The Role of a Pharmacist in the Analysis of Adherence Rates and Associated Factors in HIV-Patients Registered on Centralized Chronic Medicines Dispensing and Distribution (CCMDD) Programme in the Public Sector in South Africa

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Abstract: The study assessed adherence rates and associated factors in Human Immunodeficiency Virus (HIV) patients registered on the Chronic Medicines Dispensing and Distribution (CCMDD) programme in the public Primary Health Care (PHC) set in South Africa (SA) and the role a pharmacist could be played in ARV adherence. Data were collected from 100 HIV-infected patients during a descriptive cross-sectional study using a standardized-questionnaire and face-to-face-exit interviews. Pill-counts technique was performed and adherence-rate of 95% considered acceptable. Data were analyzed using SPSS 22.0. Univariate factors associated with poor-adherence to Highly Active Antiretroviral Therapy (HAART) were assessed using ANOVA and a $p \leq 0.05$ is considered statistically significant. Of 100 HIV-infected, 74 were females and 26 males with mean-age ($\pm$ SD) of 38.98 ($\pm$ 9.24) years enrolled on HAART for more than 36 months. Of these, 26 and 36 were on WHO stages 2 and 3 respectively. Adherence-rates computed from 76 patients revealed 43 (56.6%) having poor adherence-rate and 33 (43.4%) with acceptable adherence rate. Of the demographic factors analyzed age and educational background had an influence on adherence rates with $p = 0.087$ and 0.097 respectively. Other factors associated with acceptable adherence were: WHO staging ($p = 0.016$), recent CD4 count ($p = 0.07$), adverse effects ($p = 0.073$), stigma ($p = 0.027$). Of the different areas with waiting times, reception and pharmacy were statistically significant with $p = 0.095$ and 0.042 respectively.

Key words: Adherence-rates, HIV/AIDS, CCMDD, HAART, PHC.

1. Introduction

Due to the rapid proliferation of human immunodeficiency virus (HIV) treatment options, there is a need for healthcare providers with knowledge of antiretroviral therapy (ART) quality. In an HIV multidisciplinary care team, the HIV pharmacist, as a custodian of medicines, is well equipped to provide this expertise. Pharmacists can play a pivotal role in patient care through counseling, medication therapy management (MTM), disease-state management as stated by Suzanne Albrecht in her research done in 2011 [1]. The traditional role of medication dispensing as is the best-known function of the pharmacist has evolved to pharmaceutical care. There are opportunities in every type of pharmacy practice to improve patients' adherence and therapeutic outcomes, and pharmacists must embrace and act on them.

Medication adherence is defined as the voluntary cooperation of the patient in taking drugs or medicine as prescribed, including timing, dosage, and frequency. According to Bangsberg et al. in 2000 [2] and Wahl & Nowak [3] low levels of adherence rates less than 95%,

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can lead to the resumption of rapid viral replication, reduced survival rates, progression to AIDS and death furthermore the mutation to treatment-resistant strains of HIV [4]. Patient's medication adherence is dictated by factors and each patient is unique. Therefore it is the role of the pharmacist to approach each patient individually and determine the level of adherence and what barriers exist that are preventing the patient from taking his or her medication appropriately [5].

In a systematic review performed by Parya et al. [5] in 2012 on an impact of HIV clinical pharmacist on HIV treatment outcome, there was an association between HIV pharmacist activities and improvements in Antiretroviral (ARV) adherence and viral load. A pharmacist caring for the HIV-infected performed functions related to reductions in hospitalization, physician office visits, number of hospital delays, visits to emergency department, pill burden, and inappropriate discontinuation of outpatient medications, as well as improvements in inpatient documentations of home medications and accuracy of ARV dosing. All this demonstrates the crucial role of a pharmacist as an essential member of HIV multidisciplinary team.

According to UNAIDs, 36.9 million (31.1 million–43.9 million) people globally were living with HIV in 2017. Of these, 21.7 million (19.1 million–22.6 million) people were accessing ART in 2017. Furthermore, 1.8 million (1.4 million–2.4 million) people became newly infected with HIV in 2017 [6]. South Africa has the world's largest ART programme with an estimated total of 7.1 million people living with HIV [7]. From this number, only 65% of these people are aware of their HIV status, with only 3.9 million people having access to treatment, a value that is far short of the 2020 USAID 90% target. This then means that only 45% of the people living with HIV have a notable viral suppression [8]. According to Williams and Colleagues [6], SA is the largest country in Southern Africa with the largest number of HIV/AIDS infections in the world and even though other countries in the region, such as Botswana, Lesotho, and, Swaziland, have similar or even higher infection rates.

UNAIDS gave a worrying report in 2016, indicating that one in five people in the world with HIV infection lives in SA. Williams and colleagues [9] stress this point even further by mentioning that, ending AIDS in the world is dependent on ending AIDS in South Africa. By ending AIDS in South Africa it is going to represent an opportunity to showcase what can be done and a challenge to the world, given the scale of the problem in an uncertain health system operational.

South Africa has experienced an unpredicted growth in patients requiring access to long term therapies. Not only has SA introduced universal access to Antiretroviral Therapy (ART) but has also been a steady increase in the proportion of the population with Non-Communicable Diseases (NCDs) requiring therapy. This change in the epidemiological profile has led the country to extend the public sector healthcare facilities, placing enormous strain on availability of resources and contributing towards medicine shortages thus declining the quality of care.

Therefore Centralized Chronic Medicines Dispensing and Distribution (CCMDD) programme was rolled out since 2014 as a pilot study for National Health Insurance (NHI) implementation in SA [10]. This program has helped to improve access to chronic medications and reduce on the waiting times thus improving on the quality of care. The CCMDD Programme has been rolled out in the NHI Districts in SA since February 2014. A patient with a chronic disease is issued with a repeat prescription for six months. The process consists of: registration which involves patient enrollment and consent, and dispensing of 1st issue of repeat, thereafter the prescription receives authorization. Next is the dispensing process which involves the capturing of prescriptions and dispensing subsequent months. Thereafter is the distribution that involves the distribution of prescribed medicines to Pick-up Points (PuPs). Once the parked medicines have been received

at PuPs, then SMSs are sent to the patients for collection of their medications. During the collection process, the PuPs do the receipt and management of parcels, thereafter patients come to identify and thereafter be issued their parcels. Facilities are notified if parcels are uncollected, and the uncollected parcels are returned. Lastly is the tracing process which involves defaulter tracing, and providing feedback to the facility [10].

However there are limitations in this pilot process which include: variations by internal practices by individual service providers e.g. non-differentiation of parcels (manual process vs. web-based patients). Others include affected practices at PuPs, reliant on the appropriate use by end-users and PuP staff attitudes (affected electronic scanning communication). Internal infrastructure at facilities and PuPs, e.g. certain PuPs do not have internet access at the dispensing terminals and this results in non-use of the system [10].

This situation poses potential adherence barriers which may lead to poor health outcomes and places strain on the patient in terms of transport costs and loss of income. A pharmacist forms part of the healthcare team. The traditional roles of a pharmacist have evolved to those of pharmaceutical care in the management of chronic diseases. Therefore the aim of this study was a pharmacist as a custodian of pharmaceutical care to analyse adherence rates and associated factors in HIV-patients registered on CCMDD programme in the public primary health care setting in SA.

2. Materials and Methods

2.1 Context of the Study

The study was performed at one of the PHC clinics which forms part of 4 clinics located in King Sabata Dalindyebo (KSD) subdistricts in Eastern Cape of South Africa. Eastern Cape is one of the nine provinces in SA; it is heavily populated with the highest unemployment rate, poor infrastructure, with shortages of healthcare professionals in the public sector and with a high prevalence of HIV/AIDs. The clinic was

selected for the study because it is one of the best accredited to offer HIV/AIDS services and registers patients of the CCMDD Programme that have been rolled out in the NHI Districts in SA since February 2014. The clinic is also one of the pick-up points for the CCMDD patients. In terms of staff structure, they are a number of nurses, four doctors and a pharmacist.

2.2 Study Design

A descriptive cross-sectional study using a standardized-questionnaire and face-to-face-exit interviews was used. The design was selected since it is one time collection of data in patients who come monthly to collect their repeat prescriptions that have been delivered by the CCMDD service providers. This clinic as part of the task shifting was accredited for ARV roll-out and caring of HIV-infected patients registered on CCMDD programme in South Africa. The design was used since there is a pharmacist who can play a role in the analysis of adherence rates and associated factors in HIV-patients registered on CCMDD programme.

2.3 Data Collection and Instrument

Data were collected from 100 adults HIV-infected of 18 years , among whom 74 were females and 26 males with mean-age (± SD) of 38.98 (± 9.24) years of and had been enrolled on HAART for more than 36 months prior to the study. A standardized-questionnaire and face-to-face interviews were used to collect data. A convenient sampling technique was used to select the participants. Data adherence rate was obtained using Pill-counts technique and adherence-rate of 95% was considered acceptable. Prior to collection of data patients were explained the purpose of the study and its significance to them and entire community. This was done using the patient information sheet. Patients were told that they were voluntary to participate in the study and were asked to sign a consent form. Patients were told that confidentiality was guaranteed by their names not appearing on the questionnaires. Patients were also

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told that it was their rights to withdraw from the study at anytime and also explained that if they withdrew from the study it would not have any effect on them and the care they are receiving from the clinic. Ethical clearance was obtained from Walter Sisulu University, Faculty of Health Sciences, Scientific and Research Innovation and Ethics Committees.

Data were collected from the tool that had demographic variables like age (years), gender, educational status, employment status, salary earned. Other variables of interest collected were: time on ARVs, recent CD4 count, stigma, WHO staging, adverse effects (ADEs) experienced by the patients, waiting times in the different areas of the clinic. The collected data on the questionnaire were properly secured by storing all the questionnaires in a locked cabinet and key kept by the Principal Investigator (PI). Electronic data were saved in a password-protected device to which only the PI had access.

2.4 Data Analysis

After the data had been collected, they were cleaned, coded and entered into the computer using Microsoft Excel. Later it was analyzed using a Statistical Package for Social Sciences (SPSS) version 22 software. Descriptive statistics that were analysed were: mean, range, standard deviation, minimums, maximums for numerical data and frequencies for categorical data. Data were analyzed using SPSS 22.0. Univariate-factors associated with poor-adherence to HAART were assessed using ANOVA and a $p \leq 0.05$ was considered statistically significant. Results are presented in Tables 1 and 2.

2.5 Ethical Considerations

Ethical clearance was obtained from Walter Sisulu University, Faculty of Health Sciences, Scientific and Research Innovation and Ethics Committees. Thereafter, permission to collect the data from the clinic was first granted by the Eastern Cape Province Department of Health , then KSD district manager, and finally by the clinic manager. Patients in this type of research are sensitive, in such a way that their dignity and rights have to be protected. Therefore they had to be told that the information collected from them was kept confident.

Table 1   Factors associations with poor adherence to HAART in HIV-infected registered on CCMDD (*N* = 76).

Factors of interest		Acceptable adherence rate ≥ 95%	Poor adherence rate ≤ 95%	*p*-value
Age (years)		N (%)	N (%)	0.87
	20-34	11 (33.33)	13 (30.23)	
	35-44	13 (39.39)	18 (41.86)	
	≥ 45	9 (27.27)	12 (27.91)	
Educational background				0.097
	Primary	4 (10.5)	14 (34.15)	
	High school	12 (3.75)	7 (17.07)	
	Matric	10 (31.25)	12 (29.27)	
	Tertiary	6 (18.75)	8 (19.51)	
Recent CD4 count				0.070
	< 200	3 (9.68)	0 (0)	
	200-340	1 (3.23)	3 (7.32)	
	350-490	3 (9.68)	8 (19.51)	
	≥ 500	24 (77.42)	30 (73.17)	
ADEs				0.073
	1	3 (33.33)	1 (8.33)	
	2	2 (22.22)	4 (33.33)	
	3	0 (0)	3 (25.00)	
	4	1 (11.11)	2 (16.67)	

Table 2 Univariate associations between other variables and poor adherence to HAART in HIV-infected registered on CCMDD ($N = 76$).

Factors of interest	Accepted adherence rate $\geq$ 95%	Poor adherence rate $\leq$ 95%	p-value
Stigma	N (%)	N (%)	0.019
1	11 (34.38)	14 (32.52)	
2	21 (65.63)	29 (67.44)	
WHO staging			0.016
1	2 (6.06)	11 (25.58)	
2	9 (27.37)	17 (39.53)	
Reception			0.095
1-5	25 (75.76)	27 (62.79)	
6-30	6 (18.18)	15 (34.88)	
31-60	2 (6.06)	0 (0.00)	
61-90	0 (0.00)	1 (2.33)	
Doctors			0.042
1-5	10 (32.26)	7 (20.00)	
6-30	11 (35.48)	20 (57.14)	
31-60	7 (22.58)	8 (22.86)	
61-90	3 (9.68)	0 (0.00)	

3. Results

A total 100 HIV-infected were enrolled in the study. Of these, 73 (73%) were females and 27 (27%) males with mean 1.270 ($\pm$ 0.446) and mean-age ($\pm$ SD) of 38.98 ($\pm$ 9.24) years enrolled on HAART for more than 36 months. Of these, 26 and 36 were on WHO stages 2 and 3 respectively. Adherence-rates computed from 76 patients revealed that 33 (43.4%) had acceptable adherence rates as compared to 43 (56.6%) with poor adherence-rate.

3.1 Socio-Demographics

3.1.1 Gender Distribution (n = 76)

Of the 100 patients recruited in this study, 73 were females and 27 males with mean-age ($\pm$ SD) of 38.98 ($\pm$ 9.24) years and these were enrolled on HAART for more than 36 months. Of the 76 patients that were computed, 54 were females and 22 males. Of the females 22 (66.67%) were adherent, while 32 (74.41%) non-adherent as compared to 11 (33.33%) males were adherent and 11 (25.58%) non-adherent. There was no univariate association between gender and adherence rate ($p = 0.460$).

3.1.2 Age in Years (Patients)

The age range of patients interviewed was from 20 to

$\geq$ 45 years old. The age ranges were: (20-34) years 31%, (35-44) 44% and 25% for > 45 years. This is the key age group of adults that represented the majority of patients. Of those between 35 and 44 years of age, 39.39% were adherent, while 41.86% were not adherent to ARV treatment. There was a univariate association between age of the patients and adherence rate for $p = 0.087$.

3.1.3 Marital Status

The majority of the respondents 49 (51.6%) were married followed by the single ones with 34 (35.8%). Of the married ones, 40.63% were adherent as compared to 60.98% that were non-adherent. Whereas among the singles 43.75% were adherent, 24.39% were non-adherent. Once again there was no univariate association between marital status of the patients and adherence rates for $p = 0.142$.

3.1.4 Educational Level

As shown in Table 1, the level of education with the highest number of patients was those that had matric with 22. Of these, 10 (31.25%) had acceptable adherence rates, while 12 (29.27%) had poor adherence. There was a univariate association between educational level and adherence rate for the $p = 0.097$. As stated by Mills et al. in a systematic review of developing nation

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patient-reported barriers and facilitators, the low level of education is reflected as a lower socioeconomic status. This is due to an incomplete understanding of treatment importance or simply forgetting taking medications [11].

3.1.5 Employment Status

Of the total number of patients that were in the study, 40 (40.8%) were employed as opposed to 56 (57.1%) that were unemployed. Of the employed, 45.45% were adherent, while 40.48% were not. O the unemployed these 17 (51.52%) were adherent while 24 (57.14%) were non-adherent. Those that were employed 22 (46.8%) earned a salary of R > 4,000. There was no univariate association between employment status of the patients and adherence rate with a $p = 0.885$.

3.1.6 Salary Earned

The majority of the patients that participated in the study, the majority 22 (12.5%) earned more than R4,000. Of these, 8 (44.44%) had acceptable adherence rates, while 11 (61.11%) were non-adherent. There was no univariate association between the amount of money earned per month and adherence rate giving a p value of 0.461.

3.2 Other Associated Factors

3.2.1 Adherence Level

Of the 100 patients that were recruited in the study, of these, 73 (73%) were females and 27 (27%) males with mean1.270 (± 0.446) and mean-age (± SD) of 38.98 (± 9.24) years and enrolled on HAART for more than 36 months. Of the 76 that were computed, 54 were females and 22 males. Of these, 33 (43.4%) males were reported adherent as compared to 43 (56.6%) males that were non adherent.

3.2.2 WHO Staging

The majority of the patients 46 (46.5%) were classified as HIV stage 3 based on WHO staging. Of those that were computed, those in WHO stage 3, 22 (66.67%) had acceptable adherence rates, while 14 (32.56%) had adherent rate that was not acceptable. There was a univariate association between WHO staging of patients and adherence rates of $p = 0.016$.

3.2.3 The Waiting Times in Different Areas of the Clinic

Since CCMDD is a new model introduced to improve health care services in terms of reducing waiting times the patients spend in different areas, so had to assess average waiting times in different areas of the clinic. The average time spent in each area was that: the mean waiting time (minutes) at reception was 55.9 ± 46.9 ranging from 2-210, nurses station: 44.8 ± 39.4 ranging from 2-180, to see a doctor: 84 ± 90.6 ranging from 3-300, laboratory: 83.3 ± 83 ranging from 30-180; and to collect medicines from the pharmacy: 30.1 ± 25.6 ranging from 2-120 minutes. The waiting areas associated with poor ARV adherence were: at reception ($p = 0.095$), doctors with ($p = 0.042$), while waiting areas at nurse's station ($p = 0.29$) and pharmacy ($p = 0.43$) were not associated with poor ARV adherence as indicated in Table 2.

3.2.4 Recent CD4 Count

Recent CD4 of the patients was also assessed. The majority of patients had CD4 count of above 500. Of these 24 (77.42%) were adherent while 30 (73.17%) were non-adherent. It was established that there was a univariate association between patient's recent CD4 counts and adherence rates with p of 0.007.

3.2.5 Adverse Effects

Patients in this study when interviewed expressed side effects they felt. The majority of the patients complained of ADEs related to central nervous system like drowsiness, insomnia, dizziness, hallucinations after taking the tablets. Others said that they experienced ENT effects related to noises in the ears, while others complained of GIT. It was established that there was an association between adverse effects and adherence rates with a $p = 0.073$.

3.2.6 Stigma

Of the patients interviewed, 36 (36.4%) complained of the stigma they experience from the society. The patients who said they were discriminated because of being HIV positive did not adhere to their treatment.

These accounted for 21 (65.63%) as compared to 29 (67.44%) who were non-adherent. There was a univariate association between stigma experienced by the patients and adherence rates with a $p = 0.019$.

4. Discussion

This study assessed adherence rates and associated factors in HIV-patients registered on CCMDD programme in the public primary health care set in SA and the role a pharmacist can be played in caring these patients. It was established that there was a univariate association between the following variables: age of the patients, their educational background, WHO staging, recent CD4 count, stigma, ADEs and waiting times in different areas of the clinic. Adherence-rates computed from 76 patients revealed 43 (56.6%) having poor adherence-rate. The same outcome was reported by Katende [12] in a study conducted on patients not registered on CCMDD that adherence-rate computed from 32 patients revealed 23 (71.9%) having poor adherence-rates. Of 23 non-compliant, 10 (40%) gave the reason of drugs-unavailability, 7 (30%) adverse-effects, 5 (20%) drugs' complexity, and 1 (10%) too busy to take them. Waiting areas were also associated with poor ARV-adherence with reception ($p = 0.095$), doctors ($p = 0.042$), while nurse's station ($p = 0.29$) and pharmacy ($p = 0.43$) revealed acceptable ARV-adherence.

It was observed in this study that among the determinants for non-adherence, age is a determinant for adherence. Studies done in Ethiopia [13], Rwanda [14], Uganda [15] and Tanzania [16] reported better adherence to have been seen in older patients (> 35 years) as compared with younger patients. These results are in accordance with results obtained in this study. Older patients tend to take care more of themselves than the young ones. The young ones are engaged in so many activities and to them going for health care is not a priority.

Some studies reported that gender influences adherence, stating that there was better adherence for women [17, 18], while in one study by Alemu et al. [13] it was reported the opposite. In this study gender was not statistically significant with $p = 0.460$. Females tend to take good care of themselves in terms of health therefore take their daily medications as prescribed and report monthly for their repeats.

In terms of education, patients in this study with primary background had lower adherence with $p = 0.097$ as was also reported by authors in their study that lower levels of education corresponded with non adherence [19, 20], and higher adherence was observed among patients with formal education [20]. Education, while helpful, is usually not enough to persuade the patient to comply with the physician's drug orders. Information must be presented in clear, easy-to-understand language, and the patient must understand not only the benefits of adherence, but the repercussions of non-adherence. Also, positive reinforcement goes a long way; patients who feel empowered and cared for are more apt to play an active role in their treatment. This is where the patient plays a pivotal role as stated by Susan in her study [1].

Patients with lower education do not understand the importance of taking their daily treatments and therefore adherence more especially if they have not been given enough education by the healthcare workers like a pharmacist. On the contrary, patients with higher education will firstly read and understand about the condition and therefore the importance of adherence to avoid complications [11].

With WHO staging, the majority of the patients 36 (39.53%) were classified in the HIV stage 3 based on WHO staging. All 14 (32.56%) patients in WHO stage 3 were none complaint. There was an association between WHO staging 3 with adherent rate that was statistically significant with a $p = 0.019$. Patients in WHO clinical staging 3 experience serious symptoms like chronic diarrhea for more than 1 month, prolonged fever, oral candidiasis, severe bacterial infections including pulmonary tuberculosis. All these conditions dispose patients not to adhere to their treatments

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because they are too sick to report for their monthly repeats.

Among treatment determinants affecting adherence in this study, side effects experienced by the HIV-infected and registered on CCMDD programme are also among those that have the negative influence of side effects on adherence. All our patients in this study are on a fixed dose containing Efavirenz, Tenofovir and Emicitrabine. Efavirenz (EFV), a non-nucleoside reverse transcriptase inhibitor (NNRTI), forms part of the first line therapy for many of these HIV infected individuals. The ARV experience is relatively new to South Africa in comparison to many developed nations and studies looking at adverse effects of treatment and long-term treatment complications are only now beginning to emerge. Clinical trials have reported central nervous system (CNS) side effects in > 50% of patients following commencement of EFV therapy [21].

The reported side effects by AIDS FDA drug information sheet range from dizziness and headaches to hallucinations, acute mania and psychosis [22] as also reported by 7 (30%) of patients experiencing adverse-effects, in this study with a statistical significance of $p = 0.073$.

In patients commencing therapy for the first time, the development of adverse effects may negatively influence adherence and treatment success. This is also supported by previous studies that have shown that plasma EFV concentrations display a large difference between subject variability with a coefficient of variance (CV) of up to 118% [23]. Prediction of therapeutic efficacy and the likelihood of developing adverse CNS effects have been associated with plasma EFV concentrations [23]. Patients with EFV concentrations of > 4,000 μg/L may experience neurological adverse effects more frequently, whilst those with plasma concentrations < 1,000 μg/L appear to have a greater risk for emergence of selective drug resistance and treatment failure [23].

Other authors [24, 25] have reported patients on EFV combination to complain of chronic diarrhea and body shaping effects, giving rise to the fear of involuntary disclosure of HIV status. Patients in this study also reported GIT effects as part of their adverse effects as well as CNS effects. Health facility determinants associated with non-adherence included experiencing no privacy at the facility, due to crowded pharmacies, consultations with multiple patients and lost files.

In this study of 23 non-compliant patients 5 (20%) gave the reason for non-adherence as drugs' complexity. Dosing simplification and minimization of adverse effects are extremely successful strategies for improving adherence. When filling a prescription, the pharmacist should do a quick review to see whether the dosing schedule is as simple as possible. The pharmacist should inquire frequently about any adverse effects the patient is experiencing and then consult the physician regarding suggested alternatives.

Again of 23 non-compliant in this study, one patient 1 (10%) reported to have been too busy to take the treatment. Therefore pharmacists can educate the patients about reminder calls, texts, or e-mails that are helpful for many patients, especially those with busy lifestyles. Automatic refills are a useful strategy. Small details, like splitting a patient's pills when necessary and providing easy-off caps, can be beneficial.

Preparing a dosing card containing only the most essential elements of the patient's medications can be highly beneficial. Including the name of the pill, an image (if possible), the condition it is for, and time of day taken can be extremely helpful for patients who take many medications or who have cognitive barriers.

Long waiting times and limited clinic hours were reported to lead to non-adherence, especially for employed people who would need to take time off to collect their medication [26, 27]. The waiting times in different areas of the clinic were also assessed in this study. The average time spent in each area was that: the mean waiting time (minutes) at reception was 55.9 ± 46.9 ranging from 2-210, nurses station: 44.8 ± 39.4

ranging from 2-180, to see a doctor: 84 ± 90.6 ranging from 3-300, laboratory: 83.3 ± 83 ranging from 30-180; and to collect medicines from the pharmacy: 30.1 ± 25.6 ranging from 2-120 minutes. The waiting areas associated with poor ARV adherence were: at reception ($p = 0.095$), doctors with ($p = 0.042$), while waiting areas at nurse's station ($p = 0.29$) and pharmacy ($p = 0.43$) were not associated with poor ARV adherence as indicated in Table 2.

In this study the waiting times in different areas of the clinic were that reception and pharmacy were statistically significant with $p = 0.095$ and 0.042 respectively. The average time spent in each area was that the mean waiting time (minutes) at reception was 1.47 ± 0.67 ranging from 1-90, nurses station: 1.33 ± 0.47 ranging from 1-30. The waiting areas associated with poor ARV adherence were at reception and these results concurred with studies done by authors [27, 28] and pharmacy as already stated, though in other studies the waiting times at pharmacy were not associated with poor adherence with $p = 0.43$. In this case it is expected that patients wait longer at reception due to the many processes the patients have to go through coupled with shortage of staff for the longer waiting times to collect their medicines from pharmacy is due to shortage of staff.

Fear of discrimination and/or experiencing stigma were determinants of non-adherence. This included being laughed at, exclusion from activities, being fired and alienation [26-28]. Patients from this study also expressed stigma which was associated with poor adherence with a $p = 0.019$.

The most common health status-related determinant was perceived health status. Experiencing improved health on ART, increased confidence in medication, weight gain and being able to return to work were positively associated with adherence [20, 21, 29-33]. However, some studies noted that improved health could result in non adherence if people believed to have been cured [34]. Studies assessing adherence in relation to participant's CD4 cell count were conflicting. Both low and high CD4 counts were reported to increase and decrease adherence to ARTs [10, 14, 35].

5. Limitations to the Study

This type of study has so far been done in one of the PHCs in King Sabata Dalidyebo (KSD) sub-district, in the Eastern Cape Province. Therefore findings of this study cannot be generalized to the rest of the clinics where HIV-infected are registered on CCMDD. The sample used is not a representative of the different settings.

6. Recommendation

The study was performed on patients registered on a new model that was introduced in 2014. It is therefore recommended that these results be disseminated to other settings and incorporated into the service planning process of the department of health. Policy makers should get this feedback and incorporate them into their patient quality improvement plans. Since the main aim of CCMDD is to reduce on the patients' waiting times, therefore the down referral system should be reinforced with the use of the pharmacists as custodians of pharmaceutical care. This will also need the cooperation of other health care team, like doctors and nurses. Also this will reduce on patient's waiting times, improve ARV adherence rates, and save the patients' costs and the huge amount of SA taxi-payers money. It is also recommended that regular monitoring and evaluation plans be reinforced and involve other clinics in performing such kind of study.

The following strategies are also recommended to improve adherence: patient education and case management; modified (mDOT) or directly administered antiretroviral therapy (DAART); contingency management strategies; social support adherence interventions and using technologies to promote adherence.

7. Conclusions

In conclusion results from this study confirmed that

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the HIV-infected with ARV and registered on CCMDD program do not adhere to treatment due to various determinants as discussed above. Determinants of non-adherence identified in this study could facilitate the development, evaluation and implementation of targeted interventions. Given the increased accessibility of ART in SA, optimizing adherence will improve the health of millions of people living with HIV.

Pharmacists as custodians of medicines and important PHC providers need to collaborate with other stake holders in order to educate patients on CCMDD on the importance of ARV-adherence so as to avoid complications and improve on the quality of care. Issues related to waiting times have to be tackled to seriously for this programme to be successful. Systemic challenges like late/non deliveries, lack of data at facility level, lack of patient and parcel tracking need to be attended to.

Whatever the barriers to adherence may be, the only way to assess them is to talk to the patient. The pharmacist needs to be diligent about including the patient in the treatment experience. The more trust the patient has in the pharmacist, the more he or she will open up and disclose any apprehensions or difficulties about taking his or her medication. Only then can the pharmacist play an integral role in improving a patient's adherence.

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