Association Between ART Adherence and Mental Health: Results from a National HIV Sero-Behavioural Survey in South Africa

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Abstract

This paper assesses the levels of antiretroviral treatment (ART) adherence and mental health distress among study participants in a national behavioural HIV-sero prevalence study South Africa. The study was a cross-sectional population-based multi-stage stratified cluster random survey, (SABSSM V, 2017). Structured questionnaires were used to collect information on socio-demographics, HIV knowledge, perceptions, HIV testing and HIV treatment history. Study participants were tested for HIV infection, antiretroviral use, viral suppression, and ART drug resistance. A total of 2155 PLHIV aged 15 years or older who were on ART were included in the study. Incidence of either moderate or severe mental

health distress was 19.7%. Self-reported ART adherence among study participants with no, mild, moderate, or severe mental distress was 82%, 83%, 86% and 78%, respectively. The adjusted odds ratio for ART non-adherence was 0.58 (95% CI 0.24; 1.40) for mild mental distress, 0.82 (95% CI 0.35; 1.91) for moderate mental distress and 2.19 (95% CI 1.14; 4.19) for severe mental distress groups compared to the no mental health distress group. The other factors that were associated with ART non-adherence in adjusted models included education level, alcohol use and province/region of residence. The study revealed that mental health remains a challenge to ART adherence in South Africa. To improve ART adherence, HIV continuum of care programs should include screening for mental health among people living with HIV.

Keywords: ART adherence; Mental health; Alcohol use; South Africa

Introduction

The successful initiation on antiretroviral treatment (ART) and achievement of viral suppression depends on good adherence to treatment by HIV-infected individuals who are on treatment. Non-adherence to ART leads to viral proliferation, drug resistance, disease progression and death [1, 2]. If HIV testing and linkage to care initiatives are working well, then more attention and focus should be put towards HIV treatment including adherence and retention in care. A number of factors have been mentioned as being associated with patient adherence to care and continuation with HIV treatment, with mental health being an important factor [3,4,5].

People living with HIV are at an increased risk of developing mental health disorders [6]. Evidence has demonstrated an interdependence and vicious circularity between mental health and HIV [7, 8]. Studies conducted across 38 countries found that 15% of adults and 25% of adolescents living with HIV reported depression or feeling overwhelmed [9]. Evidence from developed countries suggests that just under 50% of all PLHIV have a diagnosable mental disorder and in some instances a threefold higher rate of mental disorder compared to those not living with HIV [10]. An observational study of PLHIV conducted in the University of Washington HIV cohort found rates as high as 63% when compared to 31% among HIV-negative individuals [11].

The prevalence of mental disorders among PLHIV is markedly variable across studies conducted in low- and middle-income countries (LMICs). An estimate rate of over 30% among PLHIV has been reported across studies in some LMICs [12]. A systematic review of studies from sub-Saharan Africa found a range of 9% to 32% prevalence of probable depression [13]. Available figures from South Africa indicate that up to 25% of PLHIV may experience some form of depression during the course of the illness with major depression occurring in about 5–10% of patients, while minor depressive disorders are diagnosed in about 15–20% [14, 15].

Mental illness is associated with suboptimal adherence to ART, and consequently impaired HIV virologic control [3,4,5, 16]. Major depression is the most common mental disorder that

has been shown to affect treatment adherence and overall quality of life (QoL) of PLHIV [17, 18].

The association between mental illness and poor ART adherence among PLHIV is likely to present a significant public health challenge in South Africa [19,20,21,22]. However, others have found a tenuous or no association between ART adherence and mental illness. For instance, in a study by Kitshoff and Naidoo [23], while 62% of study participants had higher threshold levels on a depressive scale, 32% reported less than 95% adherence to ART. However, there was no significant association between depressive symptoms and non-adherence to ART in that study.

Using a nationally representative sample, we ascertain whether and to what degree mental health is associated with adherence to ART in South Africa.

Research Question

Is mental health still a challenge that is associated with ART non-adherence among HIV infected individuals from a national representative HIV sero-prevalence survey in South Africa?

Methods

This paper uses data collected as part of the SABSSM V survey, a national HIV behavioural and sero-prevalence study [24]. The study design was a cross sectional survey which employed a multi-stage cluster sampling approach to select 1000 small areas layers (SAL) each containing about 100–200 households. Fifteen households/visiting points (VP) were selected from each SAL using systematic sampling. The sample was stratified by province and locality type (urban, rural, and farming communities). Once a household was selected and the head of the household had agreed to participate in the survey, all members of that household were then invited to be part of the study. From the 9656 households that agreed to participate in the survey, 36,609 (93.6%) individuals agreed to be interviewed. The study excluded people living in education institutions, assisted living homes, hospitals and uniformed-service barracks. Adults aged 18 years or older signed informed consent forms, while parental/legal guardian consent and assent were obtained for children. Data collection took place from March 2017 to February 2018.

Socio-demographic data such as age, sex, race, education and employment status as well as data on substance use and alcohol use was collected. The Kessler Psychological Distress scale (K10) was used to measure psychological distress [25]. For this analysis, data for individuals aged 15 years or older, who self-reported to be HIV positive but were also confirmed by study testing and further self-reported ART use, was extracted.

ART Adherence

To measure ART adherence, HIV infected individuals' responses to the question "In the past 30 days, have you missed taking any of your ART/ARV pills?" were used to generate a binary outcome variable with zero representing those who reported not having missed any

treatment and one those who reported missing treatment at least once. A further question soliciting information about the number of days' treatment was missed was used as an intensity measure of adherence to treatment. Reasons for missing treatment were also assessed.

Mental Distress

The Kessler Psychological Distress scale was used to measure levels of mental distress. The distress tool consists of 10-item questions that measure distress based on questions about depression and anxiety experienced in the last four weeks prior to the study interview. Each question was scored from one to five (1—no experience; 2—a little of the time; 3—some of the time; 4—most of the time; 5—all the time). To assess internal validity of the questions, Cronbach Alpha [26] was run and a scale reliability coefficient of 0.93 was observed, with average inter-item covariance of 0.58 showing strong internal item consistency. To assess if all 10 questions contributed to the distress score, Principal Component Factor (PCF) Analysis was run [27]. The first factor, the only one with an Eigenvalue above 1 (6.20) had factor loadings ranging from 0.68 to 0.82 showing that all the 10 questions contributed significantly to the distress scale. To generate distress groups, the value for each of the 10 responses for an individual were added up and the total score (possible range of values 10 to 50) is the score on the Kessler Psychological Distress Scale (K10). Four distress groups were then generated as follows:

(1) < 20 = likely to be well

(2) 20–24 = likely to have mild mental disorder

(3) 25–29 = likely to have moderate mental disorder

(4) ≥ 30 = likely to have a severe mental disorder

Data Analysis

Data was imported into STATA (Version 15, College Station, Texas 77,845 USA) from CSPro. Frequencies and weighted percentages were reported for socio-demographic data by sex. To assess the level of mental distress, weighted prevalence with 95% confidence intervals were reported. To test if there was an associated between socio-demographic and distress levels, Fisher exact tests were used. The outcome is a binary variable (0 = adhered to treatment, 1 = missed treatment), and the exposure variable was distress groups, 4 levels as described above. Logistic regression was used to assess the association between ART adherence and mental distress. Prevalence of adherence was reported for socio-demographic variables as well as substance use including alcohol use. Alcohol use was measured using the Alcohol Use Disorders Identification Test (AUDIT) [28]. AUDIT scale identified abstainers (scored as 0), low risk drinkers (those who scored 1–7), high risk drinkers (those who scored 8–19) and hazardous drinkers (those who scored 20 +). Univariate models for socio-demographic, drug use and alcohol use and mental distress were fitted on ART adherence. A multi-variable model was built using all factors that had a significance level of 5% or lower but excluding the mental health variable. Once this model

was fitted, the mental health variable was included in this final reduced model in order to assess the association between ART adherence and mental health adjusting for other variables. A saturated model that included all the factors used to build the model is also reported. Odds ratios for univariate models and adjusted Odds ratios (aOR) for multi-variable models with p-values and 95% confidence Intervals (95% CI) are reported.

Results

A total of 2155 individuals were included in the analysis, of whom 1692 (79%) were females. The majority (63%) were aged 25 to 44 years, although there were proportionately more people who were 50 years or older among males (22%) compared to females (16%), see Table 1. Most participants (66%) reported never being married, more among females (69%) compared to males (59%). Just over a quarter (26%) of all participants had a high school certificate or post-secondary school certificate. The majority of study participants were unemployed (71%) and from urban areas (65%). In terms of provincial distribution, Gauteng province (23%), Kwazulu-Natal (21%) and the Eastern Cape (16%) contributed the highest number of participants.

Prevalence of Mental Distress?

Table 2 shows the prevalence of mental distress among the study participants. Ten percent (10%) of the study participants had severe mental distress, and another 10% presented with moderate mental distress. There was no statistical difference in levels of mental health between males and females (Design based F- value = 1.71, p = 0.16). When mental distress levels were compared across age groups, 19%, 19%, 21%, 14%, and 21% among 15 to 24 year olds, 25 to 34 year olds, 35 to 44 year olds, 45 to 49 year olds and 50 plus year olds respectively reported severe or moderate mental health distress (F-value = 1.52, p-value = 0.12). The levels of severe or moderate mental distress was highest among those who reported being divorced or separated (23%) and lowest among those who were married (17%) (F-value = 1.25, p-value = 0.27). Participants reporting a post-secondary education (30% severe or moderate distress) had the highest levels of mental distress, while participants who reported completing secondary school (13% severe or moderate distress), reported the lowest (F-value, p-value = 0.92, p-value = 0.50). Participants who reported being sick/disabled and where thus unable to work had higher levels of severe or moderate distress (34%) compared to those who were employed (14%) (F-value = 0.34, p-value = 0.89). When it came to provinces, mental distress was highest in Northern Cape (18%) and lowest in the Free State (5%), (F-value 1.41, p-value = 0.31). There was no association between mental distress and the following variables, sex, age, marital status, education or geographical location.

Patterns of Adherence/Non-adherence?

Overall, the median duration of missed treatment for participants who indicated that they had missed treatment at some point was 2 months (Q1–Q3, 1 to 5 months).

Table 1. Socio-demographic characteristics of study sample

	Gender					
	Male n (%)		Female n (%)		Total n (%)	
Age group						
15–24 years	23	4.2	131	6.4	154	5.8
25–34 years	82	21.8	515	33.9	597	30.5
35–44 years	163	32.3	521	32.2	684	32.3
45–49 years	79	19.4	206	11.5	285	13.7
50 + years	116	22.3	319	15.9	435	17.7
Marital status						
Married	127	31.4	261	18.5	388	22.1
Never married	297	59.4	1228	69.0	1525	66.3
Divorced/separated	19	4.9	79	5.9	98	5.6
Widower/widow	20	4.3	124	6.7	144	6.0
Education level						
No school or up to 7 years of primary school	126	27.8	386	24.7	512	25.6
Up to 4 years of secondary school	175	49.4	630	47.4	805	47.9
Completed secondary school (metric certificate)	73	18.8	333	23.8	406	22.3
Post metric	17	4.0	54	4.2	71	4.1
Employment status						
Unemployed	272	60.9	1264	75.3	1536	71.2
Sick/disabled or unable to work	11	2.0	23	1.0	34	1.3
Student/pupil/learner	12	2.2	36	1.9	48	2.0
Employed/self employed	164	34.4	351	20.0	515	24.1
Other	3	0.5	16	1.8	19	1.4

Geographic area						
Urban area	234	69.7	793	62.9	1027	64.8
Rural/traditional	174	25.3	757	33.9	931	31.5
Farms	55	4.9	142	3.2	197	3.7
Province						
Western Cape	15	7.0	46	6.0	61	6.3
Eastern Cape	36	12.9	169	17.8	205	16.4
Northern Cape	15	1.2	40	1.0	55	1.1
Free State	44	13.1	84	6.5	128	8.3
KwaZulu-Natal	161	19.6	666	21.1	827	20.7
North-West	30	6.9	125	7.6	155	7.4
Gauteng	80	24.2	246	21.8	326	22.5
Mpumalanga	60	6.5	229	8.2	289	7.7
Limpopo	22	8.5	87	10.1	109	9.6

Table 2. Socio-demographic characteristics and mental health

	Mental distress group									
	No distress		Mild		Moderate		Severe		Total	Fishers exact test p-value
	Row %	95% CI	Row %	95% CI	Row %	95% CI	Row %	95% CI	Row %	
Sex										
Male (n = 246)	68.5	[60.8,75.4]	14.6	[10.1,20.6]	5.9	[3.6,9.4]	11.0	[6.8,17.4]	100.0	0.16
Female (n = 813)	66.5	[62.1,70.6]	12.8	[10.2,15.8]	11.2	[8.7,14.3]	9.5	[7.2,12.5]	100.0	
Total (n = 1059)	67.1	[63.1,70.8]	13.3	[11.0,16.0]	9.7	[7.8,12.1]	10.0	[7.6,12.9]	100.0	
Age group										
15–24 years (n = 68)	57.7	[41.1,72.7]	23.1	[13.3,37.0]	5.0	[1.6,14.8]	14.3	[7.1,26.6]	100.0	0.12
25–34 years (n = 291)	69.6	[62.6,75.7]	11.1	[7.7,15.9]	9.5	[6.1,14.6]	9.8	[5.7,16.3]	100.0	
35–44 years (n = 326)	67.8	[61.1,73.9]	11.1	[7.6,15.9]	10.5	[7.1,15.4]	10.6	[7.1,15.6]	100.0	
45–49 years (n = 151)	63.0	[53.0,71.9]	22.7	[15.1,32.5]	7.6	[4.0,13.8]	6.8	[3.6,12.6]	100.0	
50 + years (n = 223)	67.7	[60.4,74.3]	10.4	[6.4,16.7]	11.8	[7.9,17.2]	10.0	[6.1,16.0]	100.0	
Total (n = 1059)	67.1	[63.1,70.8]	13.3	[11.0,16.0]	9.7	[7.8,12.1]	10.0	[7.6,12.9]	100.0	
Marital status										
Married (n = 226)	71.2	[63.2,78.2]	12.3	[7.7,18.9]	9.3	[5.9,14.4]	7.2	[3.9,13.1]	100.0	0.27
Never married (n = 698)	65.8	[61.0,70.3]	13.6	[10.9,16.9]	8.9	[6.8,11.6]	11.7	[8.5,15.8]	100.0	
Divorced/separated (n = 59)	60.3	[44.4,74.3]	16.5	[7.4,32.6]	19.5	[9.0,37.2]	3.7	[0.9,13.5]	100.0	
Widower/widow (n = 76)	72.3	[58.7,82.7]	10.1	[4.7,20.4]	10.6	[4.7,21.9]	7.0	[2.8,16.5]	100.0	
Total (n = 1059)	67.1	[63.1,70.8]	13.3	[11.0,16.0]	9.7	[7.8,12.1]	10.0	[7.6,12.9]	100.0	
Education level										
No school or up to 7 years of primary school	67.5	[60.2,74.0]	10.7	[7.0,16.1]	9.3	[6.0,14.2]	12.5	[8.1,18.9]	100.0	0.50
Up to 4 years of secondary school	64.4	[57.8,70.5]	13.3	[9.8,17.9]	11.6	[8.3,16.0]	10.7	[7.2,15.6]	100.0	

Completed secondary school (metric certificate)	73.5	[65.2,80.5]	13.5	[8.3,21.3]	7.8	[4.5,13.0]	5.2	[2.2,11.8]	100.0	
Post metric	62.3	[38.6,81.2]	7.9	[2.3,23.6]	16.5	[4.5,45.4]	13.4	[3.5,39.6]	100.0	
Total (n = 890)	67.1	[62.7,71.3]	12.5	[10.0,15.4]	10.4	[8.1,13.1]	10.0	[7.4,13.4]	100.0	
Employment status										
Unemployed (n = 741)	65.3	[60.7,69.5]	13.4	[10.6,16.8]	11.2	[8.8,14.1]	10.2	[7.6,13.4]	100.0	0.12
Sick/disabled and unable to work (n = 18)	55.6	[28.7,79.5]	10.6	[2.0,40.6]	13.1	[3.0,42.6]	20.7	[6.5,49.7]	100.0	
Student/pupil/learner (n = 22)	2.1	[30.7,72.7]	23.8	[8.7,50.6]	0.0	-	24.1	[9.0,50.6]	100.0	
Employed/self employed (n = 261)	73.9	[67.0,79.8]	12.4	[8.1,18.5]	5.5	[2.8,10.2]	8.3	[4.7,14.2]	100.0	
Other (n = 15)	69.7	[39.3,89.1]	10.7	[1.8,44.0]	19.6	[5.4,51.2]	0.0	-	100.0	
Total (n = 1057)	67.0	[63.1,70.7]	13.3	[11.0,16.0]	9.7	[7.8,12.1]	10.0	[7.6,12.9]	100.0	
Geographic location										
Urban area (n = 582)	66.6	[61.3,71.6]	14.0	[10.9,17.7]	9.7	[7.2,12.9]	9.7	[6.6,14.1]	100.0	0.89
Rural/traditional (n = 357)	67.2	[61.1,72.7]	12.3	[8.9,16.7]	10.2	[7.3,14.2]	10.3	[7.4,14.2]	100.0	
Farms (n = 120)	74.3	[59.0,85.3]	9.5	[4.4,19.5]	5.5	[2.3,12.6]	10.7	[4.8,22.1]	100.0	
Total (n = 1059)	67.1	[63.1,70.8]	13.3	[11.0,16.0]	9.7	[7.8,12.1]	10.0	[7.6,12.9]	100.0	
Province										
Western Cape (n = 59)	75.0	[57.1,87.1]	12.9	[6.0,25.8]	4.5	[0.7,22.7]	7.6	[3.5,15.8]	100.0	0.31
Eastern Cape (n = 163)	68.7	[60.3,76.0]	13.4	[8.8,20.1]	7.4	[4.1,12.8]	10.6	[6.5,16.6]	100.0	
Northern Cape (n = 55)	54.9	[38.2,70.6]	10.1	[3.9,23.6]	17.1	[7.7,33.8]	17.9	[8.7,33.1]	100.0	
Free State (n = 128)	64.4	[52.8,74.5]	22.3	[14.4,33.0]	7.9	[3.4,17.0]	5.4	[2.4,11.9]	100.0	
KwaZulu-Natal (n = 233)	73.9	[66.1,80.4]	7.6	[4.8,11.9]	10.6	[7.2,15.4]	7.9	[4.3,14.0]	100.0	
North-West (n = 111)	59.0	[49.0,68.3]	14.9	[9.1,23.3]	18.2	[11.1,28.5]	7.9	[4.2,14.4]	100.0	
Gauteng (n = 116)	63.1	[51.5,73.4]	14.3	[8.6,22.8]	9.5	[4.8,18.0]	13.0	[6.5,24.5]	100.0	
Mpumalanga (n = 105)	61.6	[50.2,71.9]	12.1	[6.8,20.5]	12.7	[7.0,21.9]	13.6	[7.4,23.5]	100.0	
Limpopo (n = 89)	68.0	[56.4,77.8]	15.1	[8.5,25.3]	7.3	[3.3,15.4]	9.5	[4.5,19.1]	100.0	
Total (n = 1059)	67.1	[63.1,70.8]	13.3	[11.0,16.0]	9.7	[7.8,12.1]	10.0	[7.6,12.9]	100.0	

Table 3. Univariate and multi-variable models assessing the association between ART non-adherence and mental health

	ART Adherence levels	Univariate model: model-1	Multi-variable model-2: saturated model	Multi-variable model-3: reduced model
	%	OR (95% CI) p-value		aOR
Mental distress group				
Normal	0.18	1 (reference)	1 (reference)	1 (reference)
Mild	0.17	0.94 (0.48; 1.84) 0.86	0.39 (0.14; 1.06) 0.07	0.58 (0.24; 1.40) 0.23
Moderate	0.14	0.76 (0.38; 1.54) 0.45	0.69 (0.29; 1.65) 0.40	0.82 (0.35; 1.91) 0.65
Severe	**0.32**	**2.15 (1.09; 4.22) 0.03**	1.95 (0.98; 3.86) 0.06	**2.19 (1.14; 4.19) 0.02**
Sex				
Male	0.24	1 (reference)	1 (reference)	
Female	0.17	0.67 (0.41; 1.11) 0.12	0.71 (0.38; 1.34) 0.29	
Age				
15–24 years	0.20	1 (ref)	1 (ref)	
25–34 years	0.19	0.97 (0.36; 2.59) 0.95	2.06 (0.43; 9.92) 0.37	
35–44 years	0.19	0.98 (0.38; 2.54) 0.97	2.76 (0.61; 12.47) 0.19	
45–49 years	0.20	0.99 (0.33; 2.97) 0.99	2.84 (0.59; 13.68) 0.19	
50 + years	0.17	0.84 (0.30; 2.32) 0.73	1.87 (0.40; 8.86) 0.43	
Marital status				
Married	0.16	1 (reference)	1 (reference)	
Never married	0.20	1.40 (0.80; 2.44) 0.23	1.39 (0.71; 2.73) 0.34	
Divorced/separated	0.25	1.81 (0.69; 4.74) 0.23	2.08 (0.57; 7.57) 0.27	
Widower/widow	0.11	0.67(0.23; 1.93) 0.46	1.13 (0.39; 3.29) 0.82	
Education				

No school or up to 7 years of primary school	0.16	1 (reference)	1 (reference)	1 (reference)
Up to 4 years of secondary school	0.22	1.48 (0.83; 2.62) 0.18	1.37 (0.70; 2.65) 0.36	1.32(0.70; 2.49) 0.38
Completed secondary school (metric certificate)	0.22	1.50 (0.78; 2.88) 0.22	1.65 (0.72; 3.75) 0.23	1.55(0.71; 3.38) 0.27
Post metric	0.34	2.81 (1.03; 7.66) 0.04	3.44 (1.03; 11.51) 0.05	3.69(1.31; 10.37) 0.01
Employment status				
Unemployed	0.21	1 (reference)	1 (reference)	
Sick/disabled and unable to work	0.14	0.63 (0.11; 3.47) 0.60	0.31 (0.08; 1.12) 0.07	
Student/pupil/learner	0.21	1.04 (0.29; 3.77) 0.95	1 -	
Employed/self employed	0.15	0.69 (0.42; 1.14) 0.14	0.43 (0.23; 0.81) 0.01	
Geographic location				
Urban area	0.22	1 (reference)	1 (reference)	
Rural/traditional	**0.12**	**0.49 (0.32; 0.76) 0.00**	0.73 (1.29; 0.29) 0.28	
Farms	0.19	0.82 (0.45; 1.47) 0.50	1.35 (0.55; 3.31) 0.52	
Uses drugs				
No	0.18	1 (reference)	1 (reference)	
Yes	0.24	1.39 (0.76; 2.56) 0.28	0.73 (0.29; 1.81) 0.49	
Intravenous drug use				
No	0.19	1 (reference)	1 (reference)	
Yes	0.25	1.42 (0.54; 3.71) 0.47	2.40 (0.58; 0.83) 0.22	
Alcohol use				
Abstainers	0.15	1 (reference)	1 (reference)	1 (reference)
Low risk drinkers (1–7)	0.20	1.42 (0.80; 2.51) 0.23	1.22 (0.65; 2.29) 0.54	1.45(0.80; 2.62) 0.22
High risk drinkers (8–19)	0.43	4.19 (1.97; 8.88) 0.00	4.32 (1.62; 11.49) 0.00	4.10(1.67; 10.05) 0.00

Hazardous drinkers (20 +)	0.59	7.88 (1.30; 47.85) 0.03	9.83 (1.62; 59.47) 0.01	10.99(1.93; 62.58) 0.01
Province				
Western Cape	0.41	1 (reference)	1 (reference)	1 (reference)
Eastern Cape	0.12	0.20 (0.09; 0.47) 0.00	0.39 (0.14; 1.14) 0.08	0.31(0.12; 0.79) 0.01
Northern Cape	0.15	0.26 (0.09; 0.70) 0.01	0.28 (0.08; 0.99) 0.05	0.24(0.07; 0.80) 0.02
Free State	0.14	0.24 (0.11; 0.54) 0.00	0.24 (0.09; 0.63) 0.00	0.20(0.08; 0.52) 0.00
KwaZulu-Natal	0.18	0.31 (0.16; 0.64) 0.00	0.54 (0.21; 1.40) 0.20	0.47(0.21; 1.09) 0.08
North-West	0.14	0.24 (0.11; 0.54) 0.00	0.36 (0.13; 1.00) 0.05	0.26 (0.10; 0.66) 0.01
Gauteng	0.27	0.53 (0.24; 1.18) 0.12	0.75 (0.30; 1.91) 0.55	0.58 (0.24; 1.37) 0.21
Mpumalanga	0.19	0.35 (0.16; 0.77) 0.01	0.57 (0.19; 1.69) 0.31	0.41 (0.15; 1.12) 0.08
Limpopo	0.09	0.15 (0.06; 0.39) 0.00	0.23 (0.07; 0.76) 0.02	0.16 (0.06; 0.49) 0.00

Significant level is 5%

Self-reported ART non-adherence for study participants with no mental distress was 18%, mild mental distress was 17%, moderate mental distress was 14% and severe mental distress was 22%; see Table 3. Nearly a quarter of males (24%) compared to 17% of females reported missing at least one dose of HIV medication in the past 30 days prior to the study interview. When it came to age, 20% of both 14 to 24 and 35 to 49-year-old age groups reported missing HIV treatment in the past month compared to 17% of 50 years or older. In terms of marital status, a quarter (25%) of divorced compared to 11% of widows/widowers reported missing HIV treatment in the past month. One third (34%) of participants with post high school training report not taking their HIV medication compared to 16% for those with no education/primary school. Similarly, 21% of unemployed or students reported not adhering to treatment compared to 14% among those reporting being sick/disabled and unable to work. In terms of locality type, 22% of study participants living in urban areas compared to 12% of those staying in rural areas reported missing treatment as well. Finally, the proportion of participants who reported not taking their HIV medication was highest in the Western Cape (41%) and lowest were in Limpopo (9%).

Figure 1 below shows the reasons given for missing ART among people who indicated they had missed treatment in the past month. Most individuals indicated that they had forgotten to take their medication (57%), while others mentioned having been away (22%) from home or gave other reasons as the cause for not taking medication (21%).

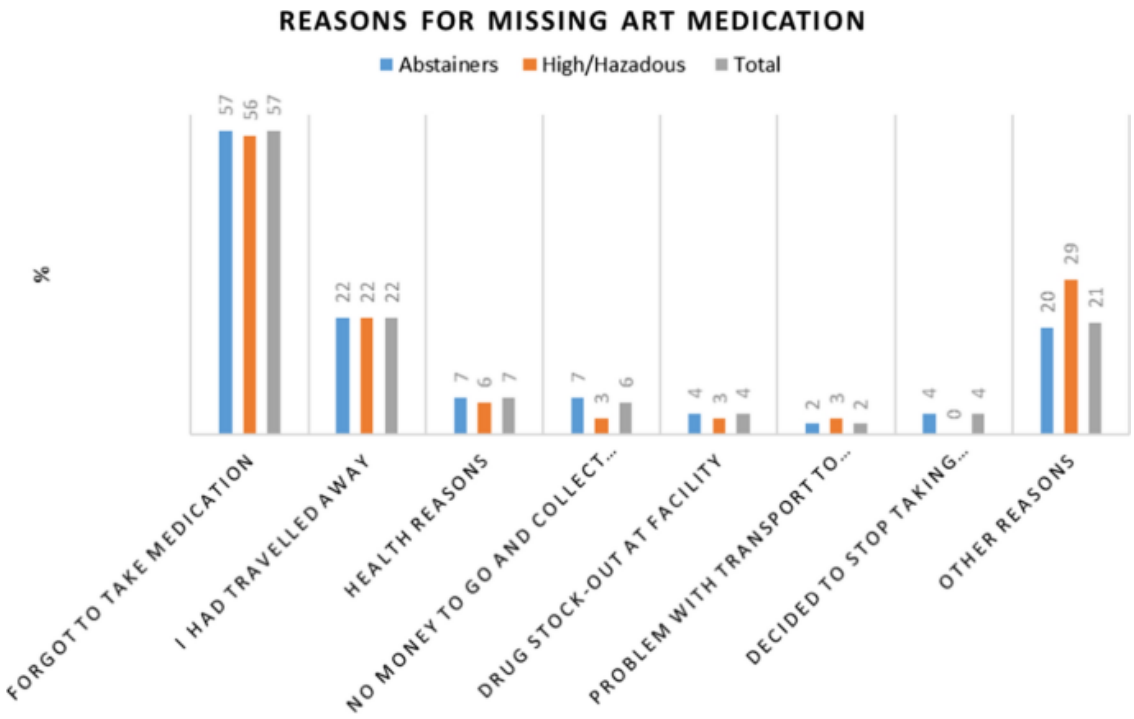

Fig. 1. Reasons for missing treatment among ART defaulters

Association Between ART Non-adherence and Mental Health Status

In univariate models, mental distress, education level, geographic area, province and alcohol use were individually associated with ART non-adherence. In a model adjusted for education, province and alcohol use, the odds of non-adherence to ART was 2.19 (95% CI

1.14–4.19) times higher among individuals presenting with severe mental distress compared to those presenting with no mental distress, (see Table 3). There was no evidence of an association on ART adherence between those with moderate (aOR 0.82, 95% CI 0.35—1.91) mental distress and those reporting no mental distress, neither between mild mental health distress (aOR 0.58, 95% CI 0.24–1.40) and those presenting with no mental distress.

Twenty percent (20%), 19%, 19% and 28% for no, mild, moderate and severe mental distress groups, respectively, had un-suppressed viral loads (< 1000 copies per μl, p-value 0.49). Viral suppression levels were higher (85%) among study participants who reported adhering to HIV treatment than those who reported missing at least one dose (77%) in the past month, (p-value = 0.05). Adherers had significantly higher viral suppression rates than non-adherers among men (80% vs 67%, p-value 0.02), while the difference was not significant between adherers and non-adherers among women (87% vs 82%, p-value = 0.2).

Other Factors Associated with Being Non-adherent to ART

In an adjusted multivariate logistic regression model, study participants with a post high school qualification had 3.69 higher odds (95% CI 1.31–10.37) of non-adhering to treatment compared to those who had no education or primary education only. High risk alcohol drinkers (aOR = 4.10, 95% CI 1.67–10.05) and hazardous alcohol drinkers (aOR = 10.99, 95% CI: 1.93–62.58) had higher odds of defaulting on ART than those who did not consume alcohol at all in the adjusted model. Viral suppression was statistically different between alcohol consumption group: 82%, 74%, 70% and 37% for abstainers, low risk, high risk and hazardous drinkers, respectively, p-value 0.001. There were statistically significant differences in the odds of ART non-adherence between the Western Cape (the reference province) which had higher odds compared to the following provinces Eastern Cape (aOR = 0.31, 95% CI 0.12–0.79), Northern Cape (aOR = 0.24, 95% CI 0.07–0.80), the Free State (aOR = 0.20, 95% CI 0.08–0.52), North West (aOR = 0.26, 95% CI 0.10–0.66) and Limpopo (aOR = 0.16, 95% CI 0.06–0.49).

Discussions

Mental illness is one of the factors that can impair adherence to ART, thereby disrupting viral suppression and resulting in higher morbidity and mortality among PLHIV. In this study, similar to results from other studies, ART non-adherence was higher among patients with severe mental distress compared to other mentally distressed groups [29]. Similar findings have been reported in other low-income countries, both in Southern Africa and elsewhere [30]. For instance, a study in Zimbabwe documented lived experiences of participants reporting poor mental health who also had low ART adherence [31]. Most of the patients suffered from a common mental disorder (CMD) called ‘kufungisisa’ (thinking too much) which led to a “burdened heart” or ‘moyo unorwadza’ as it is known in a local language in Zimbabwe. The authors noted that study participants reported daily life stressors that included poverty, stigma and marital problems which led to symptoms of CMDs such as loss of appetite, lack of sleep, and low energy levels, in turn resulting in poor ART adherence. Another study examined the relationship between ART adherence and psychosocial and circumstantial factors amongst HIV positive Haitians [32]. The authors found that depression was a major predictor of poor ART adherence followed by negative attitudes towards ART,

whilst alcohol use, partner conflict, and maladaptive coping were indirectly related to ART adherence by virtue of a direct association with depression. The authors noted that mental health was an important factor when considering adherence, and it was important to understand other protective factors that may influence these complex relationships [30].

In the present study, alcohol use was strongly associated with poor ART adherence, showing a strong dose–response relationship where higher levels of alcohol consumption were associated with poorer adherence outcomes. Heavy alcohol consumption was also associated with lower levels of viral suppression, suggesting sustained levels of poor adherence among heavy alcohol drinkers. The association between non-adherence to ART and alcohol use can be explained in a number of ways. Kalichman et al. described intentional ART non-adherence due to alcohol use: 25% of participants reported beliefs that a person taking ART should avoid alcohol, and 24% actually stopped ART when drinking [33]. A study in Atlanta, USA found that participants who endorsed high levels of interactive toxicity beliefs reported significantly more days when they missed doses of medication [34]. A qualitative study in Uganda found that cognitive impairment and intentional skipping explained the missing of ART doses due to alcohol use [35]. In this study 17% of alcohol abstainers or low risk drinkers presented with moderate or high mental distress, while 24% high risk drinkers presented with moderate to high mental distress, and 35% of participants who reported hazardous drinking reported moderate to high mental distress. These results are supported by other studies that report an association between poor ART adherence and alcohol use disorders [36].

The link between ART non-adherence and alcohol, in particular the dose–response relationship, can also be seen against the observation in this and other studies that men are less likely to adhere to ART than women [37, 38]. Men's greater propensity for hazardous alcohol use [39,40,41] and, more broadly, masculinity norms are well documented as playing a role in men's poorer ART adherence [42, 43] and the manner of alcohol use [44]. Taken altogether, these factors point to a central role for masculinity in shaping men's behaviours and some of the outcomes observed. Masculinity seems important too given that, in this study, men who adhered achieved much higher viral suppression rates as compared to those who did not, but this difference was not strong among women, suggesting the existence of moderating factors. It **i**s possible that non-adhering men were enacting stereo-typical but health-averse concepts of masculinity *in extremis,* while those adhering were exhibiting affinity for health and emergent forms of masculinity [45]. It is also still possible men encounter systematic barriers to their engagement with health that are specific to their gender [46].

While in other countries mental disorders are the main factor impairing adherence to ART treatment, in South Africa unemployment has also been noted to be closely related to depression which often leads to poor adherence [23]. Adherence to ART can be influenced or associated with numerous other factors that include social stigma, drug addiction, alcohol use related disorders, low socioeconomic status, neurocognitive disorders and mental disorders [36]. In this study, participants with lower levels of education reported better adherence to ART than those with high levels of education. This is supported by a cross-sectional study conducted in a Nigerian clinic, where 55.8% of individuals with higher levels of education reported lower adherence to ART [47].

In the current study, individuals who had higher education levels, who were likely to be employed, reported being busy, and thus often forgot to take their ART medication. In contrast, in a study conducted in rural Eastern Cape Province, South Africa, individuals with low educational levels showed lower adherence to ART treatment compared to those with higher levels. The main reason cited as impeding adherence was that PLHIV on ART did not have money to travel to treatment clinics to get their medication [48].

In our study, province was associated with ART adherence, where Western Cape (41%), Gauteng (27%), Mpumalanga (19%) and KwaZulu Natal (18%) had the lowest adherence levels. KwaZulu Natal, Gauteng and Mpumalanga have some of the most extensive and comprehensive HIV programmes in South Africa, thus the high levels of ART non-adherence are concerning. Similarly, the levels of non-adherence in the Western Cape are concerning as the prevalence of HIV in the Western Cape almost doubled from 5% in 2012 to 9% in 2017. There is a need to strengthen HIV programmes in the Western Cape to stem this tide of HIV infections as well as treatment outcomes.

Results from this study show that mental health remains a challenge in HIV/AIDS treatment adherence, despite clear ART guidelines on mental health. Further operation research is needed to identify where the gaps are.

The Limitations of the Study

This paper was based on secondary data analysis of a large study meant to look at other key HIV outcomes, thus although the original sample may have been representative of the main objectives, this may not be the case for this sub-analysis. For example, if people who chose to participate were different from people who refused to participate in the survey in terms of levels of ART adherence and/or mental health, then the provided estimated ART adherence and mental health cannot be generalised to the population of PLHIV on ART. The study cannot discount other potential sources of biases, including social desirability bias where participants may report what is desirable rather than what they did, or recall bias on reported treatment adherence.

Conclusions

The findings in this paper suggest that as part of HIV universal test and treat (UTT) implementation, more focus and integration of mental health assessment and management should be considered. This is critical to achieving better health outcomes for PLHIV and reaching the aims of the UNAIDS strategy and UTT goals. This will in turn reduce new infections and HIV-related health disparities. As such, this paper suggests that improved HIV management strategies should include proper integration of HIV and mental health services that is geared toward providing PLHIV with effective treatment of mental illness.

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