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Comparison on treatment outcomes of patients enrolled on anti-retroviral therapy at different levels of the health-care system in a high HIV/AIDS setting

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Abstract

HIV/AIDS prevalence in Botswana is amongst the highest in the world and remains a significant public health problem. however, the introduction of anti-retroviral therapy (ART) lead to a significant reduction in morbidity and mortality. Decentralization of anti-retroviral therapy has improved access to treatment for people living with HIV. Treatment outcomes for patient initiated on treatment at different levels of care is unknown and this study seeks to compare treatment outcomes of patients enrolled on ART at different levels of the health care. This is a retrospective cross-sectional study that included review of data from January 2017 to December 2018. The study was conducted in 2 health districts in the country. Nine hundred and sixty (960) patient's record were included in analysis. More than half (63%) of patients were enrolled at primary care level while 37% were at tertiary level. Sixty one percent (n = 587) were female while 39% (n = 373) were males. There were no statistically significant differences in viral load suppression after 12 months of treatment between patients enrolled at tertiary level and primary care level, x2 = 0.75, p value = 0.56. Time to initiation was longer at tertiary (median = 126) compared to primary are level (median = 18), p < 0.001. We reccommend further decentralization of ART services to lower levels of the health care system to initiate PLWHIV early on treatment and improve their health outcomes and reduce transmission through treatment by prevention.

Keywords

Anti-retroviral therapy. COVID-19. Outcome. Primary. Tertiary. Treatment.

Introduction

Globally, Since the start of the epidemic, around 75 million have become infected with HIV[1,2]. An estimated 0.8% of adults aged 15-49 years worldwide are living with HIV, although the burden of the epidemic continues to vary considerably between countries and regions[1-5]. Botswana like most sub-Saharan countries has been hard hit by the HIV-epidemic, with the third highest HIV prevalence worldwide among adults age

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15-49, after Lesotho and Swaziland[3,4]. Botswana rolled out the Antiretroviral Program in 2002, and the country appears to be approaching the UNAIDS "90-90-90" HIV testing, treatment, and viral suppression targets[5]. These high levels of coverage have led to significant reductions in HIV-related mortalities[3,6-9].

Decentralization of anti-retroviral therapy (ART) services from tertiary centers to lower levels of the health-care system has shown varying treatment outcomes across different regions, globally. A large study conducted in South Africa which compared the treatment outcomes between three levels of the health care system, reported higher likelihood of virologic suppression as well as other outcomes at primary health centers compared to regional and district level hospital[10]. In Kenya, decentralization of ART services improved access to HIV care and treatment outcomes; however, the quality of care at primary health facilities was least comparable to the quality of services at secondary healthcare[11]. Poorer ART outcomes were found at lower-level clinics compared to primary hospitals in a study conducted in Central Nigeria[12]. Patients at satellites sites had longer waiting time to commencement of ART compared to patients at prime sites. The study also found out that the risk of death was higher for patients enrolled at satellites compared to primary sites. This is contrary to the study conducted in Malawi in which lower death rates at health centers were documented compared to hospital settings[13]. Further decentralization of ART services to the community in Malawi showed no significant differences with regard to detectable viral load, mean CD4 count, change in ART regimen, new opportunistic infections or pregnancy rates[14]. In another study in South Africa, treatment outcomes of patients on ART who were referred to a primary health clinic were as good as or better than the outcomes of similar patients at a hospital-based anti-retroviral clinic and the cost of treatment was lower at primary health care than hospital settings[15]. Nurse led primary care-based ART care resulted in improved clinic attendance and better patient experiences than hospital care even though health-related outcomes remained the same in a study conducted in Swaziland[16]. Decentralization of ART to primary health facilities and communities was found to be associated with improved retention in a met analysis study by Amitabh and colleagues[17]. This study informed the operational and service delivery of the section of the World Health Organization consolidated ART guidelines.

A study conducted in Mozambique looking at a 4 - year treatment outcomes of adult patients enrolled on a rapidly expanding ART program suggested that early initiation of patients on ART and co-trimoxazole therapy could improve treatment outcomes[18]. Virological response at 6 months after beginning ART was found to be the strongest predictor of viral suppression at 12 months and 36 months in a study conducted in Papua, Indonesia[19]. Majority of the studies focusing on treatment outcomes for patients enrolled in ART in resource-constrained settings across the globe showed comparable treatment outcomes.

The Government of Botswana introduced the Treat All Strategy in 2016 as the most cost-effective option for HIV response and to achieve epidemiologic control by 2020. However, there has been lower than expected number of patients initiated on ART and no improvement in the number of new infections. There are uncertainties on the implementation of the Treat All Strategy in Botswana. The literature has shown varying treatment outcomes, specifically virologic suppression for patients enrolled on treatment at tertiary, secondary and primary care settings in different parts of Africa. There is no literature comparing treatment outcomes at different levels of the health-care systems in Botswana. The aim of this study is to compare treatment outcomes of patients enrolled on ART at tertiary and primary health-care levels in two District Health Management Teams in Botswana from January 2017 to December 2018.

Methods

Study design

This is a quantitative and cross-sectional study comparing treatment outcomes of patients enrolled on ART at different levels of the health-care system in two health districts in Botswana. The primary outcome for the study was viral suppression. Study included all patients that were enrolled on ART at the selected study sites that met the inclusion criteria.

Study setting

The study sites selected included two tertiary care facilities (Princess Marina Hospital in Gaborone and Nyangwabe Hospital in Francistown) and four primary level facilities included two from Gaborone (Broadhurst and Bontleng Clinics) and two from Francistown (Tonota and Itekeng Clinics). The study sites were purposively selected because they have the highest number of patients currently enrolled on ART in the

respective DHMTs (data quality assessment report, 2018). Princess Marina is the largest hospital and serves the south of the country while Nyangabwe Referral Hospital is the second largest hospital and serves the north of the country. There are only two tertiary-level government facilities in the country. Tonota clinic is located in a rural setting in the northern part of Botswana, while the other clinics are found in urban settings.

Study population

The study population included patients enrolled on ART from January 2017 to December 2018 that met the inclusion criteria from the selected health facilities. Those above 20 years of age were included in the study looking at the Botswana HIV treatment guidelines. The treatment guidelines for those above 20 years is different for those below 20 years. We therefore included patients aged 20 years and older, in first-line treatment who were in care for 12 months and initiated treatment at the study site. Only patients on first-line treatment were enrolled in the study. According to Botswana HIV Treatment Guidelines, all HIV-positive Naïve patients are treated with Truvada 1 Tablet PO OD + dolutegravir 50 mg PO OD. Patients who were transfer in, 20 years and older and those without national identification number were excluded from the study.

Sampling and sample size

This study included all (census) patients that met the inclusion criteria at the selected sites.

Data procedures

Data were extracted from Ministry of health databases from January 2017 to December 2018. These included patient information management system (PIMS), inpatient management information system (IPMS), and district health information system 2. Data matching using patient's unique identification number from HIV testing services and treatment were conducted on completion of extraction.

The main variables are as follows included demographic factors (patient unique identification number, age, sex, and place of residence), date of HIV/AIDS diagnosis, date of initiation on ART, viral load at 12 months, and name of treatment site. A checklist was also developed which was used to assess the capacity of the facilities under study to offer HIV/AIDS testing and treatment services. The following were the parameters included in the checklist: services offered pre and post counseling services, patient follow-up (defaulters, missed appointments, and lost to follow-up), laboratory investigations offered (viral load, CD4 count, chemistry, and full blood count), patient's review as per guidelines or schedule and failure clinics and adherence services (side effects management [identify, reporting, and treatment], utilization of software system for patient monitoring [PIMS, IPMS], pharmaceutical services [drug availability], availability of medical doctors [onsite or outreach], availability of prescribing and dispensing nurses, and availability of pharmacy personnel [onsite or outreach]).

Table 1. Demographic characteristics of study participants (n = 960)

Variables	Frequency	Percentages
Age (years)		
20-49	763	79.48
> 50 +	197	20.52
Sex		
Male	373	38.85
Female	587	61.15
Health facility level		
Primary	605	63.02
Tertiary	355	36.98

Data analysis

The exposure variables for this study included age, gender, and type of health facility-initiated treatment. The primary outcome measure includes treatment outcomes (viral load, adherence). Data analysis was done using statistical analysis software. Descriptive statistics including frequencies and measures of central tendencies were generated as appropriate. Categorical variables were analyzed using summary statistics such as frequencies and percentages. For continuous variables such as age, median (inter-quartile range) or mean (and standard deviation) were presented depending on whether the variable under consideration is skewed or not, respectively. Analysis such as Chi-square test for association and t-tests was used as relevant to determine factors associated with HIV/AIDS treatment outcomes. $p < 0.05$ was deemed to be statistically significant.

Table 2. Comparison of viral load suppression for patients enrolled on ART for 12 months at tertiary versus primary health care level (January 2017-December 2018)

Level of the health-care facility	Viral suppression		Missing	Chi-square	p-value
	Yes (%)	No (%)			
Primary	332 (96.8)	11 (3.2)	196	0.75	0.56
Tertiary	190 (97.4)	5 (2.6)	122		

Table 3. Comparison of time to initiation for patients enrolled on ART for 12 months at tertiary versus primary care level of the health-care system (January 2017-December 2018) and disaggregated by sex

Level of care and gender	Days to initiation					
	Same day	2-7 (%)	7-30 (%)	> 30 (%)	Median	p-value
Primary (n = 539)	95 (17.6)	125 (23.2)	127 (23.6)	192 (35.6)	18	< 0.001
Tertiary (n = 317)	22 (6.9)	43 (13.6)	48 (15.1)	204 (64.4)	126	< 0.001
Male (n = 342)	55 (16.1)	70 (20.5)	75 (21.9)	142 (46.5)	21	< 0.001
Female (n = 536)	65 (12.1)	101 (18.8)	107 (20.0)	263 (49.1)	30	< 0.001

Ethical considerations

This study was conducted according to Botswana, and International Standards of Good Clinical Practice, applicable government regulations, and Institutional research policies and procedures. The protocol and any amendments made were submitted to the Botswana, Ministry of Health and Wellness Institutional Review Board, where it was approved. The protocol number awarded for this study is HPRD 6/14/1.

The study did not involve any interaction with study participants and no consent was sort.

Results

A total of 960 patients records were extracted for analysis. Patient records were excluded from analysis based on missing ID numbers, ART experienced (for time to initiation), transfer outs, and age < 20. More than half of the patients (63.02%) were from primary care level while 36.98% were from tertiary level. The median age was 38 years old. Sixty-one percent (n = 587) were female while 38.8% (n = 373) were male (Table 1).

There was no statistically significant difference in viral suppression at 12 months between patients enrolled at these two levels of the health-care system, p = 0.52 (Table 2). Patients were likely to be initiated on ARTs earlier at primary health-care facility (median number of days is 16) compared to tertiary health facility (median number of days is 126) (Table 3). Males were more likely to be initiated faster (median = 21 days) compared to their female (median = 30 days) counterparts regardless of the level of the health-care system they were being enrolled. The Wilcoxon test conducted to compare the median time to initiation by sex showed a statistically significant difference (p < 0.001). Sixty-five (12.1%) of females were initiated on treatment on the same day compared to 55 males (16.1%) and 263 (49.1%) of females were initiated on treatment after 30 days compared to 142 (41.5%) males.

Discussion

This study has shown that there is no difference in virologic suppression between patients initiated on anti-retroviral treatment at primary of tertiary level.

However, studies done particularly in the African region have shown varying treatment outcomes, that is, virologic suppression, loss to follow-up, retention in care, development of opportunistic infections, and AIDS-related deaths for patients enrolled on ART at different levels of the health-care system.

A study done in South Africa a high prevalent HIV/AIDS setting like showed that overall ART treatment outcomes were found to be superior at primary health-care clinics than at a hospital (secondary and tertiary level) settings[20]. However, it is worth noting that this study was conducted before the introduction of the Test and Treat strategy. Furthermore, worth noting for this study, 37% of patients that were initiated on treatment at these selected sites and had completed for 12 months of treatment had no viral load records available. Even though this number did not affect the comparison between the two levels, it demonstrates some gaps that exist in virologic monitoring at these two levels of the health-care system. It is uncertain that whether the difference could be due to data issues or viral load monitoring issues. The assessment conducted to find out if these facilities have the capacity to offer comprehensive and satisfactory ART services indicated that the two tertiary institutions in Botswana processed viral loads on site and machine breakdowns were rare as while viral load specimens at the primary care level were processed at a central level in the primary care system and the turnaround time for the results was within a week or two.

This study has also showed that patients are initiated much faster in the primary health-care system than at tertiary level. These results differ from what was found in a study conducted in Nigeria where patients enrolled at satellites sites were taking longer to be initiated than those at primary or tertiary sites[12]. The decentralization of ART services to the lowest health care facilities in Botswana has clearly improved access to ART services aiding in improved time to initiation observed in primary care settings in this study. This was a good step in the country attaining its 90-90-90 targets to eliminate HIV/AIDS. One other observation that was made during the study, especially at the analysis stage was that one of the tertiary institutions, that is, Princess Marina Hospital was transferring most of the patients that were tested at that site to be initiated at primary health-care facilities nearest to them. This is a clear evidence of the ongoing decentralization of ART services to lower levels of the health-care system in Botswana.

Males were found to be more likely to be initiated faster than their female counterparts in this study. There was no literature that was consistent with this finding. Interestingly, programmatic data shows that women in Botswana access HIV services more often and readily compared to their male counterparts. This study could not establish if the delay in initiation observed in females was due to biological or psychosocial issues. Botswana adopted the Treat All Strategy in 2016 with the goal to achieve epidemic control through prevention in 2020. This decision was made based on the Temporano and Smart Trials which demonstrated a reduction in morbidity and mortality by at least 60% in persons living with HIV when initiated on treatment as early as possible following their diagnosis. Access to laboratory services especially virologic monitoring is a key component of ART management. This key component is also highlighted as part of the minimum program requirements set out by PEPFAR. Botswana has so far been doing well in terms of viral load monitoring and viral suppression. According to ARV program data (2018), 96% of persons living with HIV who are on treatment are virally suppressed. This study also demonstrated that for those who were eligible to be included in the analysis, 97% were virally suppressed.

It was observed though that the national databases had data management issues that could compromise the country's data. Of the 22,238 patient's records that were extracted from HIV testing services database, 17% were duplicates, 7.2 % had incorrect national ID number digits and an undocumented amount had no National Identification numbers. These data management issues can have a huge bearing on the outcomes of the country's statistics. Particular attention needs to be paid to these issues to assist the country in having reliable and accurate statistics.

The existence of a well-established national antiretroviral program with clear indicators and supporting PIMS was found to be one of the strengths that aided in the successful completion of this research project.

The limitations of the study are this study utilized secondary data extracted from Ministry of Health, Headquarters, and facility-based databases. Unfortunately, the data extracted was unclean and incomplete, limiting analysis. The databases did not provide patient-level data to allow for analysis of variables such as source of infection, opportunistic infections, clinical condition, or CD4. Further studies will be required to establish the predictors for viral suppression as well as desirable time to initiation.

Conclusion

There was no statistically significant difference in treatment outcomes, that is, viral load suppression after 12 months of treatment in patients enrolled on ART at tertiary versus primary care level. However, the time to initiation was longer at tertiary than at primary care level. Further decentralization of ART services to lower levels of the health-care system could improve the number of patients initiated on treatment and outcomes of treatment.

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Conflicts of interest

None.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article. Furthermore, they have acknowledged and followed the recommendations as per the SAGER guidelines depending on the type and nature of the study.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

Use of artificial intelligence for generating text. The authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscript, nor for the creation of images, graphics, tables, or their corresponding captions.

References

1. Obeagu EI, Alum EU, Obeagu GU. Factors Associated with Prevalence of HIV Among Youths: A Review of Africa Perspective. Vol. 3, Madonna University Journal of Medicine and Health Sciences. 2023.
2. Obeagu EI. A Review of Challenges and Coping Strategies Faced by HIV/AIDS Discordant Couples [Internet]. Vol. 3, Madonna University Journal of Medicine and Health Sciences. 2023. Available from: http://madonnauniversity.edu.ng/journals/index.php/medicine
3. Bajunirwe F, Tumwebaze F, Akakimpa D, Kityo C, Mugyenyi P, Abongomera G. Towards 90-90-90 target: Factors influencing availability, access, and utilization of HIV services-a qualitative study in 19 Ugandan districts. Biomed Res Int. 2018;2018.
4. Moyo S, Gaseitsiwe S, Mohammed T, Holme MP, Wang R, Kotokwe KP, et al. Cross-sectional estimates revealed high HIV incidence in Botswana rural communities in the era of successful ART scale-up in 2013-2015. PLoS One. 2018;13(10).
5. Gaolathe T, Wirth KE, Holme MP, Makhema J, Moyo S, Chakalisa U, et al. Botswana's progress toward achieving the 2020 UNAIDS 90-90-90 antiretroviral therapy and virological suppression goals: A population-based survey. Lancet HIV. 2016;3(5).
6. Unaids. AIDS epidemic update. Aids. 2000;37(6).
7. UNAIDS. Global AIDS Update 2016. World Health Organization. 2016;(March).
8. Jacob John T, Marie Moulin A, Schulz ThomasF. Joint United Nations Programme on AIDS. The Lancet. 1995;345(8952).
9. World Health Organization W. Global AIDS Response Progress Reporting. Vol. 371, The Lancet. 2015.
10. Fatti G, Grimwood A, Bock P. Better antiretroviral therapy outcomes at primary healthcare facilities: An evaluation of three tiers of ART services in four south african provinces. PLoS One. 2010;5(9).
11. Reidy WJ, Sheriff M, Wang C, Hawken M, Koech E, Elul B, et al. Decentralization of HIV care and treatment services in central Province, Kenya. J Acquir Immune Defic Syndr (1988). 2014;67(1).
12. Okonkwo P, Sagay AS, Agaba PA, Yohanna S, Agbaji OO, Imade GE, et al. Treatment outcomes in a decentralized antiretroviral therapy program: A comparison of two levels of care in north central Nigeria. AIDS Res Treat. 2014;2014.
13. Brennan AT, Maskew M, Sanne I, Fox MP. The interplay between CD4 cell count, viral load suppression and duration of antiretroviral therapy on mortality in a resource-limited setting. Tropical Medicine and International Health. 2013;18(5).
14. Renju J, Rice B, Songo J, Hassan F, Chimukuche RS, McLean E, et al. Influence of evolving HIV treatment guidance on CD4 counts and viral load monitoring: A mixed-methods study in three African countries. Glob Public Health. 2021;16(2).
15. Long L, Brennan A, Fox MP, Ndibongo B, Jaffray I, Sanne I, et al. Treatment outcomes and cost-effectiveness of shifting management of stable ART patients to nurses in South Africa: An observational cohort. PLoS Med. 2011;8(7).
16. Humphreys CP, Wright J, Walley J, Mamvura CT, Bailey KA, Ntshalintshali SN, et al. Nurse led, primary care based antiretroviral treatment versus hospital care: A controlled prospective study in Swaziland. BMC Health Serv Res. 2010;10.
17. Suthar AB, Rutherford GW, Horvath T, Doherty MC, Negussie EK. Improving antiretroviral therapy scale-up and effectiveness through service integration and decentralization. AIDS. 2014;28(SUPPL. 2).
18. Auld AF, Mbofana F, Shiraishi RW, Sanchez M, Alfredo C, Nelson LJ, et al. Four-year treatment outcomes of adult patients enrolled in Mozambique's rapidly expanding antiretroviral therapy program. PLoS One. 2011;6(4).
19. Limmade Y, Fransisca L, Rodriguez-Fernandez R, Bangs MJ, Rothe C. HIV treatment outcomes following antiretroviral therapy initiation and monitoring: A workplace program in Papua, Indonesia. PLoS One. 2019;14(2).
20. Fatti G, Grimwood A, Bock P. Better antiretroviral therapy outcomes at primary healthcare facilities: An evaluation of three tiers of ART services in four south african provinces. PLoS One. 2010;5(9).