Published in final edited form as:
AIDS Behav. 2014 November ; 18(11): 2219–2229. doi:10.1007/s10461-014-0849-1.

Gender-specific risk factors for virologic failure in KwaZulu-Natal: Automobile ownership and financial insecurity

Anna Q. HARE[1], **Claudia E. ORDÓÑEZ**[2], **Brent A. JOHNSON**[3], **Carlos DEL RIO**[1,4], **Rachel A. KEARNS**[5], **Baohua WU**[3], **Jane HAMPTON**[2], **Peng WU**[3], **Henry SUNPATH**[2,6], and **Vincent C. MARCONI**[1,4,7]

[1]Emory University School of Medicine, Atlanta, Georgia, USA

[2]McCord Hospital, Durban, South Africa

[3]Department of Biostatistics and Bioinformatics, Rollins School of Public Health, Emory University, Atlanta, Georgia, USA

[4]Department of Global Health, Rollins School of Public Health, Emory University, Atlanta, Georgia, USA

[5]Department of Epidemiology, Rollins School of Public Health, Emory University, Atlanta, Georgia, USA

[6]Infectious Diseases Unit, Nelson Mandela School of Medicine, University of KwaZulu-Natal, KwaZulu-Natal, South Africa

[7]Atlanta Veterans Affairs Medical Center, Atlanta, Georgia, USA

Abstract

We sought to examine which socioeconomic indicators are risk factors for virologic failure among HIV-1 infected patients receiving antiretroviral therapy in KwaZulu-Natal, South Africa. A case-control study of virologic failure was conducted among patients recruited from the outpatient clinic at McCord Hospital in Durban, South Africa between October 1, 2010 and June 30, 2012. Cases were those failing first-line antiretroviral therapy (ART), defined as viral load > 1000 copies/mL. Univariate logistic regression was performed on sociodemographic data for the outcome of virologic failure. Variables found significant ($p<.05$) were used in multivariate models and all models were stratified by gender. Of 158 cases and 300 controls, 35% were male and median age was 40 years. Gender stratification of models revealed automobile ownership was a risk factor among males, while variables of financial insecurity (unemployment, non-spouse family paying for care, staying with family) were risk factors for women. In this cohort, financial insecurity among women and automobile ownership among men were risk factors for virologic failure. Risk factor differences between genders demonstrate limitations of generalized risk factor analysis.

For Correspondence and Reprints: Vincent Marconi [vcmarco@emory.edu and current address:341 Ponce de Leon Avenue, Atlanta, GA, 30308, USA].

Keywords

HIV/AIDS; antiretroviral treatment; virologic failure; structural barriers; gender; South Africa

INTRODUCTION

Globally over 34.2 million people are living with HIV (1). Efforts to reduce morbidity and mortality from HIV via roll-out of antiretroviral therapy (ART) have increased HIV treatment access world-wide. Yet as access has expanded, HIV drug resistance (HIVDR) and virologic failure (VF) have risen, posing a threat to ART sustainability (2, 3). A 2012 World Health Organization (WHO) report on HIVDR based on surveys performed in 2010 estimates global HIVDR at around 6.8%, an increase from previous levels (4). In Southern Africa specifically, prevalence of any drug resistance mutation has increased by approximately 14% per year (5).

Starting in 2003, South Africa, with the largest population of individuals living with HIV globally and some areas with the highest prevalence of HIV in the world (1, 6, 7), began implementing a large-scale rollout of ART and comprehensive HIV care to address the HIV epidemic. Yet, in line with global trends, ART failure and HIVDR emerged as access to ART increased. First-line ART failure in South Africa is estimated at 4.9% to 19%, using varying viral load thresholds (8–11). KwaZulu-Natal province (KZN) has the highest prevalence of HIV in South Africa, estimated at up to 40%(12), and studies based in its largest city, Durban, and surrounding rural areas demonstrated ART failure rates of 8–20% in the first year of therapy (13, 14). Of those failing first ART, most (>83.5%) have at least one major resistance mutation and 64.3% have dual-class resistance mutations (13).

To tackle increasing HIVDR, the WHO urged countries to adopt strategies aimed at reducing VF and HIVDR. These strategies included monitoring program-level measurements of ART outcomes (termed Early Warning Indicators), such as clinic retention rate, on-time pill pickup, and drug supply continuity (15, 16). However, individual-level factors associated with virologic failure among those engaged in continuing HIV care are equally important to identify and understand in order to improve treatment outcomes.

In order to identify and explain individual-level factors, this study used a socio-ecological perspective (17) by drawing on the analytical concept of “structural factors.” Structural factors are the economic, institutional, political, sociocultural and other environmental factors that shape the context in which individuals contract, treat, and live with HIV and can act as facilitators or barriers to treatment (18–20). Structural factors always impact health outcomes, but are especially pertinent in resource-limited settings and among vulnerable populations (21–23). Socioeconomic factors (e.g. level of a community’s economic development, degree of unemployment, economic and health resources), a subset of structural factors, in particular have great impact when there are competing demands in the face of constrained resources, such as low income, food insecurity or inadequate public transportation (18, 24–32).

Socioeconomic factors often do not affect the entire population equally. Some of these factors may have a greater impact among specific subpopulations, defined by gender, age, or socioeconomic status (20). For example, women in traditionally patriarchal societies, who often lack access to personal financial or productive resources (33, 34), may be greatly impacted by financial insecurity (18, 35, 36). Conversely, men greatly affected by cultural expectations to be strong and provide for family may find employment a greater barrier to accessing care when they cannot get time away from work to attend clinic due to lost wages or fear of losing their job by revealing their HIV status (37–40). It is known that men in Sub-Saharan Africa seek ART less often or later and have poorer treatment outcomes than women (41, 42); however, the reasons for these discrepancies remain unknown. Analyzing these subpopulations to ascertain key individual factors affecting ART treatment outcomes could be vitally important for both identifying those at risk of VF and providing direction for improving ART outcomes through appropriate interventions.

In an effort to better characterize the key individual-level indicators of VF and HIVDR in South Africa, the Risk Factors for Virologic Failure (RFVF) study (43)examined a multitude of factors to find those most strongly associated with VF among a cohort of 458 people living in urban and peri-urban areas of the KZN province, South Africa. However, the RFVF analysis, focused on identifying the most significant risk factors for the entire cohort, did not intend to look closely at significant impacts of additional factors on specific subpopulations. An analysis that does not consider subpopulation factors can miss potentially remediable barriers, such as transportation constraints, that are overshadowed by statistically stronger, non-remediable risk factors, such as age. Finally, a better understanding of the relationships among socioeconomic risk factors can shed light on the mechanisms of VF.

In this analysis, we examine the impact of socioeconomic factors on ART outcomes and the differences in this impact between men and women living with HIV and receiving care at an outpatient clinic of McCord Hospital in Durban, South Africa. In doing so, we attempt to contribute to the construction of a mechanistic model for VF. We believe this model will be critical in developing effective strategies to prevent VF and HIVDR.

METHODS

Study Setting and Population

Data for this study was collected from the Sinikithemba Clinic (STC), an outpatient HIV clinic at McCord Hospital (MCH). MCH is a semi-private hospital serving the city of Durban and surrounding townships, an area with a high level of poverty: 44% lives in poverty and unemployment is estimated at 30–40% and increasing (44, 45). The STC, supported by the South African government and the President's Emergency Plan For AIDS Relief (PEPFAR), provided outpatient HIV care to around 6000 patients per year, referred from both MCH and local providers. Clinic attendees paid a fixed clinic fee of around $15 USD per visit, which covered all clinical care and medication (46). Monitoring at STC followed the National Antiretroviral Treatment Guidelines set by the South African Department of Health, including HIV-1 viral load and CD4 cell count monitoring every 6 months or more frequently if indicated (47).

Study Design

The present analysis is a sub-study of data from the RFVF study, which utilized a case-control design and is described elsewhere (43). Patients eligible for the RFVF parent study were ≥18 years old, HIV positive, receiving care at MCH or affiliated clinics, and on ART for ≥5 months. Cases were those with VF, defined as having a single viral load (15)> 1000 copies/mL obtained through routine clinical care (47). Two unmatched controls, defined as having a VL ≤ 1000 on routine labwork, were selected from clinic weekly for every case enrolled.

Upon enrollment in the RFVF study, a survey administered by ART counselors covered demographic, socioeconomic, and psychosocial information as well as medical and HIV history. The data collected in the enrollment survey were used for this secondary analysis. Demographic and socioeconomic questions targeted basic demographic information, education, relationship status, living situation, housing type and material, transportation to clinic, funding for clinic visits, food security, employment, and asset ownership, including data used by USAID and the Demographic and Health Surveys (DHS)to create wealth indices (48). The survey, designed with attention to local context, language, and culture, was administered in person in English or isiZulu, and was not included in the patient medical record.

Statistical Analysis

Univariate logistic regression was used to evaluate the marginal associations of VF with demographic and socioeconomic variables recorded in the enrollment survey. VF was selected as the most clinically relevant statistical endpoint, given the current in accuracies in measuring adherence. Free response answers for type of employment were categorized into basic labor, skilled labor, and professional labor based on contextual research, including interviews with ART counselors (Supplemental Table I). Age was analyzed both as a continuous variable and as a dichotomous variable with a cutoff at 40 years of age, which is the mean and median population age. Education was categorized as ≤8 years, 9–11 years, ≥12 years and as dichotomous variables with cutoffs at 8 years and 12 years, based on the education system in South Africa. Number of cohabitants and dependents had similar distributions and were both analyzed by quartile categories and as dichotomous variables with cutoffs at 0, 1, 3, 5, and 7 people. Living situation was separated into categories of staying with friends or family (dependent situation), living independently in a house or apartment, or living with employer. A wealth index was created using Principal Component Analysis on proxies of wealth, namely assets and utilities (Supplemental Table II), and the first extraction was used to assess association with VF and to adjust for wealth in models.

Those variables involving demographic and socioeconomic status found statistically significant ($p<=0.05$)were further evaluated by multivariate logistic regression. Variables that trended toward significant and were meaningful to a socioeconomic analysis, such as level of education, were forced in the multivariate models. Multiple multivariate models were run assessing the effects of variables of financial insecurity. Collinearity and multicollinearity were assessed using the Condition Index (CI) with CI<10 indicating mild/little collinearity, CI=10–30 indicating modest collinearity, and CI>100 indicating

significant collinearity. Models were run with and without variables showing modest collinearity by CI. The largest CI included in the final models was 16; all others were <10. Variables that were closely related or demonstrated collinearity were examined both individually and in combinations in models to assess effect; ultimately the variable most significantly associated with VF was selected for multivariate models. Association between employment type and VF was analyzed separately from the multivariate models due to non-convergence of the model caused by overlap with unemployment and income variables. All multivariate models were adjusted for age, gender, and treatment length, which have established association with VF (14, 49–53).

These univariate and multivariate models and adjustments were then repeated after stratifying by genderto determine differences in risk factors between gender groups. Additionally “having non-spouse family pay for care” and “automobile ownership” were each analyzed individually by univariate analysis to further define these populations (Supplemental Tables III, IV, VIII). SAS 9.1 was used for all analysis and the REDCap electronic database for storage of all data (54).

RESULTS

Of the 458 patients enrolled in the study (158 cases and 300 unmatched controls), ages ranged from 18–74 with the mean age at enrollment approximately 39.6 years (SD=9.0). Thirty five percent (35.4%) were men, 98.9% black South African, and 53% had ≥12 years of education. 19% were unemployed (12% of men and 23% of women) and 17% owned an automobile (30% of men and 9.1% of women). Among cases, the median HIV-1 viral load was 95,221 copies/mL and median CD4 count was 300.5 cells/uL (IQR 183–447) with 88 people >500 cells/uL and 126 people <200 cells/uL. The mean treatment time was 2.54 years (SD=2.06) and median treatment time was 2.05 years (Table I).

Univariate analyses of all variables for the entire cohort were reported elsewhere (43), but analysis of demographic and socioeconomic variables can be found in Table I. Socioeconomic variables found significant by univariate analyses among the entire cohort were lack of income (OR=1.76, p=0.015), unemployment (OR=1.72, p=0.025), dependent living situation, indicated by staying with family or friends (OR=1.53, p=0.031), driving an automobile to clinic (OR=2.21, p=0.0034), owning an automobile (OR=2.35, p=0.0026), and family (non-spouse) paying for care (OR=2.38, p=0.0013). Professional labor (OR=2.04, p=0.060) and 12 years or more of education (OR=1.43, p=0.071) showed borderline significance. Skilled labor showed border line inverse association with VF (OR=0.56, p=0.051).

In a multivariable model including all socioeconomic variables found significant in univariate analyses (Table I), other than age < 40 years and male gender, only owning an automobile (OR=2.35, p=0.0027) and family paying for care (OR=2.71, p=0.041)were significantly associated with VF (Table I). Skilled employment and taking an automobile to clinic were excluded from the multivariable analysis due non-convergence for the former and collinearity with automobile ownership for the latter.

Univariate analysis of all socioeconomic variables stratified by gender revealed a stronger association for women (Table II) in the majority of variables found to be significant overall ($p<0.05$). Strong risk factors for VF among women included lack of income (OR=2.01 p=0.011), unemployment (OR=1.91 p=0.027), dependent living situation (OR=1.98 p=0.010), and non-spouse family member paying for care (OR=2.97 p=0.0006). An additional risk factor for women not found significant in the entire cohort was professional employment (OR=2.85, p=0.024), however only 22 women were in this category (Supplemental Table I). In multivariable models for women, family paying for medication (p=0.040) remained significantly associated with VF when including other indicators of financial dependency (lacking income, staying with family). Among men, univariate analyses revealed the main significant risk factors for VF were younger age and owning an automobile (OR=2.36, p=0.013) while transport to clinic via minibus (OR=0.42, p=0.013) and skilled labor (OR=0.42, p=0.04) were inversely associated with VF. In a multivariate analysis among men, besides younger age, only owning an automobile remained significantly associated with VF (OR=3.10, p=0.0031) (Table II).

DISCUSSION

We analyzed individual socioeconomic characteristics among a cohort of 458 individuals being treated for HIV in KZN, South Africa to identify socioeconomic risk factors for VF. Socioeconomic risk factors are an important subset of structural risk factors for VF. They can help identify those at risk and provide direction for discrete interventions in order to improve ART outcomes (18, 29, 55). However, the impact of such entrenched and interrelated influences can be difficult to concretely define (18, 29). A directed acyclic graph (Figure 1) illustrates some possible interconnections between structural factors at play in this context and their impact on ART outcomes. The impact of each of these factors can vary significantly by population subgroup, such as gender, as seen in this analysis (18).

Analyses among women in this cohort showed that socioeconomic risk factors for VF were related to financial dependency and financial insecurity:unemployment, lack of income, having a non-spouse family member pay for medical care, and staying with family or friends instead of owning or renting a home. Existing literature has demonstrated that financial insecurity is a barrier to care and is associated with poor adherence and VF, yet no studies have assessed differences in this association between genders (25, 26, 56–58). The association between financial dependency indicators and VF among women but not men in this cohort may indicate that personal financial insecurity is a risk factor for VF more specific to women in this context, as has been suggested by some findings in countries where women are often dependent upon men (16, 59, 60).

Moreover, our results show a difference in treatment outcomes depending on who pays for care among female clinic attendees, which raises the question of whether payer identity affects ART outcomes. Studies noting higher VF or loss to follow-up when a fee was required for care demonstrated a financial barrier to ART, but did not address payer identity (25, 26, 56, 57). From our analysis, among women clinic attendees, women dependent upon non-spouse family to pay for care are more likely to experience VF. Similar results from a study in Uganda assessing quality of life among HIV+ patients found that the only clinically

significant sociodemographic predictor of poorer quality of life was financial dependence on another individual (61). In a separate analysis, women in this cohort whose family paid for care were more likely to be <40 years old, unmarried, staying with family, and unemployed.

While we focus on the structural barriers generated by, for example, financial insecurity, it is clear that this socioeconomic factor can have psychological effects as well, such as arousing feelings of shame for asking for money or symptoms of depression or poor self-esteem. Financial insecurity can also generate psycho-social pressures such as being a perceived burden on others (62). However, psychological effects and psycho-social processes are difficult to assess quantitatively, while direct impacts of financial insecurity are quite obvious structural barriers: inability to pay for medication copays, clinic visits, or transportation. While the mechanistic pathways are not fully characterized, our results indicate that financial insecurity, namely financially depending on a non-spouse family member, unemployment, and staying with family or friends, are significant risk factors for VF among women in this cohort.

Among males the main significant socioeconomic risk factor for VF in both univariate and multivariate analysis was automobile ownership. Automobile ownership was not found to be significant among women, though fewer women owned cars. While not likely a direct cause of ART failure, automobile ownership is correlated with unmeasured factors that could be directly related to VF. First, automobile ownership requires money to pay for the automobile, gasoline and maintenance, which can compete with other financial needs. Consequently, automobile ownership becomes a visual symbol of financial success and status (63–65). Automobile ownership can also come with family and social responsibility to help others who do not own an automobile, as suggested by those patients who did not own an automobile but used one for travel to clinic visits. Finally, automobiles could distract from HIV care when owners are “Too busy to take ARVs,” which may indicate prioritization of responsibility to family, work, or community over HIV treatment (Supplemental Table VIII).

To examine possible underlying risk factors for VF that are correlated with automobile ownership, we further characterized the automobile owner subpopulation. In a separate univariate analysis of data from this cohort, automobile ownership among men was associated with marriage, having income, being self-employed, owning a home, and being educated beyond 9 years (Supplemental Table VIII). These characteristics fit conceptually with both a higher level of wealth and with the South African ideal of masculinity. Adjusting for wealth (using a wealth index) or income did not offset or dampen the strong association between car ownership and VF, as would be expected were these characteristics directly linked to individual wealth. Automobile ownership, as a mark of status and a means of providing for family, may be part of the ideal of masculinity in South Africa (66), as has been noted in other cultures (40, 63, 67, 68), and may impact HIV care (40, 41, 69).

We considered the hegemonic masculinity of both Zulu culture, given that 92% of patients in this cohort are of Zulu ethnicity, as well as that of South Africa as a whole. The hegemonic masculinity in Zulu culture is one of strength, invulnerability, and power (34, 70, 71). In the contemporary and traditional, patriarchal Zulu home life, the man’s role is to

marry, work and provide for his wife (or wives and/or girl friends) and family (72, 73). Qualitative research has shown that a similar masculine ideal of the strong provider pervades the whole of South Africa (34, 37, 39, 74).

Although gender roles are changing in South Africa, traditional ideas of manhood persist (75), and can be a barrier to men seeking and adhering to treatment (38, 39, 41, 70, 72, 74, 76). Recent focus on men and access to HIV care in South Africa has yielded some insight into the impact of pervasive ideas of masculinity on men's actions and motivations regarding HIV treatment (66, 69, 71, 74, 76). Admitting vulnerability to HIV, as well as periods of illness or unemployment because of HIV, are in conflict with the South African ideal of manhood (38, 70, 71, 74, 77), potentially leading to compensatory responses or public denial of HIV infection (38, 70). Additionally, although association between "Too busy to take ARVs" and automobile ownership could not be adequately assessed with this sample size (Supplemental Table VIII), literature suggests that family, employment, and other societal expectations and responsibilities can be a barrier to ART (38, 58, 74, 78).

If automobile ownership is part of subscribing to the prevailing ideal of masculinity and societal expectations for men, these men may be susceptible to other aspects of this masculinity that make it difficult to fully subscribe to treatment needs (38, 70, 73, 74). The association between automobile ownership and VF allows identification of males at higher risk of VF, but also may indicate a need for interventions such as support groups or treatment supporters, which have been successful in similar contexts (79–81), or even male-centered HIV clinics (41)to help men manage the conflict between culturally determined gender roles and HIV care.

Several limitations of the present study should be noted. While baseline characteristics of this study population mirror the larger population engaged in HIV treatment in KZN (45, 82), the study population exhibits a lower unemployment rate (20%) as compared to the general population (33%)(45)and the greater HIV population as found in other studies (82). Though the magnitude of this difference is unlikely to either preclude generalizability or change the association found between VF and unemployment given that unemployment rates are lower in the study population, it is a notable difference. Additionally, while the sample size was powered appropriately for analysis of the entire cohort, stratification by gender and age decreased sample size and thus power. With only 35% of patients in the cohort being male, it is possible that the lack of significant association among men in variables shown to be risk factors for VF among women is a result of insignificant power to detect those associations. Along these lines, it is much less common for women to own automobiles than men, and as such, had more women owned automobiles there may have been an association evident between automobile ownership and VF among women as well. Further limitations were described in the RFVF study. Of note as pertaining to both this analysis and the larger RFVF study, we performed many statistical tests but only report the positive results and do not adjust for multiple comparisons. It is possible that some positive findings from this study are spurious and would not be reproducible given another iteration of the same study.

CONCLUSION

Key factors to successful expansion of ART in South Africa, as in much of the world, include improving ART program effectiveness, efficiency and sustainability. Identifying risk factors for virologic failure is a key piece in addressing these three concerns. While algorithms to identify higher risk patients are useful, easy, and definitely have a place in treatment centers that are under staffed and over-crowded, there is also a need for deeper understanding of risk factors specific to the sub-groups of the patients being treated. Our data suggests that some risk factors are more specific to select population groups and can collectively paint a clearer picture of structural factors associated with or contributing to VF and potential ways to mitigate these risk factors. From this analysis we postulate that certain individuals might benefit from additional assistance. Women who do not have employment or personal income and depend on extended family to pay for their clinic visits may benefit from employment counseling, vocational training or microfinance initiatives to increase employment, independence, and self-empowerment (36). Men who feel pressure to fulfill perceived expectations and ideals of masculinity may benefit from treatment supporters, support groups, motivational interviewing or male-centered clinics to address the sociocultural expectations they experience and develop some solidarity and emotional support. While these associations are still generalizations to be used cautiously, this analysis highlights that socioeconomic risk factors can differ significantly among a population, particularly along gender lines. These differences should be considered in future exploration of structural risk factors and their solutions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Foremost, we express our deepest admiration and appreciation for the patients who participated in the RFVF study for their great courage and support of this research; for the counselors, nurses, medical officers and staff of Sinikithemba for their tireless commitment to patient care; and to the entire RFVF team. Funding for this research came from Emory University Center for AIDS Research (CFAR) (P30AI050409), Emory University School of Medicine Division of Infectious Diseases, NIH (R01 AI098558-01A1), Elizabeth Glaser Pediatric AIDS Foundation as part of Project HEART, the Gilead Foundation and Research and Health Sciences IT Division grant support (UL1RR025008).

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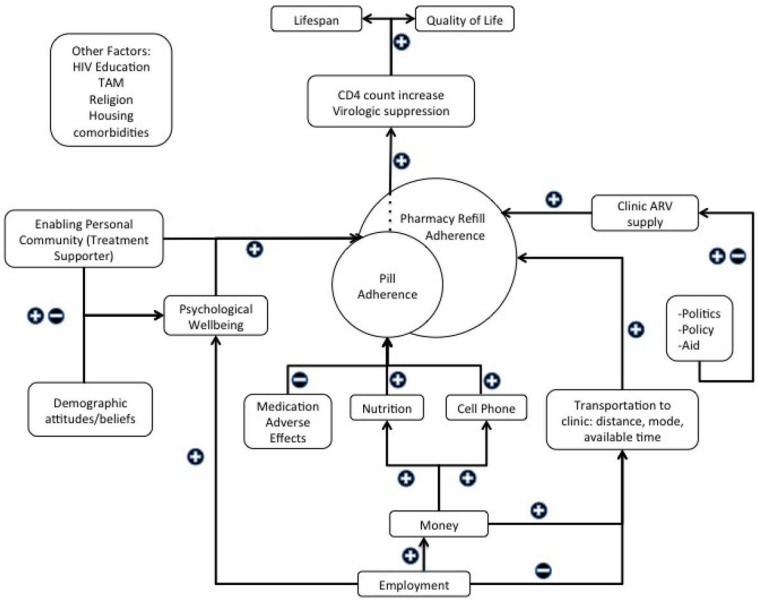

Figure 1.

Directed acyclic graph of structural factors and their potential interconnections and impact on ART outcomes

This diagram proposes a mechanistic pathway to successful ART treatment, specifically viral suppression. A failure in one of these pathways or a negative effect of one of these inputs may lead to virologic failure instead. This diagram highlights the role of socioeconomic factors in ART success. In this diagram, we see the effect of employment as potentially positive or negative. Employment provides income and access to personal funds to pay for treatment, adherence aids (cell phone), and food [36], transport to clinic. Employment also potentially precludes available time for clinic visits and introduces the barrier of stigma in the workplace[50]. We see the dual nature of an “enabling personal community”, which includes the effect of financial dependence (as demonstrated in the present analysis), the positive effects of treatment supporter programs [69–71], and the potentially negative impact of community “support” depending on pervasive stigma [36]. We also see the effect of “demographic attitudes/beliefs”, which can include stigma, gender roles, religion, and Traditional African Medicine (TAM in diagram)[72].

AIDS Behav. Author manuscript; available in PMC 2015 November 01.

Table I

Baseline Characteristics, Univariate (UV), and Multivariate (MV) analysis of entire cohort

Characteristic	UNIVARIATE				MULTIVARIATE[i]	
	Total (n=458)	**Case (n=158)**	**Control (n =300)**	***p***	**OR (95% CI)**	***p***
Age mean years (SD)	39.6 (9.0)	37.1 (8.4)	40.9 (9.1)	<.0001	0.95 (0.93–0.98)	0.0007
Male gender % (SD)	35 (2.2)	47 (4.0)	29 (2.6)	<.0001	2.20 (1.41–3.45)	0.0006
Years on ART[ii], mean (SD)	2.54 (2.1)	2.11 (2.1)	2.77 (2.0)	0.0012	0.88 (0.79–0.98)	0.024
≥12 years education % (SD)	53 (2.3)	59 (3.9)	50 (2.9)	0.0767	1.11 (0.71–1.75)	0.64
CD4 Count Categories% (SD)						
>500	19 (1.8)	11 (2.5)	23 (2.4)			
350–500	23 (2.0)	11 (2.5)	29 (2.6)			
200–350	30 (2.1)	30 (3.6)	30 (2.6)			
<200	28 (2.1)	47 (4.0)	17 (2.2)			
No income[iii] % (SD)	21 (1.9)	28 (3.6)	18 (2.2)	0.015	0.68 (0.20–2.33)	0.53
Unemployed %[iv] (SD)	19 (1.8)	25 (3.4)	16 (2.1)	0.025	1.50 (0.49–4.63)	0.48
Full time employed% (SD)	52 (2.3)	47 (4.0)	54 (2.9)	0.13		
Self-employed% (SD)	13 (1.6)	15 (2.8)	11 (1.8)	0.24		
Basic labor% (SD)	68 (2.2)	70 (3.6)	67 (2.7)	0.56		
Skilled labor% (SD)	23 (2.0)	16 (2.9)	26 (2.5)	0.051		
Professional labor% (SD)	9.3 (1.4)	14 (2.8)	7.0 (1.5)	0.060		
Employment (categ.) [v]% (SD)				0.19		
Self pays for care % (SD)	79 (1.9)	73 (3.5)	81 (2.3)	0.051		
Family pays for care [vi]% (SD)	14 (1.6)	22 (3.3)	11 (1.8)	0.001	2.71 (1.04–7.04)	0.041
Spouse pays for care % (SD)	4.4 (1.0)	3.2 (1.4)	5.0 (1.3)	0.37		
Lives in house% (SD)	92 (1.3)	91 (2.3)	93 (1.5)	0.48		
Living (categ.)[vii]	--	--	--	0.59		
Owns own home% (SD)	36 (2.2)	32 (3.7)	38 (2.8)	0.20		
Owns or rents home % (SD)	50 (2.3)					
Dependent living[viii]% (SD)	50 (2.3)	52 (4.0)	41 (2.8)	0.031	1.00 (0.61–1.63)	1.00

Characteristic	UNIVARIATE				MULTIVARIATE[i]	
	Total (n=458)	**Case (n=158)**	**Control (n =300)**	***p***	**OR (95% CI)**	***p***
Married% (SD)	21 (1.9)	17 (3.0)	22 (2.4)	0.25		
In a relationship[ix]% (SD)	64 (2.2)	73 (3.5)	60 (2.8)	0.005		
Any cohabitants% (SD)	96 (1.0)	95 (1.7)	97 (1.0)	0.37		
>2 cohabitants% (SD)	73 (2.1)	72 (3.6)	74 (2.5)	0.67		
>5 cohabitants% (SD)	36 (2.2)	38 (3.9)	35 (2.8)	0.58		
Any dependents % (SD)	94 (1.1)	94 (1.9)	93 (1.5)	0.69		
>2 dependents % (SD)	54 (2.3)	51 (4.0)	56 (2.9)	0.27		
>5 dependents % (SD)	28 (2.1)	28 (3.6)	29 (2.6)	0.85		
Patient owns a car % (SD)	17 (1.8)	25 (3.4)	13 (1.9)	0.0008	2.35 (1.35–4.11)	0.0027
Own car to clinic[x] % (SD)	13 (1.8)	20 (3.2)	9.7 (1.7)	0.0032		
Any car to clinic[xi] % (SD)	14 (1.6)	21 (3.2)	11 (1.8)	0.0034		
Bus/minibus to clinic % (SD)	84 (1.7)	78 (3.3)	87 (1.9)	0.014		

[i] The multivariate model includes variables found significant ($p<0.05$) in univariate analysis, excluding variables with significant colinearity. Education was forced in multivariate models despite borderline significance

[ii] for each increasing year

[iii] "No Income" refers to the patient having no income from any source

[iv] "Unemployed" does not include those who are students or are retired

[v] Employment categorical variable includes basic, skilled, and professional labor categories

[vi] Family (non-spouse) pays for care: dichotomous variable consisting of family pays for care vs all other payers

[vii] Living situation categorical variable includes: owns home, rents home, stays with friends, stays with family, stays with employer

[viii] "dependent living" indicates a dependent living situation, meaning living with family or friends as opposed to other living situations such as owning or renting a home

[ix] "In a relationship" includes both married and non-married couples who self-identified as having a partner

[x] "Own car to clinic" indicates the subject uses his or her own car to get to clinic

[xi] "Any car to clinic" indicates that the subject used an automobile to attend clinic, which can include the subject's own car (60), a relative or friend's car (2), and an employer's car (3)

Table II

Univariate and multivariate analysis of demographic and socioeconomicrisk factors stratified by gender.

	MALE				FEMALE			
	UNIVARIATE		MULTIVARIATE[8]		UNIVARIATE		MULTIVARIATE	
Characteristic[9]	OR	*p*	OR (95% CI)	*p*	OR	*p*	OR (95% CI)	*p*
Age	0.96	0.028	0.95 (0.9–1.0)	0.042	0.94	<.0001	0.95 (0.9–1.0)	0.0038
Years on ART	0.91	0.247	0.98 (0.8–1.2)	0.80	0.82	0.0049	0.83 (0.7–1.0)	0.012
≥ 12 yrs education	1.62	0.13	1.20 (0.6–2.4)	0.61	1.53	0.11	1.10 (0.6–2.0)	0.75
No income	2.27	0.085	0.98 (0.05–20.6)	0.99	2.01	0.011	0.55 (0.1–2.3)	0.41
Unemployed	2.40	0.080	2.14 (0.1–44.5)	0.62	1.91	0.027	1.47 (0.4–5.1)	0.54
Basic Labor	1.83	0.12			0.79	0.50		
Skilled Labor	0.42	0.040			0.64	0.31		
Professional Labor	1.59	0.50			2.85	0.024		
Self pay for care	0.53	0.19			0.51	0.018		
Family pay for care	2.52	0.11	1.53 (0.2–11.0)	0.68	2.97	0.001	3.30 (1.1–10.3)	0.040
Dependent living	1.41	0.29	0.87 (0.4–1.9)	0.74	1.98	0.010	0.99 (0.5–1.9)	0.98
Owns a car	2.36	0.013	3.10 (1.5–6.5)	0.0031	1.32	0.52	1.61 (0.7–4.0)	0.30
Travel via Minibus	0.68	0.26			0.71	0.46		

[8] Multivariate models are those used in Table 1, utilizing variables found significant ($p<0.05$) in univariate analysis, excluding variables of significant colinearity. Education was forced despite borderline significance in univariate models ($p=0.08$ for entire cohort)

[9] Categories are as stated in Table I