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BRIEF REPORT

Associations Between Alcohol Use, Other Psychosocial Factors, Structural Factors and Antiretroviral Therapy (ART) Adherence Among South African ART Recipients

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Abstract We examined whether alcohol use is associated with antiretroviral therapy (ART) adherence independently of structural and psychosocial factors among 304 male and female ART recipients in ART sites in Tshwane, South Africa. ART adherence was assessed by the CASE Adherence Index. Independent variables were demographic, structural, psycho-social, and alcohol use (AUDIT score) factors. In hierarchical multiple regression, demographic variables (Step 1) explained 4 % of variance in ART adherence ($p \leq 0.01$). Variance explained increased to 16 % ($p \leq 0.001$) after entering structural variables (Step 2); 19 % ($p \leq 0.001$) after entering psychosocial variables (Step 3); and 24 % ($p \leq 0.001$) after entering AUDIT score (Step 4). Alcohol use is independently associated with ART adherence.

Keywords Antiretroviral therapy adherence · Alcohol · Structural factors · Psychosocial factors · South Africa

Background

South Africa has the largest antiretroviral therapy (ART) programme in the world, with an estimated 1.7 million people currently on ART [1]. Although extensive, the success of the programme is dependent on, among other factors, high levels of adherence among those who are enrolled on ART regimens. Levels of adherence have been estimated to be about 77 % among people in sub-Saharan Africa (SSA) [2] and are far from optimal.

The most commonly recognised barriers to ART adherence in SSA are structural and psychosocial factors [3, 4]. Structural factors are generally related to limited economic resources and include food insecurity, transport costs, travel times to clinics, and waiting times at clinics [3, 4]. Regarding food insecurity, dietary requirements can be a barrier to taking medication for people who cannot afford the recommended types and amounts of food to be taken with their ART. Also, as increased appetite may be a side effect of ART, patients may refrain from taking their ART when food is not available so as to avoid having to deal with the increased appetite [3]. Long travel times and inadequate, unreliable and costly transport systems may also prevent patients from attending clinics to receive their medication refills [3, 4]. Moreover, lengthy clinic waiting times may deter people from collecting their medication because they often require time off work and lost wages, particularly for employees who have not disclosed their serostatus or whose employer is not supportive of their need for HIV care [3, 4].

Psycho-social factors, such as HIV stigma and HIV non-disclosure, also impact negatively on ART adherence [5, 6]. HIV stigma may impact on adherence in a number of ways, most notably, by discouraging health-seeking behaviour. Regarding non-disclosure, Stirratt et al. [6] describe numerous mechanisms by which it may influence adherence: in the presence of others, individuals may fail to take their medication for fear of being recognised as living with HIV; non-disclosure can be associated with non-adherence via social support in that those who have not disclosed may not have access to social support that can enhance their

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adherence; or ART adherence may be maintained because in keeping individuals in good health it may disguise perceived physical indications of HIV illness among those who have not disclosed their status [6]. Stigma and non-disclosure are also closely related, as individuals may fail to disclose their serostatus for fear of being stigmatised [6].

Over the past decade researchers have shown increasingly that alcohol consumption plays a role in ART non-adherence [2, 7]. However, few studies in SSA have examined whether, in relation to other psycho-social and structural factors, alcohol's role in ART non-adherence is unique, or whether its association with non-adherence may be mediated by, or attributable to, those psychosocial or structural factors that are commonly associated with non-adherence.

Given the pervasiveness of the episodic binge drinking style of alcohol consumption in South Africa [8], South Africans who drink alcohol are particularly likely to experience ART non-adherence associated with their drinking. The findings of this study should be of use in informing HIV services on the factors, including alcohol consumption, which may impact on ART adherence among HIV patients in South Africa.

The aim of the present study, therefore, was to determine whether alcohol use is associated with ART non-adherence over and beyond structural (i.e. hospital site, socio-economic status, stable living situation, food insecurity, time to doctor, and difficulty picking up ART) and psycho-social (i.e. HIV stigma and HIV non-disclosure) factors. The study was conducted among ART recipients in ART clinics in the Tshwane Metropolitan Municipality, South Africa. This area of the country was chosen given the relatively limited research conducted on ART adherence in this area.

Methods

For this study, we used a cross-sectional design. We sampled 304 HIV patients at two out of four PEPFAR-funded HIV clinics based at district (Level 1) hospitals in the Tshwane Metropolitan Municipality, in Gauteng province. We selected district hospital-based sites because they are most accessible to the public, and are the most common type of hospital in South Africa. Given our interest in studying structural and social determinants of ART adherence (e.g. stigma), we felt it imperative to include both township and town-based sites as the sites' clientele are likely to differ on such variables. Consequently, we used our prior knowledge of the ART sites and selected for inclusion one hospital from a township and one from a city area. These two clinics were selected on the basis that they enrolled sufficiently large numbers of ART patients (as determined by our previous qualitative research in the various ART sites) to enable recruitment of the required sample within the study period. Half of our final sample ($N = 152$) came from each facility.

Using procedures recommended by Cohen [9], with power set at 0.80, and alpha = 0.01, for multiple regression analysis with a maximum of eight predictor variables, we determined that we would require a sample of 147 participants per site to detect a medium effect size. The final required sample size was 294 (i.e. 147 participants per site).

Trained fieldworkers recruited participants from each of the two clinics. On each morning a study supervisor (hired for this study) would first inform all the patients who were waiting to be attended to by clinic staff of the purposes and nature of the study. Fieldworkers would then approach those in the queue. The eligible and willing patients would then be informed individually of the aims and purposes of the study in a private space, and invited to take part in the study. Eligibility criteria for recruiting the participants were: (a) 18 years or older; (b) HIV positive; (c) on ART for at least 4 months; (d) speakers of English or seTswana/seSotho or isiZulu; and (e) cognitively intact, since cognitive impairment could interfere with the ability to give informed consent. Those who consented to taking part in the study then signed informed consent forms and were interviewed. At the end of the interviews, the participants were given a supermarket shopping voucher worth ZAR30 (approximately US$4).

Interviews were conducted using a structured questionnaire, which consisted of measures of demographic factors, psychosocial factors, structural factors and alcohol use (the alcohol use disorders identification test; AUDIT) [10]. Other alcohol use measures, not directly relevant to this paper, assessed the participants' consumption of alcohol in the past 30 days and their typical beverage of consumption. Adherence to ART, the dependent variable, was measured by the CASE Adherence Index [11], which is a three-item measure which assesses (a) difficulty taking ART on time, with the response options ranging from never (4) to all the time (1); (b) frequency of missed doses, with the response options ranging from never (6) to every day (1); and (c) time since the most recent missed dose, with the response options ranging from never (6) to within the past week (1). As recommended by the scale developers [10], scores on each item were summed and categorised such that those with "good adherence" had a score above 10 on the scale, and those with a score of 10 or less were defined as having "poor adherence". The questionnaire was translated from English into seTswana and isiZulu by one first-language speaker of both languages, and then back-translated into English. The original and back-translated versions were compared and errors in the translations were corrected.

The data were analysed using hierarchical multiple regression analysis. The dependent variable was ART adherence, assessed by the CASE Adherence Index where scores were continuous. The analyses were conducted in four steps, based on the study's primary aim. In Step 1, we entered demographic variables (age, education, gender, employment status, and marital status). In Step 2, we entered the structural factors (hospital site, SES, stable living situation, food insecurity, time to doctor, and difficulty picking up ART). In Step 3, we entered the two psychosocial factors (HIV stigma and HIV non-disclosure). The AUDIT score variable was log transformed (as it was positively skewed), prior to being entered in the final step (Step 4).

The research was approved by the Faculty of Health Sciences Research Ethics Committee of the University of Pretoria (Protocol Number 98/2009); and the Centers for Disease Control and Prevention.

Results

There were 205 (68 %) women and 98 (32 %) men in the sample (the gender of one participant was missing). The mean age of the males was 37.3 years (SD = 7.77) and of the females was 35.2 years (SD = 8.14), with the largest groups of participants (about 50 %) aged between 30 and 39 years. About two-thirds of both the males and females were not married (i.e. single). Just over one quarter of the males (26.5 %) and females (29.3 %) were employed. The majority of the sample had completed between Grade 8 and 12 (75.7 %). Finally, about two-thirds of the males (61.2 %) and females (65.9 %) reported that their household sometimes or often go hungry or have no food to eat.

The participants from the two hospitals only differed on two demographic characteristics, namely employment and stable living condition: those from the city site (41.4 %) were more likely than those from the township site (15.8 %) to be employed ($\chi^2 = 24.5$; df = 1; $p < 0.001$), but those from the township site were more likely to report having a stable living condition (83.6 %) than those from the city site (51.3 %; $\chi^2 = 36.0$; df = 1; $p < 0.001$).

At the time of the study, the participants had been on ART for a mean of 24.9 months (SD = 18.7 months; range 4–126 months). Just over half of the participants (54.7 %) had good adherence as indicated by a score of >10 on the CASE Adherence Index. Females (59.9 %) were significantly more likely than males (43.9 %) to report good adherence ($\chi^2 = 6.84$; df = 1; $p < 0.01$). Non-drinkers (65.4 %; 117/179) were significantly more likely than drinkers (39.7 %; 48/121) to report good adherence ($\chi^2 = 19.26$; df = 1; $p < 0.001$). Similarly, among the drinkers, those with an AUDIT score below 8 (50.9 %; 28/55) were significantly more likely than those with an AUDIT score of 8 or above (30.3 %; 20/66) to report good adherence ($\chi^2 = 5.32$; df = 1; $p < 0.05$).

Just over half of the men (52.0 %) and about one-third of the women (34.6 %) reported having ever consumed alcohol. Almost all the participants (91.0 %) who were lifetime drinkers had consumed alcohol in the past month, with the figures for men and women being 98.0 % and 86.1 %, respectively. Just over half of the drinkers (53.3 %) had an AUDIT score of 8 or more, suggestive of hazardous or harmful drinking, and the mean AUDIT score was 9.84 (SD = 6.96; range 1–27). About two-thirds of the males (74.5 %) and one-third of the females (38.0 %) had an AUDIT score of 8 or more.

The correlations between the independent variables can be seen in Table 1. In addition, the relationship between AUDIT and ART adherence was significant for the drinkers alone ($r = -0.36$, $p < 0.001$), as well as for the total sample ($r = -0.35$, $p < 0.001$). The relationship between AUDIT and ART adherence was also significant for males ($r = -0.47$, $p < 0.001$) and for females ($r = -0.22$, $p < 0.001$).

The results of the hierarchical multiple regression analysis can be seen in Table 2. On the first step, which included the demographic factors only, only gender was significantly associated with adherence (with women more likely to be adherent than men). The associations between both employment status and marital status, and ART adherence were marginally significant, and the total model explained 4 % of the variance (adjusted $R^2 = 0.04$; $F = 3.30$; $p < 0.01$). In the second step, we added the structural factors, which led to a significant increase in the variance explained in ART adherence; for the total model adjusted $R^2 = 0.16$. The structural factors that were significantly associated with ART adherence were site ($\beta = -0.22$), SES ($\beta = 0.13$), food insecurity ($\beta = -0.13$), and time to get to the doctor of more than one hour ($\beta = -0.21$). In the third step, we added the two psycho-social variables, HIV stigma and HIV non-disclosure. The total model explained 19 % of the variance in ART adherence (adjusted $R^2 = 0.19$; $p < 0.001$). Both HIV stigma ($\beta = -0.17$) and HIV non-disclosure ($\beta = -0.11$) were significantly associated with ART adherence. In the final step we added the (transformed) AUDIT score, which led to a 5 % increase in the variance explained. The total model explained 24 % of the variance in ART adherence (adjusted $R^2 = 0.24$; $p < 0.001$). AUDIT score was significantly and independently associated with ART adherence ($\beta = -0.25$) over and above the demographic, structural and psychosocial variables. In the overall model, the association between gender and ART adherence was now only marginally significant. Three structural factors (site, food insecurity, and time to doctor), and one psycho-social

Table 1 Correlations among independent variables

S.No		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Age	–	−0.35***	−0.12*	0.03	0.15**	−0.01	−0.10+	0.17**	0.10^{+}	−0.07	0.09	−0.01	0.00^{a}	−0.04
2.	Education		–	0.01	0.12*	0.01	0.10+	0.34***	0.00^{a}	−0.19***	0.06	−0.15**	−0.17**	0.05	−0.09
3.	Gender			–	0.03	−0.01	0.05	0.01	−0.10^{+}	0.05	0.01	−0.03	−0.12*	0.04	−0.31***
4.	Employed				–	0.06	0.28***	0.01	−0.10^{+}	−0.12*	0.02	−0.18**	−0.01	0.07	0.02
5.	Married status					–	0.07	0.08	0.00^{a}	−0.09	−0.12*	−0.03	0.06	−0.02	−0.07
6.	Site						–	−0.03	−0.34***	−0.01	0.10^{+}	−0.07	0.16**	0.20***	0.06
7.	SES							–	0.27***	−0.26***	−0.02	−0.27***	−0.17**	0.01	−0.10
8.	Stable living condition								–	−0.03	−0.05	0.00^{a}	−0.07	−0.11^{+}	−0.08
9.	Food insecurity									–	0.14*	0.35***	0.13*	0.05	0.00^{a}
10.	Time to doctor										–	0.26***	−0.02	0.14*	0.14*
11.	Difficulty picking up ART											–	0.19***	−0.08	0.10^{+}
12.	HIV stigma												–	0.01	0.15*
13.	HIV non-disclosure													–	−0.01
14.	AUDIT score														–

$^{+}$ $p \le 0.10$; * $p \le 0.05$; ** $p \le 0.01$; *** $p \le 0.001$

[a] This figure is reported as 0.00 due to rounding

variable (HIV stigma) remained significantly associated with ART adherence, while SES and HIV non-disclosure were marginally significant.

Discussion

This study, conducted among a sample of male and female HIV patients on ART in South Africa, found that alcohol consumption played a unique role, independent of demographic, structural and psycho-social factors, in accounting for ART adherence. Just over half of the patients were adherent (in terms of their scores on the CASE Adherence Index) [11]. This is lower than the adherence rate reported by Mills et al. of 77 % for sub-Saharan African countries [2], and may reflect a rate for Tshwane Municipality only. However, that figure (77 % adherence rate) is most likely based on controlled studies in which participants tend to be included based on their relatively good health [12].

The results support the notion that alcohol use is independently associated with ART adherence, given that it explained unique variance in the ART adherence outcome. Numerous explanations exist regarding how alcohol accounts for non-adherence [13]. For example, non-adherence may occur where individuals simply forget to take their medication due to drinking. Alternatively, non-adherence may occur where individuals deliberately refrain from taking their medication so that they may drink alcohol and avoid anticipated negative ART/alcohol interactions. The latter behaviour could result from individuals' interactive toxicity beliefs stemming from their health care providers' discouragement of mixing alcohol and ART [13]. More research is needed to investigate these observed associations.

This study's findings, based on a sample of patients in South Africa, are of particular importance for the region given that South Africa has the largest number of people on ART, and one of the highest rates of absolute alcohol consumption among drinkers globally [1, 8]. In other words, the tendency to drink in episodic drinking fashion does not bode well for the adherence levels and treatment outcomes of ART recipients who drink alcohol in South Africa, and suggests an urgent need for HIV treatment services to more seriously address alcohol consumption among their clients.

We supported previous findings of associations between structural factors (i.e. food insecurity and time taken to get to the clinic) and ART adherence [3]. Hardon et al. [3] recommended addressing these barriers by providing ART recipients with food parcels and spacing out their prescriptions, especially once they have proven themselves to be adherent, so as to minimise the number of clinic or hospital visits they may need to receive their medication [3].

Table 2 Results of hierarchical regression analysis

Predictors	Variable	Beta	t	R^2	Adj. R^2	ΔR^2	F
Step 1				0.06	0.04	0.06	3.30**
Demographic factors	Age	0.06	0.94				
	Education	0.09	1.37				
	Gender	0.18	2.97**				
	Employed	−0.11	-1.82^{+}				
	Married status[a]	0.10	1.75^{+}				
Step 2				0.19	0.16	0.14	5.85***
Structural factors	Site	−0.22	−3.56***				
	SES	0.13	2.11*				
	Stable living situation	0.00[c]	−0.06				
	Food insecurity	−0.13	−2.17*				
	Time to doctor[b]	−0.21	−3.53***				
	Difficulty picking up ART	0.03	0.53				
Step 3				0.23	0.19	0.04	6.10***
Psychosocial factors	HIV stigma	−0.17	−2.86**				
	HIV non-disclosure	−0.11	−2.02*				
Step 4				0.28	0.24	0.05	7.42***
Alcohol use	AUDIT score	−0.25	−4.39***				

$^{+}$ $p \leq 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

[a] Married status: married = 1, not married = 0

[b] Time to doctor: more than 1 h = 1

[c] This figure is reported as 0.00 due to rounding

However, other structural factors which were not significantly associated with ART adherence in this study after the psycho-social and alcohol variables were included were SES, stable living condition and difficulty picking up one's ART. The psychosocial and structural factors that were significantly associated with ART adherence may be mediators of the relationship between the non-significant structural factors and ART adherence.

Like previous research, we found that psychosocial factors that were associated with ART non-adherence were stigma [5], and HIV non-disclosure [6]. Although they are strongly interrelated, in this study, both HIV stigma and non-disclosure were independently associated with non-adherence. Stirratt et al. [6] found an association between disclosure and ART adherence, but they failed to support their hypothesis that the association between disclosure and ART adherence would be mediated by social support and stigma.

The study had a number of limitations. First, we relied on self-reporting of both adherence levels and alcohol use, both of which can be unreliable. Participants can be expected to under-report their alcohol use in health care settings, particularly given the widespread teaching by health care providers that alcohol use is contraindicated among those who are on ART [13]. Under-reporting of non-adherence can also be expected, as individuals have a need to appear compliant with the prescriptions and required behaviours of their health care providers.

Second, the cross-sectional design of the study cannot permit us to disentangle whether or not the obtained associations between ART adherence and the independent variables are causative; nor can it indicate the direction of the associations between adherence and those independent variables. Indeed, it is conceivable that as a result of increasing their levels of adherence and becoming healthier, individuals may take less time going to the doctor, become less stigmatised, and may be more likely to disclose their serostatus [6].

Finally, the generalisability of the findings is unclear as the participants may not be representative of ART patients in general. To participate in our study, patients had to be on ART for at least four months, at least 18 years old, and fluent in one or more common language in the area. However, it is not clear whether these findings would be applicable to a population within other sites, younger than 18 years, non-volunteers, and based in other types of ART clinics. Repetition of this study could assess the replicability of these findings.

The results of the study have implications for the work of health care providers who provide ART and manage patients on ART. Given alcohol use's association with ART adherence, it is recommended that routine and ongoing screening

for harmful use of alcohol and alcohol use disorders is conducted among all ART recipients (new and currently enrolled). Furthermore, health care providers need to be empathic and acknowledge the difficulties associated with adhering to medication and reducing or abstaining from alcohol consumption, while also supporting their patients' self-efficacy to modify their drinking behaviour. Those who are identified as being users of alcohol should be provided with appropriate alcohol reduction interventions such as on-site advice or brief counselling (if they display harmful or hazardous use of alcohol), or referrals to more intensive alcohol treatment services (for those who have serious alcohol-related problems or an alcohol use disorder).

The results also suggest that HIV stigma and non-disclosure need to be addressed in order to bring about reductions in levels of ART non-adherence. Fortunately, the South African government's latest HIV and AIDS strategic plan (2012–2016) includes stigma reduction as a key focus area. ART patients may benefit from being informed about the potentially negative and positive impacts of disclosure on ART adherence. Disclosing to many people may minimise uneasiness about taking medication in front of people, and may increase social support [6]. On the other hand, it may also invite stigma which may be internalised by patients and negatively impact on their view about their illness and medication. Interventions should encourage disclosure to people who are likely to be supportive and enhance individuals' adherence self-efficacy if they have not disclosed their serostatus [2].

Structural impediments to ART adherence need to be addressed in order to enhance adherence levels and in the long run, minimise the development of resistance. These include increasing the density of health care facilities that provide ART, minimising travelling times for ART recipients, and addressing food security via government grants and other means.

Finally, the finding of women's superior adherence levels can be explained by previous qualitative research. Skovdal et al. [14] have shown how constructions of masculinity that promote self-reliance may compromise the 'good-patient' profile required for presenting to HIV care and prevent compliance with instructions regarding good health care such as taking medication. Such research suggests that interventions may need to address some contradictions in masculinity discourses, such as the promotion of the provider role, which requires men to be healthy, and the promotion of self-reliance which can (inadvertently) prevent men from taking care of their health and fulfilling this responsibility. However, the association between gender and ART adherence was only marginally significant with inclusion of AUDIT score in the regression analysis. We also found a stronger association between alcohol consumption and ART adherence among males than females, which would suggest that the higher drinking levels of men than women may explain the association between gender and ART adherence. Further research on gender, structural, psychosocial and alcohol consumption factors and ART adherence is needed.

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