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## Predictors of poor adherence among people on antiretroviral treatment in Cape Town, South Africa: A case-control study

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### Abstract

A case-control study was conducted to describe the frequency with which structural- and individual-level barriers to adherence are experienced by people receiving antiretroviral (ARV) treatment and to determine predictors of nonadherence. Three hundred adherent and 300 non-adherent patients from 6 clinics in Cape Town completed the LifeWindows Information-Motivation-Behavioral Skills ART Adherence Questionnaire, the Substance Abuse and Mental Illness Symptoms Screener and the Structural Barriers to Clinic Attendance (SBCA) and Medication-taking (SBMT) scales. Overall, information-related barriers were reported most frequently followed by motivation and behaviour skill defects. Structural barriers were reported least frequently. Logistic regression analyses revealed that gender, behaviour skill deficit scores, SBCA scores and SBMT scores predicted non-adherence. Despite the experience of structural barriers being reported least frequently, structural barriers to medication-taking had the greatest impact on adherence (OR: 2.32, 95% CI: 1.73 to 3.12), followed by structural barriers to clinic attendance (OR: 2.06, 95% CI: 1.58 to 2.69) and behaviour skill deficits (OR: 1.34, 95% CI: 1.05 to 1.71). Our data indicate the need for policy directed at the creation of a health-enabling environment that would enhance the likelihood of adherence among antiretroviral therapy users. Specifically, patient empowerment strategies aimed at increasing treatment literacy and management skills should be strengthened. Attempts to reduce structural barriers to antiretroviral treatment adherence should be expanded to include increased access to mental health care services and nutrition support.

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## Keywords

antiretroviral adherence; structural barriers; predictors of adherence

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## Introduction

With an estimated 5.6 million people infected with HIV, South Africa has one of the highest burdens of HIV in the world [1]. Since 2004 when antiretroviral therapy (ART) became available in the public sector, South Africa's national antiretroviral (ARV) treatment programme has been rapidly scaled up and an estimated 1.8 million people are currently receiving treatment [2]. Not only are the benefits of ART for individuals well-established, but the large scale provision of ARV treatment has the potential to result in population-level reductions in the transmission of HIV [3, 4]. Adherence is the most important predictor of effective viral suppression and treatment [5–7], thus monitoring and support for adherence are critical components of any ARV treatment programme [8, 9].

Numerous (mostly qualitative) studies conducted in sub-Saharan Africa (SSA) have identified factors that challenge the ability of individuals to adhere to ARV treatment. Individual-level barriers to dose adherence and clinic attendance have been found to include forgetfulness [17–23], fear of disclosure [14, 17, 18, 20–25], the experience and fear of side effects [14, 21, 23, 26–31], travel/migration [17, 21, 22], use of traditional medicine [17, 26, 30], alcohol use [24, 25], feeling hopeless or depressed [14, 17, 28] and feeling better on treatment [20, 29]. Structural barriers are particularly salient in resource-poor settings where social, economic, political and environmental factors can impede individual behaviour to a greater extent than in wealthy, industrially developed countries [32]. Indeed, two of the most commonly reported barriers to ARV adherence in SSA are food insecurity [e.g., 17–19, 21, 24, 25, 28, 31, 33, 34, 35] and financial constraints [e.g., 14, 17, 19, 21, 25, 27, 30, 34, 36]. Other structural factors reported to impede adherence include a lack of confidentiality and poor treatment by clinic staff [18, 26, 34], distance to the clinic [21, 37], drug stock-outs [23, 30] and long patient waiting times [27, 29, 34].

Potential barriers to optimal adherence are thus well known, but few studies have measured the impact of these on adherence. Understanding the determinants of adherence is important for ensuring that interventions are designed and implemented to support ART adherence. The present study was conducted to investigate barriers to adherence among people on ARV treatment in Cape Town, South Africa. Specifically, we aimed to compare the frequency of individual-level barriers to structural-level barriers and to identify the significant predictors of non-adherence.

## Methods

### Study design and setting

We conducted a case-control study with 600 adult patients from 6 primary health care ARV clinics in the Cape Town metropolitan area. During data collection, these clinics were providing free ARV treatment for between 1147 and 2343 adult patients (Western Cape

Department of Health, unpublished data). Strategies to support ARV adherence in all primary health care clinics in the Western Cape included the provision of individual counselling and the roll-out of “adherence clubs” (Medicines Sans Frontiers, 2012). Individual counselling was delivered by clinic-based lay counsellors who prepared patients to initiate ART during three counselling sessions in which information relating to HIV, ARVs and adherence was delivered. Following treatment initiation, patients identified as non-adherent by clinic staff were referred for follow-up adherence counselling. Adherence clubs are groups of up to 30 patients who are clinically well and adherent to treatment [40]. These groups meet in clinics or other communal spaces (including patient’s homes) for a quick clinical assessment and to receive pre-packaged treatment for two months. Clubs offer peer support and save time and money spent travelling and queuing at clinics [40]. At the time of the study, 4 of the 6 participating clinics had an adherence club programme.

### Participants and sampling

Participants included roughly equal numbers of adherent and non-adherent patients who had been on ART for a minimum of 1 month from each of the six participating clinics. Participants were not matched. Patients were identified as dose or programme non-adherent by nursing staff as per routine practice, i.e., by means of pill counts (<95% of doses taken since last pharmacy refill) or scheduled clinic-visit dates (>3 days late). Patients who were 15 days late were referred to by clinic staff as “returned defaulters”. Systematic random sampling was utilised to recruit adherent patients in to the study, whereby every fifth patient was approached and invited to take part. Because fewer patients are non-adherent, all those identified as non-adherent were approached and invited to take part. Recruitment continued until 300 adherent and 300 non-adherent patients had been recruited. The sample size was calculated for the comparison of the prevalence of structural barriers reported by adherent and non-adherent patients, and to allow us to detect a significant odds ratio of 1.6 with 80% power at a 5% significance level.

### Data collection

Data collection took place in clinics over a 4-month period (February–June 2012). Data collectors obtained participants’ date of treatment initiation and last viral load count from their folders; viral load data were collected as a measure that could be used to confirm participants’ adherence status. Participants completed a questionnaire by audio computer-assisted self-interview during regular scheduled visits. The questionnaire was administered in English and Xhosa and included questions on demographic characteristics as well as the following scales:

**The LifeWindows Information-Motivation-Behavioral Skills ART Adherence Questionnaire (LW-IMB-AAQ)**—The LW-IMB-AAQ (The LifeWindows Project Team, 2006) is a 33-item measure based on the Information-Motivation-Behavioural Skills (IMB) model of health risk behaviour. (We divided one information item into two separate items, for a total of 34 items.) In this model, health risk behaviour is understood as the result of information, motivation and/or behaviour skills deficits (Fisher & Fisher, 1992). Information items assess knowledge regarding the impact of ART, sub-optimal adherence, traditional medicine and alcohol use on treatment efficacy, and what to do in the event of a dose being

missed or when there is no food to take treatment with. Items on the Motivation sub-scale assess attitudes around the burden of adherence and its impact on daily life, social support and the nature of the patient–provider relationship. The Behaviour Skills sub-scale assesses self-efficacy in terms of ability to manage adherence in the context of side effects, daily life and health status. Cronbach’s alpha was used to determine the reliability of all scales used in our sample. The reliability of the Information sub-scale in this sample was poor ( $\alpha = 0.57$ ). Items measuring Behavioural Skill barriers had excellent reliability ( $\alpha = 0.88$ ). The Motivation sub-scale had acceptable reliability ( $\alpha = 0.73$ ).

**Structural Barriers to Clinic Attendance Scale (SBCA)**—The SBCA and the Structural Barriers to Medication- taking scale (below) were developed by Coetzee and Kagee (2013) based on qualitative work around structural barriers to ARV adherence in the Western Cape. The SBCA scale consists of 12 items that ask the participant to identify the extent to which various structural barriers have affected their clinic attendance. Items pertain to transport difficulties, work-related commitments, patients’ experiences at the clinic and a fear of being identified as HIV-positive by others. We added a time frame of 6 months to each item, and 3 items relating to travel between provinces, internationally and for work. Participants respond to items on a 5-point Likert scale (“never” to “always”). The reliability of this measure in our sample was excellent ( $\alpha = 0.90$ ).

**Structural barriers to medication-taking scale (SBMT)**—The SBMT scale consisted of 17 items which ask the participant to identify the extent to which various structural barriers have affected their medication-taking (since this study the SBMT has been reduced to 13 items) (Coetzee & Kagee, 2013). Items pertain to food insecurity, non-disclosure of HIV status, the influence of church leaders and traditional healers, alcohol use, the disability grant as disincentive to adhere and not having a way to remember to take ARVs. The reliability of this measure in our sample was good ( $\alpha = 0.84$ ).

**Substance Abuse and Mental Illness Screener (SAMISS)**—The SAMISS consists of 16 items and was developed to screen for substance abuse and mental illness (depression, anxiety, post-traumatic stress disorder, mania associated with bipolar disorder) in people living with HIV [43]. The reliability of items measuring substance abuse in our sample was questionable ( $\alpha = 0.64$ ), while items measuring metal illness had excellent reliability ( $\alpha = 0.87$ ).

### Statistical analysis

Tests of association, accounting for the clustering of patients within clinics, were done to test for significant differences between adherence groups on demographic variables.

To determine the frequency with which participants reported the various barriers, responses for each item were dichotomised based on guidance given in the LW- IMB-AAQ (The LifeWindows Project Team, 2006) and on the researchers’ choice for the SBCA and SBMT scales: “never” and “rarely” were taken to represent no barrier, while “some of the time”, “most of the time” and “always” were taken to indicate the presence of a barrier. The

frequency with which structural and individual-level barriers were reported was calculated overall and by group.

Cronbach's alpha was calculated for the structural, information, motivation and behavioural skills scales as well as for the SAMISS. The reliability of the information sub-scale in this sample was improved by removing 3 items, although it remained questionable at 0.67. Removing 2 items from the motivation sub-scale and 1 from the behaviour skills sub-scale improved internal consistency to .77 and .89 respectively. Based on the internal consistencies of the scales, composite scores were calculated for each participant. Based on the SAMISS responses, a variable indicating a positive screen for substance abuse or mental illness was created. The composite scores and the SAMISS indicator were included as predictors in conditional logistic regression models to identify the barriers associated with ARV adherence. Gender was included as a covariate, and the observations were grouped by clinic. Conditional logistic regression models were fitted in which ARV adherence was regressed on gender and each score separately. A conditional logistic regression model was also fitted to ARV adherence on all five composite scores, gender and the SAMISS indicator. Analyses were conducted using Stata (version 12.1, College Station, TX, USA).

### Ethical review

Ethical approval for all study procedures was granted by the Human Research Ethics Committee at the University of Cape Town, South Africa.

### Results

In total, 622 people were approached to take part. Twenty-two people (12 adherent and 10 non-adherent) declined to take part. Reasons for refusal included being in a hurry and/or late for work, and a lack of interest. Demographic data was not collected for these people.

Of the non-adherent participants, 92 (31%) were on time or 3 days late for their scheduled clinic visit (they were thus non-adherent by virtue of their pill counts). Seventy-one non-adherent participants (24%) were >3 but 14 days late. The remaining non-adherent participants (n = 137, 46%) were "returned defaulters", having been 15 days (maximum 167) late. In terms of the characteristics of the sample presented in Table 1, employment status (p = .032), annual income (p = .028), first language (p = .010) and screening positive for mental illness or substance abuse (p = .028) were significantly associated with non-adherence.

Overall, information-related barriers were reported most frequently, with the majority of barriers being endorsed by more than 50% of participants (range: 0.09 – 0.75). Motivation deficits were reported with the second greatest frequency (range: 0.16 – 0.50) followed by behaviour skill deficits (range: 0.17 – 0.43). Structural barriers were reported with the least frequency. All items on the SBCA and the SBMT, with the exception of two relating to food insecurity, were reported by 25% or fewer of the participants. Barriers relating to food insecurity included not always having food to take ARVs with, and feeling ill when taking ARVs without food. These barriers were reported with by 37% (95% CI: 28 – 46%) and 40% (95% CI: 31 – 48%) of the participants respectively.

The linear range of the scores was determined through exploratory analysis (i.e., lowess graphs). A highest attainable value of 6 and 10 was set for the SBCA and SBMT scores respectively, and these ranges were utilised in further analyses (Table 2).

When modelled individually, SBCA, SBMT, Information, Motivation and Behavioural Skills scores were found to be significantly associated with ARV non-adherence. The result of the conditional logistic regression model with all predictors included is shown in Table 3. Gender (OR: 2.13, 95% CI: 1.37 to 3.30,  $p = .001$ ), SBCA (OR: 1.39, 95% CI: 1.23 to 1.56,  $p = <.001$ ), SBMT (OR: 1.38, 95% CI: 1.23 to 1.54,  $p = <.001$ ) and Behavioural Skills (OR: 1.08, 95% CI: 1.01 to 1.15,  $p = .032$ ) were significantly associated with non-adherence. Males were 2.13 times more likely to be non-adherent in comparison to females. There was no difference between sites in terms of the odds of poor adherence.

Using standardised regression coefficients, the effects of each scale on ARV adherence can be compared (Table 4). Results indicate that barriers measured by the SBMT had the greatest impact on adherence: one standard deviation increase in the SBMT scale increases the odds of being non-adherent by 2.32 (95% CI: 1.73 to 3.12). This is greater than the increase in odds associated with a one standard deviation increase in the SBCA scale (OR: 2.06, 95% CI: 1.58 to 2.69) and the Behavioural Skills scale (OR: 1.34, 95% CI: 1.05 to 1.71).

## Discussion

In South Africa, efforts to expand access to ART have included the decentralisation of ART to primary healthcare clinics and the provision of free ARVs for life at these centres. In the Western Cape province, the roll-out of adherence clubs further addresses barriers to access and adherence by providing easier and quicker access to continued treatment, and reducing the frequency and time spent by patients at clinic visits [40]. As the national ARV treatment programme continues to grow, it is important to understand the barriers to adherence faced by people on treatment so that the programme may continue to respond with interventions that meet the needs of recipients. Our study is one of the first to determine the relative frequencies with which individual- and structural-level barriers impede adherence, and to quantify the impact of these barriers on adherence to ART in SSA.

In this preliminary investigation in to the kinds of barriers impacting ARV adherence in Cape Town, we found that adherence-related information deficits were common among all participants in this study, although not significantly associated with poor adherence. Previous research suggests that increased knowledge does not lead to behaviour change on its own (Kalichman, Cain, Eaton, Jooste, & Simbayi, 2011). Nevertheless, people on chronic medication should understand their treatment and the implications of sub-optimal adherence. Counselling delivered by lay counsellors in preparation for treatment initiation in the Western Cape is intended to empower patients towards self-management of their condition through treatment literacy. An evaluation of the content and delivery of these sessions, as well as patients knowledge immediately following these sessions, may be of value in identifying ways to ensure that patients emerge from treatment initiation counselling adequately informed about ART.



Behaviour skill deficits were significantly associated with non-adherence, suggesting that people on ART would benefit from assistance in problem-solving and actively managing barriers to optimal adherence. The adherence counselling programme within all ARV clinics in the Western Cape is intended for this purpose, however previous research indicates that adherence counselling consists mainly of the provision of information and advice [44]. There is little evidence to suggest that this is an effective way in which to promote medication adherence. In contrast, interventions that target practical medication management skills have proved to be among the more successful in terms of ARV adherence outcomes [45]. The ARV adherence counselling programme, already in place, has the potential to address behaviour skill deficits as well as low levels of knowledge regarding ART. Strengthening activities may be necessary.

In contrast to barriers associated with IMB constructs, structural barriers were least commonly reported but had the greatest impact on adherence. Data from this study supports findings from previous qualitative work suggesting food insecurity as a primary barrier to adherence in SSA settings. Food insecurity was significantly associated with non-adherence, and constitutes a threat to adherence for those who are currently managing optimal adherence [e.g., 19, 35]. Thirty-seven percent of all participants in the current study reported not always having food with which to take their ARVs. This is consistent with estimates that up to one-third of South Africa's population is food insecure [46]. While patients are not necessarily advised that they need to take ARVs with food, some (as in the current study) report feeling ill when taking ARVs in the absence of food. Other ways in which food insecurity can undermine adherence include competing demands between the cost of obtaining food and the cost of attending clinic, and the experience (or fear) of increased appetite when on treatment [31, 33, 35]. Evidence regarding the effectiveness of food support for improving ARV adherence is limited. A review of the characteristics of HIV treatment programmes in 7 SSA countries has shown that the provision of food support is not associated with retention in care [47]. Among patients who *are* retained in care though, there is some evidence to suggest that medication adherence is higher in those programmes that offer food support [48, 49].

A high percentage of participants in this study screened positive for either substance abuse or mental illness, and this was significantly associated with non-adherence. This is consistent with previous research and a systematic review of studies in SSA which found that the likelihood of achieving good adherence was 55% lower among people with depressive symptoms compared to those without [50]. Inadequate services exist for the diagnosis, treatment and management of mental health problems in many SSA countries [32] including South Africa. In terms of depression, current research is focusing on the feasibility of using brief tools [e.g., 51, 52] and community health workers [manuscript being prepared for publication] to screen for depression in the context of antenatal care. This research could be extended to focus on HIV care, and should be accompanied by attempts to improve access to mental health care.

Limitations to this study include the use of clinic staff to refer patients for recruitment by data collectors. Primary health care clinics in South Africa are over-burdened and understaffed, and data collectors reported cases in which patients were not referred for recruitment

because staff were too busy and/or forgot. Randomisation was thus likely compromised. Another limitation to this study (and other similar studies) is that the categorisation of participants as “adherent” or “non-adherent” is somewhat arbitrary because adherence status is not necessarily stable over time. Some people classified and interviewed as “adherent” during one month of our study might have been classified and interviewed as “non-adherent” the next, and vice versa.

Contradictory results from studies evaluating the efficacy of adherence interventions in SSA settings suggest that intervention content and/or context are important for intervention success [53]. Despite the above-mentioned limitations, this study provides valuable information regarding the factors impacting adherence in urban ARV clinics in the Western Cape that can be used to guide future research and the development and/or implementation of adherence interventions. Our data suggests that patient empowerment strategies aimed at increasing treatment literacy and management skills are likely of benefit to people attending HIV care at these centres. Attempts to reduce structural barriers to adherence should be expanded to include increased access to mental health care services and nutrition support.

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SD, CM and CL designed the study with input from ML and AK, and SD supervised acquisition of the data. TP and CL conducted statistical analysis of the data. SD wrote the initial draft of the manuscript, with substantial contributions from TP. All authors interpreted the data, revised the manuscript for important intellectual content, and approved the final version.

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**Table 1**

Demographic characteristics of participants by adherence status.

	Adherent <i>n</i> = 300	Non-adherent <i>n</i> = 300	<i>p</i> -values
Age (mean years) (SD)	36.4 (8.2)	35.3 (9.1)	.387
Gender: <i>n</i> (%)			.100
Male	76 (25)	104 (35)	
Female	224 (75)	196 (65)	
Marital status: <i>n</i> (%)			.064
Single/widowed/separated/divorced	218 (73)	236 (79)	
Married or living with a significant other in a marriage-like relationship	82 (27)	64 (21)	
Living situation: <i>n</i> (%)			.872
Live alone	82 (27)	83 (28)	
Live with other adults and/or children	218 (73)	217 (72)	
Education: <i>n</i> (%)			.461
No formal education	33 (11)	44 (15)	
Primary (Grades 1–7)	59 (20)	74 (25)	
Attended/completed secondary school	191 (64)	168 (56)	
Attended/completed tertiary education	17 (6)	14 (5)	
Work situation: <i>n</i> (%)			.032*
Employed full-time	62 (21)	39 (13)	
Employed part-time	58 (19)	60 (20)	
Unemployed	163 (54)	182 (61)	
Other (home-maker, disabled, student)	17 (6)	19 (6)	
Annual income <sup>d</sup> : <i>n</i> (%)			.028*
<R12,000 per year	228 (76)	243 (81)	
R12,000–R40,000	32 (11)	12 (4)	
R41,000–R80,000	10 (3)	2 (1)	
R81,000 and above	13 (4)	8 (3)	
First (or home) language: <i>n</i> (%)			.010*
Xhosa	233 (78)	219 (73)	
Afrikaans	18 (6)	33 (11)	
English	20 (7)	12 (4)	
Other	29 (9)	36 (12)	
SAMISS indicator: <i>n</i> (%)			.028*
Yes	204 (68)	250 (83)	
No	93 (31)	48 (16)	
Missing data	3 (1)	2 (1)	
Time on ARVs: days (median IQR)	525 (227,1090)	670 (276,1156)	.117
Viral load <sup>b</sup>			.149
<50 copies/ml	187 (62)	121 (40)	
50 copies/ml	61 (20)	117 (39)	

	<b>Adherent <i>n</i> = 300</b>	<b>Non-adherent <i>n</i> = 300</b>	<b><i>p</i>-values</b>
Missing data	52 (17)	62 (21)	

<sup>a</sup>ZAR8 = approx. US\$1;

<sup>b</sup>A viral load of <50 copies/ml is currently regarded as the optimal outcome of ART;

\* *p* < .05. Source: Doyle et al., 2012.

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**Table 2**  
Descriptive table for SBCA, SBMT, Information, Motivation and Behavioural Skill scores.

Scores	Group	n	Mean	SD	Min.	Max.	p-values
SBCA score	Adherent	300	0.68	1.48	0	6	<.001*
	Non-adherent	294	2.76	2.36	0	6	
SBMT score	Adherent	299	0.90	1.71	0	10	<.001*
	Non-adherent	294	3.45	2.80	0	10	
Information score	Adherent	300	2.58	1.56	0	7	.079
	Non-adherent	300	3.08	1.73	0	7	
Motivation score	Adherent	300	2.46	2.19	0	8	.035*
	Non-adherent	297	3.24	2.41	0	8	
Behavioural score	Adherent	298	2.50	3.18	0	13	<.001*
	Non-adherent	289	4.95	4.02	0	13	

SD, standard deviation.

\* p < .05.



**Table 3**

Conditional logistic regression of adherence status on gender, mental health, structural barrier and information, motivation and behavioural scales.

Variables	Odds ratio	95% confidence interval		<i>p</i> -values
		Lower limit	Upper limit	
Gender (male)	2.13	1.37	3.30	.001*
SAMISS (positive)	1.02	0.63	1.65	.942
SBCA score	1.39	1.23	1.56	<.001*
SBMT score	1.38	1.23	1.54	<.001*
Information score	1.12	0.98	1.28	.085
Motivation score	1.01	0.93	1.11	.770
Behavioural Skills score	1.08	1.01	1.15	.017*

\*  
p < .05.