably low, the VA “cares for >20,000 patients with HIV infection, providing >1 million outpatient clinic visits and 170,000 days of hospital care, making it the single largest provider of HIV care in the United States.” [9] As such, many early HIV-related clinics were started on VA campuses, and approximately 50,000 veterans with HIV/AIDS have been treated at a VA facility since 1981.[9]

In a study investigating the organization and management of HIV/AIDS care offered at VA facilities, representatives from 118 facilities (out of 138 facilities that had directly cared for at least one HIV/AIDS patient in the 1999 fiscal year) responded. Eighty-two percent of the sample was comprised of urban VA facilities, which parallels the fact that most veterans live in urban areas. These same facilities were reported as having a significantly higher number of HIV caseloads than their rural counterparts.[9] As a rule established by the VA, “all HIV-infected subjects have access to comprehensive primary care and to all available antiretroviral drugs.” [10] However, since rural VAs are limited in their access to specialty care—as is the case in nearly all rural areas—most rural VAs refer patients to either other VAs or to primary care providers. Despite this, rural VA clinics are noted to “have accomplished their mission with comparable chronic disease and prevention performance and higher patient satisfaction, compared with their urban counterparts. However, it is not known whether patients who are treated for HIV disease in rural VA settings enjoy similar benefits” although it is known that HIV/AIDS patients in rural communities are less likely to receive prophylaxis for *Pneumocystis* pneumonia (PCP) or to receive Highly Active Antiretroviral Therapy (HAART).[9] While, at the time of this study, variation in treatment rates between urban and rural VAs had not been calculated, the study confirmed three significant differences in the two facility types: “rural VAs had much lower HIV caseloads, had less access to needed HIV expertise, and, not surprisingly, tended to mainstream HIV care.” [9]

While it is known that significant differences in populations of HIV/AIDS patients exist between urban and rural areas and among urban and rural VA facilities and rural community clinics, to our knowledge, no attempts have been made at comparing rural VA and rural community HIV/AIDS clinics. Therefore, the purpose of this study was to create and compare profiles of a rural VA HIV clinic and a rural community HIV clinic in order to determine what, if any, characteristics are more associated with HIV patients in one setting versus the other. Additionally, a comparison of these results was made to other studies that focused on HIV/AIDS in rural America.

Methods

East Tennessee State University's (ETSU) James H. Quillen College of Medicine located in Johnson City, TN received designation as an HIV/AIDS Center of Excellence in 1999. As part of the Tennessee HIV Centers of Excellence project, ETSU developed a community HIV clinic (COM), which offers "a standardized and coordinated delivery system, encompassing a comprehensive range of services needed by individuals or families with HIV disease to meet their health care and psychosocial service needs throughout all stages of the illness." [11] To be designated and remain as such, certain criterion have to be met, including "expertise in HIV/AIDS care, standardized procedures, linkage with AIDS service organizations, social services and case management, available referral services, available ancillary services, increased access to care, optimal level of services, participation with managed care organizations, and a research component." [11] Approximately 500 patients benefit from services offered by the COM, most of who are from the Tri-Cities and surrounding region. Funded by grants from the state of Tennessee Department of Health and Human Services and the Ryan White Care Act, the COM is able to offer a range of services to their patients that include but are not limited to "medical care management, assistance with social service needs, use of current HIV/AIDS standardized treatment [guidelines], care managed by experts, increased focus on research, a system that responds quickly to changes in technology, focus on prevention of opportunistic infection, increased access to clinical trials, inappropriate treatment reduced or eliminated, and finally a treatment environment that is patient and provider friendly." [11]

While it is part of an entirely different health care system, the Division of Infectious Diseases at James H. Quillen Veterans Affairs Medical Center (VAMC) located in Mountain Home, TN includes the same physicians who provide HIV care at the COM. Therefore, the care and benefits provided by the two clinics is practically identical, as are the numbers of patients served: The COM clinic serves patients who reside in approximately 150 surrounding counties, while the VAMC serves over 170,000 veterans who live within 41 counties dispersed throughout east Tennessee, southeast Kentucky, southwest Virginia, and west North Carolina.[12]

Both clinics are in Washington County, TN, which is part of the TN-VA metropolitan statistical area (MSA). As of 2009, the United States Census Bureau reported that the TN-VA combined statistical area (CSA) (comprised of Johnson City, Kingsport, and Bristol, TN and Bristol, VA) contained 503,010 residents. The Johnson City MSA alone accounted for 197,381 of these residents, while the Kingsport-Bristol, TN-Bristol, VA MSA accounted for 305,629.[13] It is also notable that, as of 2009, African-Americans were recorded as comprising 4.1% of the Washington County population and 16.8% of the state of Tennessee while Caucasians were noted to compose 93.8% and 80.2% of those populations, respectively.[14] Many HIV-infected persons who reside in these and surrounding areas are patients at either the VAMC or COM clinic.

All patients with HIV infection at the VAMC and a sampling of COM HIV-infected persons for the years 2000-2009 were included in the study. The sample included 99 VAMC patients and 100 COM patients. All data were obtained via retrospective medical record review.

The following data were collected and recorded for each patient:

- Age at first visit
- Gender
- Race
- Birthplace
- Current residence
- Heterosexuality (Because there were no records in patients' charts about how many sexual partners they had and/or whether those partners were high-risk, heterosexual HIV transmission was considered a demographic variable instead of a risk factor.)
- Risk factors (n = 3; men having sex with men [MSM], intravenous drug use [IVDU], and receiving a blood transfusion) (Note: Patients were not identified as either homosexual or bisexual but as having the risk factor of MSM in an attempt to reduce the possibility of inaccurate self-reporting.)
- Habits posing potential health risks (n = 6; use of cocaine, marijuana, alcohol, narcotics, and tobacco, and participation in habits categorized as "other," including prostitution, use of methamphetamine, and overuse of caffeine or prescription drugs)
- Co-morbidities (n = 32; psychiatry disorder, PTSD, CAD, MI, CHF, CVA/TIA, COPD, asthma, hypertension, hyperlipidemia, DM, cirrhosis of liver/liver failure, chronic renal failure/CRI, pancreatitis, lung cancer, colon cancer, leukemia/lymphoma/hematologic malignancy, anemia, seizure, connective tissue disorder/RA/SLE.I, sexual dysfunction, HSV/HZV infection,

cholecystitis/cholelithiasis/GB disease, OSA, psoriasis, BPH, GERD, erectile dysfunction, gout, radiculopathy, myopathy, and thrombocytopenia)

- Co-infections (n = 3; hepatitis C, hepatitis B, and syphilis)
- CD4 cell count and viral load at first and last visits (no later than December 31, 2009)
- Where applicable, compliance to office visits each year for a consecutive three-year period

The study was approved by the joint ETSU/VA IRB. All data were de-identified prior to data analysis.

To first explore the data for significant factors, univariate analysis was performed using chi square tests of goodness-of-fit when an *a priori* expectation existed (i.e., equal sex ratio). Chi square tests for heterogeneity were performed on 2 x 2 contingency tables in which there were two sites (VAMC; COM) and two conditions (present; absent). Chi square tests were performed using the "frequency data" option on VassarStats: Website for Statistical Computation, as were calculations of odds ratios and relative risks for significant demographic variables and all other categorical variables, respectively.[15] For demographic factors, odds ratios were presented because, by definition, an odds ratio compares the presence and absence of a factor; whereas, relative risk is concerned with the presence of a factor in a population. For the quantitative variable, age, a student t-test was performed.[15]

Multivariate analysis was performed via logistic regression using SAS version 9.2.[16] In the binary logistic regression, the response variable was clinic (VAMC or COM) with several binary predictor variables. To reduce the number of variables in the model, the entire dataset was evaluated, and instances in which a positive response for a variable (i.e., lung cancer) was observed only a few times or instances for which positive responses to variables were observed a similar number of times within each population were excluded. Then, forward stepwise selection was used with the STEPWISE SELECTION option in the PROC LOGISTIC procedure with an inclusion and removal criteria of 0.35. When two-way interactions were examined, none were significant in either the univariate or the multivariate model. Accordingly, none were included in the model. Model fit statistics—specifically AIC, SC, and -2 Log L—where lower values upon the addition of new variables are indicative of a more effective model were used to evaluate the efficiency of the models.

For the quantitative variables, CD4 cell count and viral load at patients' first and last visits, a repeated measures analysis of variance was performed using the PROC GLM procedure with the REPEATED MEASURES option in SAS version 9.2.[16] In these analyses, the main effect was clinic (VAMC or COM), with CD4 cell counts or viral load counts as the repeated dependent variable.

Thus, all variables were included in analyses except for patients' migration patterns and compliance to office visits for a consecutive three-year period, where data were available. No analyses were able to be performed on these measures due to time constraints.

Results

Demographics

The VAMC HIV patients were significantly older than COM patients (VAMC mean = 50.0 years, s.d. = 8.84, range = 32 - 76 years; COM mean = 37.9 years, s.d. = 9.75, range = 16 - 67 years; t = 9.18, df = 197, P <0.0001). Both the VAMC and the COM populations were male biased (VAMC: $\chi^2_{1:1}$ = 87.36, df = 1, P <0.0001; COM: $\chi^2_{1:1}$ = 33.64, df = 1, P <0.0001), but, as expected, the VAMC population was significantly more strongly biased (heterogeneity χ^2 = 15.15, df = 1, P = 0.0001), as 96% of the VAMC patients were males. In fact, VAMC patients were 8.51 times more likely to be male (Table 1). Both populations were strongly Caucasian (chi square test comparing the numbers of Caucasian to non-Caucasian patients: VAMC: $\chi^2_{1:1}$ = 4.94, df = 1, P = 0.03; COM: $\chi^2_{1:1}$ = 57.76, df = 1, P <0.0001). The VAMC population was also notably more strongly African-American (chi square test comparing the numbers of African-American to non-African-American patients: VAMC: $\chi^2_{1:1}$ = 4.94, df = 1, P = 0.03; COM: $\chi^2_{1:1}$ = 60.84, df = 1, P <0.0001). The patient population from the COM was more heavily Caucasian than that of the VAMC, as COM patients were 4.64 times more likely to be Caucasian (COM = 88%, VAMC = 60%; χ^2 = 18.80, df = 1, P <0.0001) (Table 1). Conversely, VAMC patients were more heavily African-American than COM patients, with VAMC patients being 5.12 times more likely to be African-American (VAMC = 38%, COM = 11%; χ^2 = 20.50, df = 1, P <0.0001) (Table 1). No other races were present in the VAMC population, and only one other race was present in the COM: 1% of COM patients were Hispanic. In addition to a more male biased population, the VAMC was more heterosexual biased, as VAMC patients were 4.09 times more likely to be heterosexual than were COM patients (COM = 27%, VAMC = 53%; χ^2 = 21.14, df = 1, P <0.0001) (Table 1).

Table 1. Demographics of VAMC and COM HIV Patients					
	VAMC*	COM	$\chi 2$	P value	Odds Ratio (VAMC: COM)
Sex Ratio					
Male	96	79	15.15	0.0001	8.5:1
Female	3	21			
Race/Ethnicity					
Caucasian					
Yes	60	88	18.80	<0.0001	1:4.6
No	38	12			
African-American					
Yes	38	11	20.50	<0.0001	5.1:1
No	60	89			
Hispanic					
Yes	0	1	0.96	1.00	———
No	98	99			
Heterosexuality					
Yes	53	27	21.14	<0.0001	4.1:1
No	35	73			

* The numbers of VAMC patients vary from the clinic total with some demographic variables because the information was unattainable.

Risk Factors

Although three risk factors were considered, only two showed significant differences between the VAMC and the COM (Table 2). Men having sex with men (MSM) was 1.59 times more likely to be associated with COM patients; while the VAMC population was nearly in a 1:1 MSM to non-MSM ratio ($\chi^2_{1:1}$ = 1.16, df = 1, P = 0.33), the COM population ($\chi^2_{1:1}$ = 16.00, df = 1, P <0.0001) was MSM biased (χ^2 = 12.65, df = 1, P <0.001) (Table 2). Both populations were biased toward non-IVDU (VAMC: $\chi^2_{1:1}$ = 20.78, df = 1, P <0.0001; COM: $\chi^2_{1:1}$ = 70.56; df = 1; P <0.0001), but the VAMC population was more prone to having IVDU as a risk factor than the COM (χ^2 = 10.93, df = 1, P = 0.001). In fact, IVDU was 3.23 times more likely to be associated with VAMC HIV patients (Table 2).

Table 2. Risk Factors of VAMC and COM HIV Patients					
	VAMC*	COM**	$\chi 2$	P value	Relative Risks (VAMC: COM)
MSM					
Yes	38	70	12.65	0.0006	1:1.6
No	48	30			
IVDU					
Yes	23	8	10.93	0.001	3.2:1
No	66	92			
Blood Transfusion					
Yes	4	2	1.72	0.23	_____
No	65	98			

* The numbers of VAMC patients vary from the clinic total with each risk factor because some patients' risk factors were unknown.

**Two COM patients had no risk factors to account for, as they were born with HIV infection.

Habits

Six habits posing potential health risks were considered in this study, and four showed significant differences between clinics (Table 3). Patients from the VAMC were 4.15 times more likely to be cocaine users than those from the COM ($\chi^2 = 22.53$, df = 1, P <0.0001) (Table 3). A similar frequency of occurrence was noted for marijuana use: the VAMC population was 1.78 times more likely to consist of marijuana users ($\chi^2 = 4.88$, df = 1, P = 0.03) (Table 3). Conversely, tobacco use was prevalent in both populations but was significantly more so in the VAMC, with VAMC patients being 1.38 times more likely to use tobacco ($\chi^2 = 15.06$, df = 1, P = 0.0001) (Table 3). Interestingly, COM patients were 10 times more likely than VAMC patients to participate in habits categorized as “other” ($\chi^2 = 7.68$, df = 1, P = 0.01) (Table 3).

Table 3. Habits of VAMC and COM HIV Patients Posing Potential Health Risks					
	VAMC	COM	$\chi 2$	P value	Relative Risks (VAMC: COM)
Cocaine Use					
Yes	37	9	22.53	<0.0001	4.2:1
No	62	91			
Marijuana Use					
Yes	30	17	4.88	0.03	1.8:1
No	69	83			
Alcohol Use					
Yes	45	38	1.14	0.32	_____
No	54	62			
Narcotics Use					
Yes	8	3	2.47	0.13	_____
No	91	97			
Tobacco Use					
Yes	86	63	15.06	0.0001	1.4:1
No	13	37			
Other Habits*					
Yes	1	10	7.68	0.01	1:10.0
No	98	90			

*Other Habits include prostitution, use of methamphetamine, and overuse of prescription drugs and caffeine

Co-morbidities

Thirty-two co-morbidities were considered, but in univariate analyses only six showed significant differences between the VAMC and the COM (Table 4). The twenty-six insignificant co-morbidities included various cancers, such as B-cell lymphoma, and diseases of the respiratory, circulatory, and urinary systems, among others, such as COPD, gall bladder disease, etc. Of the six significant results, three were expected. For example, Post-traumatic Stress Disorder (PTSD) was found only in the VAMC population, but a PTSD diagnosis would be unlikely in a COM patient, who would receive a diagnosis of a psychiatric disorder, though the symptoms could be similar. Therefore, occurrence of PTSD and psychiatric disorders were later compared by counting PTSD diagnoses as psychiatric disorder diagnoses. Eleven percent of VAMC patients had PTSD, and nine of those had been diagnosed with both PTSD and a psychiatric disorder. The remaining two patients had been diagnosed only with PTSD. Consequently, those two patients were counted as having psychiatric disorders for the purpose of analysis, and there was no statistical difference between the two clinics ($\chi^2 = 0.62$, df = 1, P = 0.46) (Table 4).

Similarly, the VAMC population had a significantly higher incidence of congestive heart failure (CHF) ($\chi^2 = 5.17$, df = 1, P = 0.03) (Table 4). However, no VAMC patient was noted to have asthma, but, considering the difficulty a person suffering from asthma would have during military basic training, this result was also expected. Both populations were biased against asthma sufferers (VAMC: $\chi^2_{1:1} = 99.00$, df = 1, P <0.0001; COM: $\chi^2_{1:1} = 67.24$, df = 1, P <0.0001), but the VAMC population was even more biased against this co-morbidity than the COM population ($\chi^2 = 9.34$, df = 1, P = 0.003) (Table 4).

For the other co-morbidities that showed a significant difference between clinics, pancreatitis was 7.07 times more likely to occur in VAMC patients than in COM patients ($\chi^2 = 4.76$, df = 1, P = 0.03) (Table 4). Conversely, thrombocytopenia was significantly more common in the COM (relative risk = 3.13:1 COM: VAMC; $\chi^2 = 6.32$, df = 1, P = 0.02 (Table 4). Similarly, COM patients were significantly more likely to have herpes simplex and/or herpes zoster infections (relative risk = 1.69:1 COM: VAMC; $\chi^2 = 4.79$, df = 1, P = 0.04) (Table 4).

Table 4. Co-morbidities of VAMC and COM HIV Patients					
	VAMC	COM	$\chi 2$	P value	Relative Risks (VAMC: COM)
Psychiatry disorder*					
Yes	60	66	0.62	0.46	_____
No	39	34			
PTSD*					
Yes	11	0	11.77	0.0003	∞:1
No	88	100			
CAD					
Yes	11	4	3.62	0.07	_____
No	88	96			
MI					
Yes	1	1	1.26×10^{-4}	1.00	_____
No	98	99			
CHF					
Yes	5	0	5.17	0.03	∞:1
No	94	100			
CVA/TIA					
Yes	8	4	1.46	0.25	_____
No	91	96			
COPD					
Yes	13	7	2.07	0.17	_____
No	86	93			
Asthma					
Yes	0	9	9.34	0.003	1:∞
No	99	91			
Hypertension					
Yes	40	38	0.12	0.77	_____
No	59	62			
Hyperlipidemia					
Yes	32	35	0.16	0.76	_____
No	67	65			
DM					
Yes	12	10	0.23	0.66	_____
No	87	90			
Cirrhosis of liver/Liver failure					
Yes	3	3	1.74×10^{-4}	1.00	_____
No	96	97			
Chronic renal failure/CRI					
Yes	3	1	96.04	<0.0001	_____
No	96	99			

Pancreatitis					
Yes	7	1	4.76	0.03	7.1:1
No	92	99			
Lung Cancer					
Yes	3	1	1.04	0.37	———
No	96	99			
Colon Cancer					
Yes	0	0	———	———	———
No	99	100			
Leukemia/lymphoma/hematologic malignancy					
Yes	2	2	1.02×10^{-4}	1.00	———
No	97	98			
Anemia					
Yes	15	18	0.29	0.70	———
No	84	82			
Seizure Dz					
Yes	4	4	2.08×10^{-4}	1.00	———
No	95	96			
Connective tissue disorder/RA/SLE.I					
Yes	1	0	1.01	0.50	———
No	98	100			
Sexual dysfunction					
Yes	2	0	2.06	0.25	———
No	97	100			
HSV/HZV Infection					
Yes	20	34	4.79	0.04	1:1.7
No	79	66			
Cholecystitis/Cholelithiasis/GB Disease					
Yes	4	5	0.10	1.00	———
No	95	95			
OSA					
Yes	3	1	1.04	0.37	———
No	96	99			
Psoriasis					
Yes	3	3	1.74×10^{-4}	1.00	———
No	96	97			
BPH					
Yes	4	2	0.71	0.44	———
No	95	98			
GERD					
Yes	22	33	2.89	0.11	———
No	77	67			

Erectile dysfunction					
Yes	7	5	0.38	0.57	–––––
No	92	95			
Gout					
Yes	1	1	1.26×10^{-4}	1.00	–––––
No	98	99			
Radiculopathy					
Yes	8	11	0.49	0.63	–––––
No	91	89			
Myopathy					
Yes	1	1	1.26×10^{-4}	1.00	–––––
No	98	99			
Thrombocytopenia					
Yes	5	16	6.32	0.02	1:3.1
No	94	84			

*Although the number of PTSD diagnoses made no significant difference between clinics, as explained in the results and discussion, the values for PTSD from the initial univariate analysis are included in this chart, but the values for psychiatric disorder are the adjusted values.

Co-infections

As the purpose of this study was to determine what, if any, factors characterized VAMC HIV patients compared to a sympatric community population, three co-infections were considered: hepatitis C, hepatitis B, and syphilis (Table 5). Statistical analyses revealed that only cases of hepatitis C co-infection were significantly different between the clinics. The VAMC population had significantly more hepatitis C than the COM population ($\chi^2 = 12.56$, df = 1, P <0.001). In fact, VAMC patients were 3.00 times more likely to be co-infected with hepatitis C (VAMC = 30%, COM = 10%) (Table 5).

Table 5. Co-infections of VAMC and COM HIV Patients					
	VAMC*	COM*	$\chi 2$	P value	Relative Risks (VAMC: COM)
Hepatitis C					
Yes	30	10	12.56	0.0006	3.0:1
No	68	88			
Hepatitis B					
Yes	6	9	0.62	0.59	_____
No	91	89			
Syphilis					
Yes	13	9	1.09	0.37	_____
No	77	86			

*The numbers of VAMC and COM patients vary from the clinic totals because such information was unattainable.

Mortality

Fortunately, neither population had a high mortality rate. As 13% of the VAMC patients passed away during the study versus 1% of COM patients, the VAMC had a higher mortality rate than the COM, with patients being 13.13 times more likely to pass away during the time-frame of the study ($\chi^2 = 11.19$, df = 1, P = 0.0006) (Table 6).

Table 6. Mortality Rate of VAMC and COM HIV Patients During the Study					
	VAMC	COM	$\chi 2$	P value	Relative Risks (VAMC: COM)
Mortality Rate					
Passed away	13	1	11.19	0.0006	13.1:1
Still living	86	99			

Multivariate Analysis

Of all the variables examined in the study, only eight were of significance in the multivariate analysis and were included in the final model. Of the eight factors, three were demographic (age, gender, and heterosexuality), two were habits posing potential health risks (cocaine use and alcohol use), two were co-morbidities (pancreatitis and thrombocytopenia), and one was a co-infection (syphilis) (Table 7). Only one (thrombocytopenia) added to the model's efficacy marginally. None of the results were sensitive to changes in the inclusion or removal criteria values used with the forward STEPWISE SELECTION option in the PROC LOGISTIC regression of SAS.[16] Additionally, when the backward STEPWISE SELECTION option was performed on the model, there was no change in results. Moreover, there were no significant interactions between any of the variables included in the models.

Table 7. Results of Multivariate Analysis Comparing Factors Associated with HIV Patients at the VAMC and COM

Effect	df	$\chi 2$	P value	Odds Ratio (VAMC: COM)
Age	1	46.71	<0.0001	mean = 50.0 years, s.d. = 8.84: mean = 37.9 years, s.d. = 9.75
Cocaine	1	11.82	<0.001	6.0:1
Gender	1	12.18	<0.001	8.5:1
Heterosexual	1	5.46	0.02	4.1:1
Pancreatitis	1	6.29	0.01	7.5:1
Alcohol	1	6.78	0.01	1.4:1
Syphilis	1	4.40	0.04	1.6:1
Thrombocytopenia	1	4.05	0.04	1:3.6

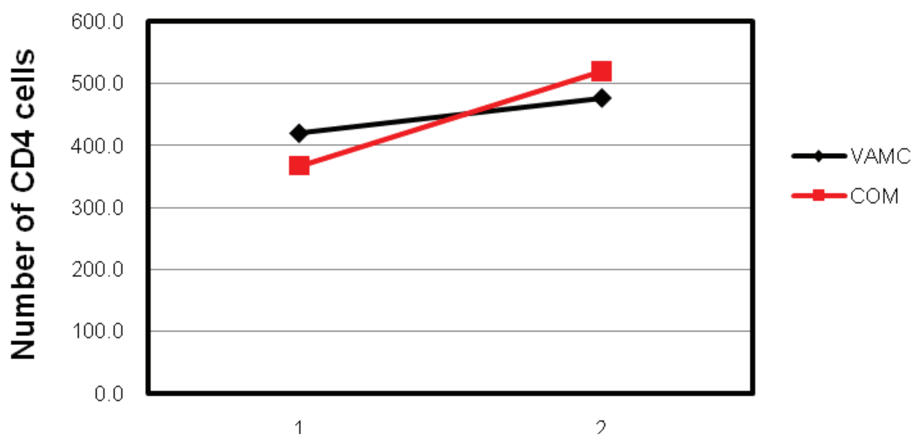
CD4 Cell Count and Viral Load

Repeated measures ANOVA showed no significant differences in CD4 cell count either at the first or last patient visit. However, a strong correlation between CD4 cell counts on first and last visits was identified such that the patients who had the higher CD4 cell counts initially also tended to have high CD4 cell counts at their last visit, regardless of which clinic the patient was from. Furthermore, a significant interaction between clinics and CD4 cell counts indicated that CD4 cell counts rose more rapidly in the COM population (Table 8, Figure 1).

Table 8. Result of Repeated Measures ANOVA for CD4 Cell Counts Taken on First and Last Patient Visits

Source	df	F value	P value
Clinic	1	0.01	0.91
CD4	1	24.19	<0.0001
Clinic x CD4	1	4.98	0.03
Error	145	-----	-----

Figure 1. CD4 Cell Count of VAMC HIV Patients versus COM HIV Patients at First and Last Visits

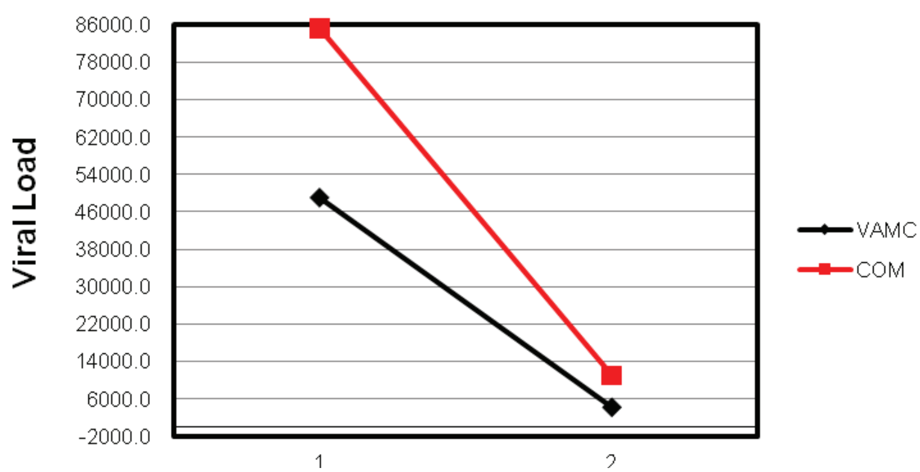


Similarly, no significant differences in viral load were found between clinics. However, there were significant differences in the first and last viral load measurements, but, in contrast to CD4 cell counts, there was no strong correlation between first and last viral loads. It can be inferred from Figure 2 that the rate accounts for the difference in first and last measurements, but the clinics themselves have nearly the same slope indicating similar rates of decrease in viral loads (Table 9, Figure 2).

Table 9. Result of Repeated Measures ANOVA for Viral Load (VL) Taken on First and Last Patient Visits

Source	df	F value	P value
Clinic	1	2.26	0.14
VL	1	16.39	<0.0001
Clinic x VL	1	1.00	0.32
Error	142	-----	-----

Figure 2. Viral Load of VAMC HIV Patients versus COM HIV Patients at First and Last Visits



Discussion

Studies of HIV/AIDS in rural areas are relatively rare. One of the first such studies was conducted in 1989 in Johnson City, TN.[3] The clinic the 1989 study was based on was, in effect, replaced by the Tennessee HIV Center of Excellence clinic established in Johnson City in 1999. It was this clinic which provided the patient sample analyzed in this study. So, although our study involved a clinic other than the one in the 1989 study, we were still presented with a unique opportunity to research HIV in the same locale 21 years after the initial study. The former study was an anecdotal one in which three physicians specializing in infectious diseases were asked to discuss their experiences with HIV/AIDS in a rural area. It was noted that gay white males constituted the largest portion of the COM clientele and that, "[a]s of June 1989[,]…[they had] seen 81 [HIV] infected patients." [3] Twenty-one years later, the COM population still predominantly consists of white males whose risk factor(s) include having sex with men. However, now the number of HIV/AIDS patients seen in this area—both at the VAMC and COM—exceeds 600,[11] coinciding with the observation that, "[w]hile rural AIDS incidence is still low compared to urban, it has been rising considerably faster since 1988-89." [6] In a hopeful concluding statement, the authors mentioned that "[i]f our findings of a low prevalence of HIV seropositivity among gay men in nonurban areas is true of other rural areas as well, a 'window of opportunity' presents itself for targeted educational efforts aimed at preventing spread of HIV infection." [3] However, from the results of this and other studies, it appears that this "window of opportunity" was not taken advantage of, as the prevalence and characteristics of HIV in this and other rural areas have dramatically changed since 1989.

Findings of High Significance

The most noteworthy findings from this study were the differences in demographic features (age, gender, race, sexual preference), habits (drug usage), and co-infections (syphilis, HCV) of the patients from the two clinics. The median age at the VAMC of 50 years, with a range from 32 to 76 years, and at the COM the median age of nearly 38 years, with a range from 16 to 67 years, were quite similar to patient age ranges in other study populations. For example, a study on the US-Mexico border reported a mean age of "35 years, with a range of 19 to 71," [5] while another study looking at four American cities in the Southeast recorded a mean age of "36 years (range, 19 to 75 years)" for male participants and of "33 years (range, 18 to 67 years)" for females.[2] A nationwide VA study that assessed National Quality Forum performance measures specific to HIV/AIDS treatment "using available electronic data for the large, diverse population with HIV in the" VA revealed a mean age of 52.5 years, with an interquartile range from 46.3-58.8 years.[17] Our results also coincided with a finding of another study that looked only at a veteran cohort: "HIV-infected veterans tend to be older…[compared to] the non-veteran HIV-infected population with similar characteristics." [10] Furthermore, a study performed in America that researched characteristics of rural AIDS patients within each of the four Census Bureau regions notes that "[r]ates within each MSA [Metropolitan Statistical Area] and region category were highest for people 30 to 49 years of age at diagnosis, followed by people 13 to 29 years of age and people 50 to 64 years of age, and were lowest for people older than 65 years of age at the time of AIDS diagnosis." [1] The mean ages of the current study very nearly fit within the most populous range cited in that study. However, it should be noted that each of the other studies had different times at which they recorded participants' ages (i.e., at the time of an interview, at the time of diagnosis, etc.).

In the current study, patients from both populations were predominantly male and Caucasian although more African-Americans were noted at the VAMC. Nearly every other related study also consisted mainly of male HIV/AIDS participants.[1-2, 4-5, 7-8, 17] Conversely, most other studies of HIV/AIDS in predominantly rural America noted that the majority of participants were African-American,[1, 2, 7] but the issue of race/ethnicity appears to be much more region-specific. For example, Hispanics made up the largest racial group in a study of HIV/AIDS patients on the US-Mexico border, followed by white non-Hispanics and then African-Americans.[5] The study that focused on rural areas within the four regions of the United States concluded that “AIDS rates differ by race…; however, some patterns are evident…. Rates for blacks are 3 to 32 times higher than rates for whites; rates for Hispanics fall between those for blacks and whites in nearly every location.” [1]

Conclusions from a number of studies support the hypothesis of HIV/AIDS spreading to rural America in two waves, the second of which is “homegrown” and considered to consist primarily of young, non-white women.[2, 4, 6] A review paper of all HIV/AIDS studies performed in rural America up to December 1995 states:

> *Rural HIV/AIDS is distributed unevenly, with 30 percent of cases concentrated in the South Atlantic states. Rural HIV/AIDS rates are particularly high among Black women, adolescents, Native Americans, and migrant workers. Rural [persons living with AIDS] are more likely to be female, heterosexual, non-White, and young. Intravenous drug use…and heterosexual contact are emerging as important modes of transmission. Individuals infected in urban locales who migrate to rural areas account for a substantial number of local cases.*[6]

The findings in the current study clearly differ from the observations described above. In our study, a large number of patients were Caucasian men, a lot of whom were homosexual. Of the 199 patients involved in the study, only 24 were women (3 VAMC; 21 COM). Of those, 13 were Caucasian (1 VAMC; 12 COM) and 9 were African-American (1 VAMC; 8 COM), a racial makeup that differs not only from that reported in other studies[2, 4, 6] but also from that of the local area. As of 2009, African-Americans were recorded as comprising 4.1% of the Washington County population and 16.8% of the state of Tennessee.[14] The fact that African-Americans composed 38% of the VAMC population and 11% of the COM shows the racial makeup of both local HIV populations differs from the general population, a result that is consistent with literature that ascertains the high prevalence of HIV infection among certain racial/ethnic groups.[1, 2, 7] In the current study, ages of the females varied, so they could not be categorized as primarily young or old. However, the predominant mode of transmission for female patients was heterosexual contact (20 out of 24); only one female patient (COM) was noted to have IVDU as a risk factor.

The review paper mentioned that "IV drug use is a major contributor to the distribution of HIV infection in women, but there may be regional variation, as yet unexplained." [6] The results of the current study support the hypothesis of regional variation since IVDU was not a major contributor to HIV infection in females. Other studies have had similar findings; for example, the regional study of America noted that "[e]xposure categories for women differed little between regions, races or size of MSA. Within each race group, the proportion of cases with injection drug use as the risk category was highest in the larger MSAs and similar in the smaller and non-MSAs…In all other race, region and MSA size categories, the proportion of cases among women due to heterosexual contact either exceeded injection drug use or was comparable; no patterns were discernible." [1]

In the univariate analysis of the current study, two risk factors (MSM and IVDU) differed significantly between the VAMC and the COM, but neither proved significant in the multivariate analysis. A study examining rural areas and small cities of four southeastern states notes that "[m]ost [of the 608] respondents had been infected through sexual contact (67 percent of men, 66 percent of women)…. Before HIV infection was diagnosed, high-risk sexual behavior and drug use were common among both men and women." [2] It should be noted that that study did not differentiate between heterosexual and homosexual contact. However, it is noteworthy that the current study—in both univariate and multivariate analyses—shows significant differences in rates of heterosexual contact between the VAMC and COM.

A regional study of the geographic distribution of AIDS in the United States says of MSM: "Except in the Northeast, within each race and region, the proportion of men who reported sex with men as their risk exposure was greatest in the larger MSAs (range, 39 percent to 76 percent), lower or the same in the smaller MSAs (36 percent to 72 percent), and lowest in the non-MSAs (39 percent to 67 percent), although some of the differences were small." [1] Furthermore, a study concerned with HIV/AIDS in medically underserved rural areas of America (Appalachia, Mississippi Delta, US-Mexico Border, Southeast Region) stated that "[i]n all regions, most people with a diagnosis of HIV were male, and the primary mode of exposure among men was sex with men. However, a larger proportion of men in the Southeast Region were exposed through heterosexual contact (28.5%) than were men in other regions (18.4% in the Mississippi Delta, 13.8% in Appalachia, and 8.0% at the US-Mexico Border)." [7] Because the

VAMC clinic most likely serves a wider region than the COM clinic, the results of the current study showed that heterosexual contact was a prevalent mode of transmission for infected VAMC male patients.

Of the 199 patients studied, only 31 were noted to have IVDU as a risk factor (23 VAMC; 8 COM). Thirty of these were males, 14 of whom were Caucasian (7 VAMC; 7 COM) and 16 African-American (16 VAMC). These results are consistent with those of other studies.[1, 4] For instance, the regional study of the United States noted that “[t]he proportion of cases among male injection drug users was considerably lower among whites than the other racial/ethnic groups and higher in the Northeast than the other regions.” [1] Thus, the racial/ethnic factor of the statement is comparable to the results of the current study, and, since the current study was performed in the South, so is the regional factor. One possible explanation given for the racial/ethnic discrepancy related to IVDU is simply that high-risk behavior is currently more characteristic of certain ethnicities than others, just as rural homosexual men have been notably slower than their urban counterparts to begin practicing safe sex.[6] Regional variances in risk factors have been observed in other studies and are attributed to “differences in IV drug use, sexual behavior, and levels of sexually transmitted diseases” (STDs).[6]

Not surprisingly, a number of researchers have observed a correlation between HIV infection and STDs in rural areas. Two HIV/AIDS studies were conducted in Georgia. One was a “seroprevalence assessment of 1,309 hospital patients in rural Georgia[; it] found a majority of those testing HIV-positive were also positive for at least one sexually transmitted disease.” [6] The other focused on HIV-positive individuals who were also users of IV drugs. The results revealed that a significant number of those individuals—both in rural and urban areas—were co-infected with syphilis.[6] A regional study of rural America states that "[t] here are some communities with relatively high AIDS rates, especially those that have been affected by interacting epidemics of sexually transmitted diseases and drug use." [1] Another study concentrating on rural America concedes that, within the "homegrown" wave of rural infection, "[s]exual acquisition of HIV infection was predominant…[but o]ther factors associated with HIV transmission in rural areas are high rates of [STDs] and alcohol and other drug abuse." [2]

Most likely, this correlation between HIV infection and STDs is a reflection of sexual behavior within regions. As one example, "[t]esting from 1988 to 1990 in rural Mississippi, a State Department of Health STD clinic yielded a [HIV] seroprevalence rate of 4.0 per 1,000 among 9,855 adolescents treated for sexually transmitted disease. The rate for females nearly equaled that of males, and the rate for adolescents from counties with populations below 25,000 was equivalent to that of counties over 100,000. Overall, rural Black adolescents had rates 3.5 times higher than Whites." [6] The Mississippi Delta Region is known for its high prevalence of HIV among African-Americans, and especially adolescents, so it is not surprising that such high rates of STDs are also found within those populations.[7] Interestingly, syphilis—the only STD included in the logistic regression model of the current study—showed no significance in the univariate analysis, but it was significant in the multivariate analysis. There was not a large majority of patients co-infected with syphilis (13 VAMC; 9 COM), but the results of the multivariate analysis coincide, to a lesser degree, with those of these other studies.

Despite the fact that HCV did not meet the criterion necessary to be included in the multivariate logistic regression model, the univariate analysis showed a significant difference between the two clinics in HCV co-infection (30 VAMC; 10 COM). Explanations as to why

HCV was not included in the logistic regression model are not fully understood at this point. However, it is plausible that the larger proportion of HIV/HCV co-infected persons at the VAMC can be explained by the larger incidence of cocaine use and also of IVDU characteristic of that population (cocaine use: 37 VAMC, 9 COM; IVDU: 23 VAMC, 8 COM).

To our knowledge, this is the first study of HIV/AIDS in rural America to include information on habits posing potential health risks. Of the six habits considered, four showed significant differences between clinics in the univariate analysis (use of cocaine, marijuana, and tobacco and participation in habits categorized as “other”). Of these, only one (use of cocaine) was included in the multivariate logistic regression model. Interestingly, another habit (use of alcohol) was included in the model even though it showed no significant differences between populations in the univariate analysis because of its near identical prevalence at the clinics (45 VAMC; 38 COM). A reasonable assumption is that alcohol use is so correlated with pancreatitis that it met the inclusion and removal criteria of the multivariate model, but other explanations could exist. Regardless, results of the current study reveal that alcohol and, especially cocaine, use are distinguishing factors between the VAMC and COM populations.

A majority of the literature on HIV/AIDS in rural America associates CD4 cell counts and measures of viral load with reasons for patient migration and/or with adherence to office visits.[4, 6, 8] Unfortunately, due to time constraints, available data concerning patient migration and compliance to office visits over a consecutive three-year period were not analyzed. Despite this, the results of the paired t-test for CD4 cell count and viral load had significant implications for the study populations. The fact that the COM population, which consisted of younger patients compared to that of the VAMC, had a lower initial CD4 cell count was surprising and indicative of treatment being sought late. However, this same factor of COM patients being, on average, younger than VAMC patients may account for the COM population's CD4 cell count rising at a faster, though not significantly faster, rate to become the highest of the two counts at patients' last visits.

A VA study conducted to evaluate the one-year survival of a group of immunosuppressed (CD4 <100) HIV-infected veterans divided the group into three cohorts based upon the time they entered the study: pre/early [highly active antiretroviral therapy (HAART)], HAART, and current HAART. The study was conducted based on the knowledge that "[e]asier to take and more effective HAART options have improved the one year virologic success rate among naïve patients. Numerous studies have shown that initiating HAART and restoration of CD4 cells positively impact survival." [10] Although this study, which was one of few that also included co-morbidities, focused on the survival of immunosuppressed HIV-infected veterans while the current study focused on describing the profiles of rural HIV-infected patients at a VAMC and a COM clinic, some results of the studies are comparable.

For example, the VA study found that "[o]lder age at time of entry into the cohort, and having a diagnosis of lymphoma…CAD, or renal insufficiency had a negative impact [on survival]." [10] Although neither CAD nor chronic renal failure/chronic renal insufficiency were of statistical significance in the current study (CAD: 11 VAMC; 4 COM and chronic renal failure/CRI: 3 VAMC; 1 COM), VAMC patients were older than COM patients (mean age: 50 years VAMC; 38 years COM) and had a higher mortality rate (13 VAMC; 1 COM). Therefore, it could be supposed that these factors explain why the VAMC population had a smaller increase in CD4 cell count from first patient visit to last. However, due to several reasons, one of which is the different criterion of inclusion in the studies, this is only a weak postulation; more research would need to be performed before making any conclusions. It is more likely that the age of VAMC patients alone accounts for the insignificantly smaller rise in CD4 cell count because, "[a]s patients age with HIV and/or enter care at older ages, the effect of aging on survival will become even more relevant [than normal]." [10] Another likely reason for this difference is that the VAMC dataset had more missing data than did the COM dataset because of less compliance to office visits, but further analyses are needed to ascertain whether VAMC patients did have a significantly lower level of compliance to office visits. Finally, considering the age and change of CD4 cell count between first and last patient visits of the COM population, another conjecture is that the COM patients had a better response to treatment because they were treatment naïve, but it is not known how many of the patients at either population were treatment naïve.

All the conjectures made concerning the observed increases in the VAMC and COM CD4 cell counts during the study could also account for the decreases in viral load, which was lower for VAMC patients compared to COM patients at both the first and last patient visits. A number of studies have shown that "HAART use, virologic suppression [VL <400], and improved CD4 cell count [CD4 >200] were major determinants of survival." [10] However, another study discusses the difficulty of controlling viral load, saying that, although it is "important for reducing patient morbidity and mortality from HIV/AIDS...In practice, this rate is constrained by the limitations of available medical therapy. Health care providers cannot prevent unacceptable adverse effects that require discontinuation of a medication, nor can they directly alter the ability of the virus to develop resistance. Shared toxicity and resistance patterns among antiretrovirals mean that fewer combinations are available after the first, second, or third regimen." [17] Thus, to reiterate, the fact that the COM population's CD4 cell count rose faster to become the higher of the two at the last visit while the COM population's consistently higher viral load steadily decreased from first to last visit at nearly the same rate as the VAMC's, could be indicative of a number of things that can only be elicited by further study but is mostly likely a result of the difference in age of the study populations.

Findings of Lesser Significance

There were some variables that showed significant differences between the VAMC and COM clinics, but these differences were of lesser significance because they were expected given the differences in the demographics and habits outlined in the previous section. Very few—if any—studies concerned with characterizing rural HIV/AIDS patients have looked at co-morbidities. A study of the one-year survival rate of immunosuppressed HIV-infected veterans included data on several co-morbidities such as "coronary artery disease (CAD), chronic obstructive pulmonary disease (COPD), depression, diabetes mellitus, anal carcinoma, and renal insufficiency." [10] In that study, "[c]o-morbidities were recorded if they were present at baseline or at any time during the follow-up period;" similarly, the current study recorded co-morbidities if they were present anytime between the patient's first visit and December 2009, when the study ended.[10] Unlike the VA study, the current study focused on finding what, if any, factors are more characteristic of the VAMC population than the COM population and included 32 co-morbidities. Of the six that showed a significant difference between the clinics in the univariate analyses (PTSD, CHF, asthma, pancreatitis, HSV/HZV, and thrombocytopenia), only two were included in the multivariate logistic regression model (pancreatitis and thrombocytopenia).

Once PTSD was adjusted by including it as a psychiatric disorder (since a diagnosis with PTSD of any COM patient is highly improbable even if the symptoms existed), rates of psychiatric disorders no longer showed a significant difference between the two study populations. This finding is in contrast to a study performed within a VA population (which also included PTSD as a psychiatric disorder) that reported “results from this study could be generalized to the non-veteran HIV-infected population with similar characteristics. Although HIV-infected veterans tend to…[have] more medical and psychiatric co-morbidities than the general US HIV-infected population, after adjustment for medical and psychiatric co-morbidities, the clinical outcomes among HIV-infected veterans are similar overall to other HIV cohorts” because the results of the current study indicate no such adjustments are necessary (Psychiatric disorders: 60 VAMC; 66 COM).[10] Perhaps HIV/AIDS patients are more prone to having psychiatric disorders (particularly depression or anxiety) as a result of infection and have a higher prevalence compared to the general population, but certainly no evidence exists in the current study to ascertain a significant difference between the VAMC and COM HIV populations as far as this co-morbidity is concerned.

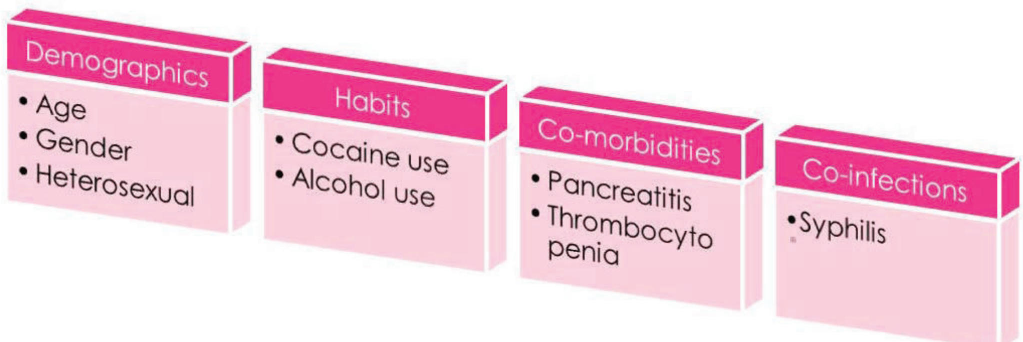
Because the VAMC population consisted mainly of comparatively older males with tobacco use common, it was not surprising that CHF was significantly more prevalent in that population. The fact that this co-morbidity was not significant in the multivariate model could be indicative of CHF being more correlated with older males than HIV-infection and thus age alone was a more efficient predictor than both age and CHF. Similarly, asthma showed significance in the univariate analysis but did not meet the criteria to be included in the multivariate model. This is likely more due to the United States Armed Forces not allowing anyone with asthma to serve rather than to an association existing between the co-morbidity and HIV-infection.

Herpes simplex and herpes zoster viruses were included in the study because we wanted to include as many co-morbidities as possible to uncover potential relationships within the observed populations. While a form of HSV can be contracted sexually, another is congenital. Likewise, HZV is not sexually transmitted. Thus, it was not surprising when HSV/HZV were not considered significant predictors in the multivariate model.

As for pancreatitis and thrombocytopenia, which proved significant in both univariate and multivariate analyses, it is thought that they could be associated with disease progression. It is known that "[a]lcohol abuse is an important contributor to HIV disease progression," [8] so it does not seem unlikely that pancreatitis—independently associated with alcohol abuse—could act in the same way. Furthermore, just as pancreatitis was more prevalent at the VAMC (7 VAMC; 1 COM), so was alcohol use (45 VAMC; 38 COM) though the difference was small. Because of the adverse effects HIV/AIDS takes on the body's immune system, it also does not appear implausible to suggest that thrombocytopenia could be associated with disease progression. However, why this co-morbidity was more prevalent among COM patients (5 VAMC; 16 COM) is not known. Typically, thrombocytopenia is seen early in HIV infection and is subsequently resolved with treatment. The data could be analyzed further to determine when in a patients' treatment he/she was diagnosed with and treated for thrombocytopenia. Regardless, further research should be conducted before making any conclusions concerning these postulations.

In conclusion, several characters were identified that distinguish HIV patients at the Mountain Home, TN VAMC from similar patients at the COM in the same rural area (Figure 3). These include age, gender, heterosexuality, cocaine and alcohol use, pancreatitis, thrombocytopenia, and a co-infection with syphilis. With the exception of thrombocytopenia, all are more characteristic of VAMC HIV patients.

Figure 3. Summary of Factors That Differ Significantly Between the VAMC and COM Patient Populations



Despite not meeting the criterion of the multivariate logistic regression model, both race and HCV co-infection showed significant differences in the two study populations in the univariate analysis and have important implications in the study. While the racial makeups of the two clinics differ, neither the VAMC nor the COM population reflects the racial makeup of the local general population; instead, both have larger percentages of African-Americans, as previously discussed. Plans for further evaluation of the issue of racial differences between the clinics and the clinics versus the local general population are being made.

While certain limitations exist within the study, such as the possibilities of inaccurate self-reporting—especially in the case of risk factors—and an uneven distribution of racial/ethnic populations in the area (i.e., patients were predominantly either Caucasian or African-American), these are common problems encountered in nearly every HIV/AIDS study focused on a single region and would likely have no effect on the accuracy of the results of this study. Having only 99 patients at the VAMC to include in the study may be considered a limitation as well, but considering that is the entire population, it was the only way to conduct the study.

Although the AIDS epidemic began in America well over two decades ago, relatively little is known about HIV/AIDS in rural areas compared to urban areas, and what studies have been conducted have focused primarily on individual regions as opposed to the nation as a whole. Furthermore, this is one of the few studies—if not the first—that has compared profiles of HIV patients at a VA facility to a community one. While these studies have been instrumental in profiling parts of the nation and even certain minorities apparently more prone to HIV infection than others, such as the African-American, Native American, Native Alaskan, and Hispanic populations,[2, 6, 7, 8] much more work is needed to uncover the full "face" of HIV/AIDS in rural America.

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