

Health-Related Quality of Life in HIV-Positive Women on Long-Term Antiretroviral Therapy—A Study from Bangalore, South India

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Abstract

Introduction: Lifelong Anti-Retroviral Therapy (ART) promotes good quality of life and health among HIV-positive men and women. However, simplified newer and effective ART has not increased retention in care, or long-term ART adherence, especially among women. There are many factors that impede long-term adherence in women. This includes among other things female gender, depression, greater than once-daily dosing, longer time since HIV diagnosis, and patient beliefs. This study measures the quality of life in women whose ART durations range from one to fifteen years, using the standardized WHO Quality of Life questionnaire. **Material and Methods:** One hundred and fourteen women were divided into three groups based on ART duration. Group 1 had 37 women on ART for less than five years, Group 2 had 48 women on ART from 5 to 10 years and Group 3 had 29 women on ART for more than ten years. They were administered the WHO Quality of Life (QOL) questionnaire, which assesses QOL in six domains. QOL was considered poor in scores between 4 - 9.9, medium in scores of 10 - 14.9 and good in scores of 15 - 20. **Results:** Scores in all 3 groups were more than 85% in five domains and around 74.5% in the psychological domain. Domain mean scores were Physical **18** (CI 17.63 - 18.37), Psychological **14.9** (CI 14.55 - 15.25), Independence **18.6** (CI 18.33 - 18.87), Social relationships **17.5** (CI 17.07 - 17.93), Environmental **17.6** (CI 17.25 - 17.95), Spiritual, Religious, Personal beliefs, **17.4** (CI 16.93 - 17.87). Scores for women on long-term ART (Group 3) are not different from the other 2 groups and the p-values were not statistically significant. **Conclusion:** Women on long-term ART fare extremely well compared to other groups with more than 93% showing good QOL and none showing poor Quality of Health in spite of being on ART for a longer period

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of time than the other two groups. Despite a multitude of impeding factors, women who continue ART faithfully and consistently enjoy a good quality of health and life. Adequate preparation and a supportive health system are essential for ensuring long-term adherence, but the attitude and commitment of women are also critical.

Keywords

Antiretroviral Treatment-ART, Quality of Life-QOL, Women Living with HIV Quality of Health, Long-Term Adherence

1. Introduction

Lifelong Anti-Retroviral Therapy (ART) is the most effective way to increase survival and promote a better quality of life among women [1] [2]. However, in studies done on HIV (Human Immuno-deficiency Virus) infected pregnant and postpartum women, the rates of three key outcomes—ART initiation, retention in care, and long-term ART adherence remain low [3]. In spite of simplified drug regimens and newer, more effective antiviral drugs, and global efforts to increase ART access in Sub-Saharan Africa and other low-resource settings, mortality rates are still high since the success of current HIV treatment programs depends not only on access to ART, but also on retention in care and good treatment adherence of more than 95% for life [4] [5] [6] [7]. This is necessary to achieve viral suppression, prevent virologic failure, and reduce viral transmission and HIV-related deaths. Women are more likely to develop severe symptomatic hepatotoxicity with Nevirapine, and severe symptomatic lactic acidosis with prolonged use of older NRTIs (Nucleoside Reverse Transcriptase Inhibitors) [8]. HIV-infected persons including women have an increased risk of osteopenia, osteoporosis, and fractures and this is increased not only by HIV Infection but also by ART regimens with Tenofovir, and Ritonavir boosted protease inhibitors, which are associated with greater loss of bone mineral density [9]. Women also have an enhanced risk of non-AIDS (Acquired Immune Deficiency Syndrome) mortality and morbidity such as cardiovascular and cerebrovascular disease [10]. Besides, women are known to always put themselves last when it comes to health care.

All of these factors can affect the adherence and thereby the quality of life of HIV-positive women on lifelong ART. Health-related Quality of Life studies on children and adults living with HIV are available [11], but few deal with women on long-term ART. These studies on women are urgently needed to educate, convince and motivate them to continue treatment despite medical, social and psychological problems. This study includes women who have been on ART for more than ten years and includes women who have been on ART for 15 years or more.

The WHOQOL-BREF (World Health Organization, Quality of Life) questionnaire was developed as a practical tool to measure several domains and

overall quality of life and health [12]. It has proved to be a useful and valid tool. A Chinese study on persons living with HIV and on ART showed good scores for all domains but did not find any relationship to the duration of ART [13]. However, other studies report a significant correlation between the duration of ART and health-related quality of life [14]. No recent Indian study is reported exclusively for women on the long-term duration of ART and hence it was proposed to use WHOQOL-BREF for describing the quality of life among women on ART whose durations ranged from one to fifteen years in Bangalore, Karnataka State in South India. In this paper, we present the background, methodology and major findings with a brief discussion leading to cogent recommendations.

2. Material and Methods

ASHA (Action, Service, and Hope for AIDS) Foundation, a non-governmental organization (NGO) located in Bangalore, Karnataka state, South India has been working in the field of HIV/AIDS for over two decades and has been providing a range of services including ART for people living with HIV. Based on meticulous records maintained, a cross-sectional study was done during 2017 to 2019 to assess the quality of life and health of all women with HIV infection on ART at ASHA Foundation. All consecutive women living with HIV (age > 18 years) who have enrolled at ASHA Foundation and who have been started on antiretroviral therapy at ASHA Foundation and who have had active follow up on ART at ASHA Foundation for one year or more and were still available for face-to-face interview were recruited for this study. There were 114 such patients. They were divided into three categories based on duration of ART: those on ART for less than 5 years were placed in Group 1, those on ART for 5 to 10 years were placed in Group 2 and those on ART for more than ten years were placed in Group 3. It was also the intention of the study to determine whether the quality of life and health in women in Group 3 who were on ART for the longest period of time (ten to fifteen years) differed from women in Groups 1 and 2 who were on treatment for less than 10 years. Ethical approval was obtained from ASHA Foundation's Research Advisory Board. Informed written consent was obtained from each woman assuring anonymity, confidentiality and security. Demographic details such as age, education, occupation and marital status were obtained from each of the women and entered into the MS excel sheet. WHOQOL-HIV BREF version- 12 was used by trained investigators to assess the quality of life and quality of health. This WHO Tool produces scores in six different domains namely Physical, Psychological, Level of independence, Social relationships, Environmental, and lastly Spirituality, Religion, Personal Beliefs (SRPB). There was also a general facet ("G" facet) which assesses general quality of life (QOL) and general quality of health. Individual items are rated on a 5-point Likert scale. Higher scores indicate better QOL. For easier interpretations, the QOL scores between 4 and 9.9 were taken as low, 10 - 14.9 as medium, and 15 - 20 as good. The Mean (SD) scores in each of the six domains for the three groups of women based on durations of ART and the overall domain score

with 95% Confidence Intervals for all the 114 women were calculated. Bivariate linear correlation between Quality of Life and each of the six domains in the three groups of women, as well as bivariate linear correlation between quality of health and each of the six domains in the three groups of women were also calculated.

All study data was transcribed in an Excel Database and analysed by SPSS (Version- 22). All measures were taken to preserve the confidentiality of the participants.

3. Results

A total of 114 women were included in this study, of whom 37 women have been on ART for less than five years (Group 1), 48 women have been on ART between 5 to 9.9 years (Group 2) and 29 women have been on ART for 10 years or more (Group 3). **Table 1(a)** summarises the demographic and clinical characteristics of the participants. Nine women were in the age group of 18 to 29 years, 57 women in the age group of 30 to 41 years and 48 women were 42 years or above. Fifty seven women (50%) were widows, 9 were divorced/separated, 2 were unmarried and the remaining 47 were currently married. Of the 47 married women, 31 husbands were also HIV-positive, and 16 husbands were HIV negative. With regard to education, 39 women had completed pre- university or college, 37 had completed high school, 25 had completed primary school and 13 had never been to school. Seventy three women (64%) were working in skilled or unskilled jobs and 40 women (35%) were housewives. Sixty nine women (60.5%) were in WHO clinical staging 3 or 4, 42 in Stage 2 and only 3 in stage 1 prior to starting ART. One hundred and one women (88.5%) had CD4 counts that were below 350cells/cu.mm and prior to starting ART.

Table 1 shows the mean scores obtained in each domain in relation to duration of ART. The maximum total score that can be obtained for each domain is 20. The quality of life of all the women studied in the three groups varies from 17.4 to 18.6 (87% to 93%) in five domains and 14.9 (74.5%) in the psychological domain. The domain scores for women on long-term ART (Group 3) are no different from the other 2 groups and none of the differences attain statistical significance as seen from the p-values.

The Quality of life and the Quality of health as measured in the three groups are compared in **Table 2**.

Table 2 shows 68.4% (78) of women had good quality of life, 23.7% (27) had medium quality of life, and 7.9% (9) had poor quality of life. Even in group 3, 69% of women who had been on ART for more than 10 years reported good quality of life, compared to 64.9% of women in group 1. With regard to Quality of Health 86.8% (99) of women reported good quality of health, 12.3% (14) reported medium Quality of Health and 0.9% (1) reported poor quality of health. Overall, the women in Group 3 fared equally well compared to the other two groups. The inter correlations between Quality of Life (G1) and each of other six domains are presented in **Table 3**.

Table 1. (a) Summary of the socio demographic and clinical characteristics of the women; (b) WHO QOL domain scores by durations of ART.

(a)

Variable	Group – 1 N-37	Group – 2 N-48	Group – 3 N-29	Total N-114
Age in years				
18 - 29	6	1	2	9
30 - 41	22	25	10	57
>42	9	22	17	48
Education				
Illiterate	5	5	3	13
Primary Education	8	11	6	25
High School Education	12	19	6	37
PUC & Above	12	13	14	39
Occupation				
Student	0	0	1	1
Skilled	17	21	11	49
Un Skilled	11	7	6	24
House Wife	9	20	11	40
Marital status				
Married	15	22	9	46
Un Married	0	0	2	2
Divorced	3	4	1	8
Widowed	19	21	17	57
Live in Relationship	0	1	0	1
WHO clinical staging				
Stage I	2	1	0	3
Stage II	17	20	5	42
Stage III	7	9	4	20
Stage IV	11	18	20	49
Weight in Kgs at baseline				
1 - 30	0	0	2	2
31 - 60	33	34	24	91
>60	4	14	3	21

Continued

CD4 cells/cu.mm at baseline									
<200	12	23	25	60					
201 - 350	16	22	3	41					
351 - 500	7	2	1	10					
>500	2	1	0	3					

(b)									
Group	3		2		1		p-value	All 114 women	
Number	29		48		37				
Duration of ART	≥10 years		5 - 9.99 years		1 - 4.99 years				
Domains	Mean	SD	Mean	SD	Mean	SD		Mean	95% CI
Physical	17.9	2.3	18.0	2.3	18.2	1.62	0.786	18.0	17.63 - 18.37
Psychological	14.5	2.0	14.8	2.1	15.3	1.66	0.300	14.9	14.55 - 15.25
Independent	18.2	1.8	18.9	1.2	18.6	1.64	0.172	18.6	18.33 - 18.87
Social Relationship	17.5	2.4	17.9	2.1	17.2	2.49	0.424	17.5	17.07 - 17.93
Environment	17.2	1.9	17.9	1.7	17.2	1.96	0.094	17.6	17.25 - 17.95
SRPB	17.1	2.9	17.5	2.6	17.5	2.27	0.781	17.4	16.93 - 17.87

Table 2. Quality of life and quality of health in the three groups.

Quality	Quality of Life							
Group	3		2		1		Total women	
Duration of ART	≥10 years		5 - 9.99 years		1 - 4.99 years			
Number	29		48		37		114	
	No.	%	No.	%	No.	%	No.	%
Poor	2	6.9	3	6.3	4	10.8	9	7.9
Medium	7	24.1	11	22.9	9	24.3	27	23.7
Good	20	69.0	34	70.8	24	64.9	78	68.4
Total	29	100.0	48	100	37	100.0	114	100.0

Quality	Quality of Health							
Group	3		2		1		Total women	
Duration of ART	≥10 years		5 - 9.99 years		1 - 4.99 years			
Number	29		48		37		114	
	No	%	No.	%	No.	%	No.	%
Poor	0	0.0	0	0.0	1	2.7	1	0.9
Medium	5	17.2	6	12.5	3	8.1	14	12.3
Good	24	82.8	42	87.5	33	89.2	99	86.8
Total	29	100.0	48	100.0	37	100.0	114	100.0

Table 3. Bivariate linear correlation between quality of Life and each of the six domains in the three groups of women.

Quality	Quality of Life (G1)					
	Group	3		2		1
Duration of ART	≥10 years		5 - 9.99 years		0.1 - 4.99 years	
Domains	r	sig	r	sig	r	sig
Physical	0.453	0.014*	0.589	<0.001**	0.266	0.111
Psychological	0.395	0.034*	0.552	<0.001**	0.536	0.001
Independent	0.381	0.041*	0.234	0.109	0.359	0.029*
Social Relationship	0.251	0.189	0.585	<0.001**	0.601	<0.001**
Environment	0.149	0.439	0.492	<0.001**	0.561	<0.001**
SRPB	0.488	0.007**	0.550	<0.001**	0.380	0.020*

(*p < 0.05, **p < 0.001).

Except for Social Relationship and Environment domain for women in Group 3, Independent domain for women in Group 2 and Physical domain for women in Group 1 **Table 3** shows significant correlations between quality of life and other domains (*p < 0.05, **p < 0.01).

The correlations show that the responses for each domain have been objective and not influenced by the questions in the other domains.

The bivariate linear correlation coefficients were also calculated between the Quality of Health (G 4) and each of the other six domains and displayed in **Table 4**.

Unlike for correlations with Quality of Life, the correlations with Quality of Health do not attain statistical significances especially in Group 3 women. Although associations do not necessarily imply causation, the reasons for low or no correlations need to be examined further. For women in Group 2 there was significant correlation in the physical, psychological and Spirituality, Religion and Personal Belief (SRPB) domains. For Group 1 women there was significant correlation in the physical, environmental and SRPB domains.

Analysis by marital status, especially among widowed, by educational status or age, revealed that these socioeconomic factors did not diminish the quality of life or health among women with longest duration of ART in all three groups and are well within normal.

Table 5 shows the mean CD4 (Cluster of Differentiation) counts at baseline in the three groups before starting ART and the current mean CD4 counts during the time of QOL assessment. The baseline and current body weights of the women are also shown.

Improvements are seen in all three groups both for body weight and CD4 counts. The paired t-test shows statistically high significance for the differences in all three groups. What stands out is the significantly higher levels of differences in Group 3 (Long term ART) compared to the other 2 groups (p < 0.001)

Table 4. Bivariate linear correlation between quality of Health and each of the six domains in the three groups of women.

Quality	Quality of Health (G4)					
	Group	3		2		1
Duration of ART	≥10 years		5 - 9.99 years		0.1 - 4.99 years	
Domains	r	sig	r	sig	r	sig
Physical	0.354	0.059	0.630	< 0.001**	0.360	0.029*
Psychological	0.235	0.219	0.446	0.001**	0.166	0.325
Independent	0.141	0.465	0.025	0.865	0.171	0.310
Social Relationship	-0.017	0.931	-0.007	0.962	0.313	0.059
Environment	0.124	0.523	0.153	0.300	0.408	0.012**
SRPB	0.147	0.448	0.417	0.003**	0.427	0.008**

(*p < 0.05, **p < 0.001).

Table 5. Changes in body weight and CD 4 Counts from baseline to current assessment in the three groups of women.

Group	3 (>10 years)		2 (5 - 9.9 years)		1 (0.1 - 4.9 years)	
Number	29		48		37	
Characteristic	Mean	SD	Mean	SD	Mean	SD
Weight (Base line)	46.2	12.08	54.9	13.04	49.4	9.54
Weight (Current)	56.9	10.89	57.9	11.64	53.9	10.70
Weight Difference	11.6	9.45	6.1	5.90	5.3	6.55
CD4 (Base line)	169.7	64.43	230.2	79.74	293.2	117.66
CD4 (Current)	847.9	326.01	765.8	247.60	622.9	225.95
CD4 Difference	697.5	325.20	551.3	267.34	370.5	202.04

both for weight and CD4 counts. However the Standard Deviation for the current CD4 values are significantly high compared to the baseline variability, which needs a closer look at possible reasons and specific factors. The current CD4 levels confirm the benefits of long-term ART and should contribute to the better quality of life.

4. Discussion

The WHO definition of QOL is a multidimensional concept which describes the women's perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their personal goals, expectations, standards and concerns [12]. The experience of QOL varies over time and in different life situations. While ART has prolonged life, they also pose a challenge for quality of life as they can cause significant side effects in addition to the

potential for drug toxicity and interaction as mentioned earlier particularly among women [1] [8]. Given the many complications, side effects and symptoms of HIV Infection [9] in addition to associated medical and psychiatric co-morbidities [15], there is a need to understand and assess how these interactions may affect health-related quality of life (HRQOL). Numerous instruments (some validated, others not) are available and have been applied to understanding how ART affects HRQOL in those with HIV infection, both in clinical trials and clinical practice [16]. Among the several tools available, the WHOQOL-BREF has stood the test of time as a simple, feasible, valid tool for use in low and middle income countries. However, the need for well-trained qualified interviewers cannot be underscored. In this research, experienced counselors built a good rapport with the clients and took adequate time to explain and elicit accurate information in a calm setting. The intercorrelations displayed in **Table 3** and **Table 4** confirm the objectivity and independence of responses with no “halo or horn” effects. In particular the low psychological score emphasizes the burden of stigma and negativity in the community despite high scores in physical and other domains. This was observed in other studies too [17] [18]. The high scores in all levels of women on long-term ART proclaims the advantages of continuing ART overcoming several social and economic challenges despite living in a resource-constrained country whereas in an Australian study socio economic factor is implied to be the cause for low adherence to ART [19].

Much research was done extensively in both developed and developing countries on factors associated with non-adherence to antiretroviral therapy among women [20] [21] [22] [23] [24] with limited focus on examining the relationship between adherence to ART regimen and health related quality of life. Over all our study showed that women across all three groups had a good quality of life and good quality of health and there was no statistical difference in any of the three groups. Women who are on ART for more than 10 years continue to have a good quality of life and good quality of health just like the other two groups. Our study showed that age, education, marital status, duration of ART does not have an impact on the quality of life. Almost a similar cross-sectional study was done in Zhejiang province, China [13], assessing the influences of demographic, laboratory and disease-related variables on QOL while on ART on 493 women using multiple linear regression models. The total score of QOL was 15.99 ± 1.99 and the scores in physiological, psychological, social relation, and environmental domains were 14.99 ± 2.25 , 14.25 ± 2.12 , 13.22 ± 2.37 , and 13.31 ± 1.99 respectively [13]. Our scores are higher indicating that our women from relatively poorer socioeconomic strata show better quality of health and life.

Despite high scores in most of the 6 domains of the assessment, the findings also show that the correlations of both quality of life and quality of health with social relations are quite low or nonexistent (**Table 3** and **Table 4**) especially for women on long-term ART (Group 3). This implies a strong link with HIV-related stigma and perhaps the need for such long adherence for an infectious disease [25]. Logie *et al.* examined pathways from HIV-related stigma to ART initiation,

current ART use, and ART adherence among women living with HIV in Canada [26]. They used baseline survey data from a national cohort of 1425 women living with HIV in Canada. Depression was the factor which mediated the pathways from personalized stigma to ART adherence, and negative self-image to current ART use and ART adherence. HIV-related stigma is associated with reduced likelihood of ART initiation and current ART use, and suboptimal ART adherence. To optimize the benefit of ART among women living with HIV, interventions should reduce HIV-related stigma and address depression. A study in South Africa [7] on 683 women reported that sustained ART adherence was associated with decreased alcohol use, decreased depressive symptoms, and decreased physical intimate partner violence. Katz *et al.* also found that HIV-related stigma compromised participants' abilities to successfully adhere to ART. Interventions to reduce stigma should target multiple levels of influence (intrapersonal, interpersonal and structural) in order to have maximum effectiveness on improving ART adherence [27].

The facet G4-quality of health was good in 86.85% (99 women), medium in 12.28% and poor in only one woman and she had been on ART for less than five years. The one woman who mentioned poor quality of health was 36 years old and started on ART one and half years prior to her assessment. Her CD4 count was low at the outset and she had multiple opportunistic infections of pneumocystis pneumonia, oral candidiasis, tuberculosis of the lungs, cerebral toxoplasmosis with focal neurological deficit, and a routine Pap smear showed carcinoma in situ of the cervix, and she had to undergo a total hysterectomy. All this contributed to her poor quality of health at that point but now she is well and employed too. The success of current HIV treatment programs depends not only on access to ART, but also on retention in care and good treatment adherence. Previous studies in Cameroon [5], however showed poor adherence, treatment interruption, and loss to follow-up among HIV-positive subjects on ART, but the factors that influence ART adherence are not well known. In the Cameroon study, patient/self-reported questionnaires and pharmacy medication refill data were used to quantify ART adherence and determine the factors associated with increased risk of non-adherence among HIV-infected Cameroonians.

A major limitation of our study could be that there was no control group of matched women who were not on ART who were also assessed by the same tool, and compared. But this seemed not only difficult but unethical as we did our best to persuade all women to start and adhere to ART. A second limitation could be that we did not design a cohort study to follow up women on ART to determine dropout rates and possible changes in quality of life. Although desirable, we were limited by our resources for taking up such studies. Despite these limitations, the findings from a cross-sectional study are still valid and useful to advocate lifelong adherence to ART. Whether longer duration of ART automatically enhances the quality of life is not proven but certainly the CD4 counts speak for a better control of the disease and therefore better health. A study on barriers to ART adherence in Sub-Saharan countries found that confidentiality

issues and a general lack of privacy had a significant influence on their ART adherence [2].

At our organization, all eligible women are evaluated on their social and financial situation based on a validated socio-economic status questionnaire and offered ART free of cost or at subsidized rates. Women undergo at least three sessions of ART adherence counseling stressing on importance of adherence, timing of medication, on what side effects to expect, diet and nutrition and how to remind themselves to take the medication etc. The woman is encouraged to bring a buddy who encourages, supervises and reminds her to take her ART on time. After completing the first two weeks of ART she is counseled again to find out if she has any adherence issues. She is regularly followed up at the medical clinic and specific dates are given for the next visit. If she misses the date she is counseled again. Counseling is also provided on an ongoing basis. She is encouraged to be part of Self Help Groups (SHGs) and interacts with other women like her so that she knows that she is not alone. Seeing other women doing well on ART long-term, she is also motivated to continue ART. Along the way a strong rapport is built between the patient and the healthcare team. But in the ultimate analysis the evidence and knowledge that it is the adherence to ART that keeps them healthy and well and helps them lead a normal life is the strongest motivating factor. This study also shows that in a low resource setting, providing a structured ART program, with close adherence monitoring, and frequent counseling and strong community support, optimal long-term adherence with successful treatment outcomes could be achieved [28].

5. Conclusion

Despite aging, marital life disruptions, socio-cultural restrictions, stigma, time from HIV diagnosis, and other disadvantages suffered by women in low-resource settings, this study has shown that HIV-positive women who continue adherence to ART faithfully and consistently for a long time enjoy a good quality of health and life in all domains. Adequate preparation, evaluation, adherence counseling, and a supportive health system are essential for ensuring long-term ART, but the attitudes and commitment of women are critical. More active counselling and education may be needed to fully overcome HIV-related stigma and further research in this area is necessary.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Rai, S., Mahapatra, B., Sircar, S., Raj, P.Y., Venkatesh, S., *et al.* (2013) Adherence to Antiretroviral Therapy and Its Effect on Survival of HIV-Infected Individuals in Jharkhand, India. *PLoS ONE*, **8**, Article ID: e66860. <https://doi.org/10.1371/journal.pone.0066860>
- [2] Becker N, Cordeiro LS, Poudel KC, Sibiya TE, Sayer AG, Sibeko LN (2020) Individual, Household, and Community Level Barriers to ART Adherence among Women in Rural Eswatini. *PLoS ONE*, **15**, Article ID: e0231952. <https://doi.org/10.1371/journal.pone.0231952>
- [3] Colvin, C.J., Konopka, S., Chalker, J.C., Jonas, E., Albertini, J., *et al.* (2014) A Systematic Review of Health System Barriers and Enablers for Antiretroviral Therapy (ART) for HIV-Infected Pregnant and Postpartum Women. *PLoS ONE*, **9**, Article ID: e108150. <https://doi.org/10.1371/journal.pone.0108150>
- [4] Mhaskar, R., Alandikar, V., Emmanuel, P., Djulbegovic, B., Patel, S., Patel, A., *et al.* (2013) Adherence to Antiretroviral Therapy in India: A Systematic Review and Meta-Analysis. *Indian Journal of Community Medicine*, **38**, 74-82. <https://doi.org/10.4103/0970-0218.112435>
- [5] Fonsah, J.Y., Njamnshi, A.K., Kouanfack, C., Qiu, F., Njamnshi, D.M., Tagny, C.T., *et al.* (2017) Adherence to Antiretroviral Therapy (ART) in Yaounde'-Cameroon: Association with Opportunistic Infections, Depression, ART Regimen and Side Effects. *PLoS ONE*, **12**, Article ID: e0170893. <https://doi.org/10.1371/journal.pone.0170893>
- [6] Kumarasamy, N., Safren, S.A., Raminani, S.R., Pickard, R., James, R., Sri Krishnan, A.K., *et al.* (2005) Barriers and facilitators to Antiretroviral Medication Adherence among Patients with HIV in Chennai, India: A Qualitative Study. *AIDS Patient Care STDS*, **19**, 526-537. <https://doi.org/10.1089/apc.2005.19.526>
- [7] Ramlagan, S., Rodriguez, V.J., Peltzer, K., Ruiter, R.A.C., Jones, D.L. and Sifunda, S. (2019) Self-Reported Long-Term Antiretroviral Adherence: A Longitudinal Study among HIV Infected Pregnant Women in Mpumalanga, South Africa. *AIDS and Behavior*, **23**, 2576-2587. <https://doi.org/10.1007/s10461-019-02563-z>
- [8] Rather, Z.A., Chowta, M.N., Prakash Raju, G.J.K. and Mubeen, F. (2013) Evaluation of the Adverse Reactions of Antiretroviral Drug Regimens in a Tertiary Care Hospital. *Indian Journal of Pharmacology*, **45**, 145-148. <https://doi.org/10.4103/0253-7613.108294>
- [9] Brown, T.T. and Qaqish, R.B. (2006) Antiretroviral Therapy and the Prevalence of Osteopenia and Osteoporosis: A Meta-Analytic Review. *AIDS*, **20**, 2165-2174. <https://doi.org/10.1097/QAD.0b013e32801022eb>
- [10] Eileen, P. (2018) Scully-Sex Differences in HIV Infection. *Current HIV/AIDS Reports*, **15**, 136-146. <https://doi.org/10.1007/s11904-018-0383-2>
- [11] Das, A., Detels, R., Afifi, A.A., Javanbakht, M., Sorvillo, F.J. and Panada, S (2017) Health-Related Quality of Life (HRQoL) and Its Correlates among Community-Recruited Children Living with HIV and Uninfected Children Born to HIV-Infected Parents in West Bengal, India. *Quality of Life Research*, **26**, 2171-2180. <https://doi.org/10.1007/s11136-017-1557-x>
- [12] World Health Organization (2004) The World Health Organization Quality of Life (WHOQOL)-BREF®.
- [13] Ma, L., Xu, P., Lin, H., Ju, L. and Lyu, F. (2015) Quality of Life of People Living with HIV/AIDS: A Cross-Sectional Study in Zhejiang Province, China. *PLOS ONE*, **10**, Article ID: e0135705. <https://doi.org/10.1371/journal.pone.0135705>

- [14] Wig, N., Lekshmi, R., Pal, H., Ahuja, V., Mittal, C.M. and Agarwal, S.K. (2006) The Impact of HIV/AIDS on the Quality of Life: A Cross Sectional Study in North India. *Indian Journal of Medical Sciences*, **60**, 3-12.
- [15] Nyamathi, A., Ekstrand, M., Heylen, E., Ramakrishna, P., Yadav, K., Sinha, S., *et al.* (2018) Relationships among Adherence and Physical and Mental Health among Women Living with HIV in Rural India. *AIDS and Behavior*, **22**, 867-876. <https://doi.org/10.1007/s10461-016-1631-3>
- [16] Gakhar, H., Kamali, A. and Holodniy, M. (2013) Health-Related Quality of Life Assessment after Antiretroviral Therapy: A Review of the Literature. *Drugs*, **73**, 651-6728. <https://doi.org/10.1007/s40265-013-0040-4>
- [17] Buregyeya, E., Naigino, R., Mukose, A., Makumbi, F., Esiru, G., Arinaitwe, J., Musinguzi, J., Rhoda, K., Buregyeya, W., *et al.* (2017) Facilitators and Barriers to Uptake and Adherence to Lifelong Antiretroviral Therapy among HIV Infected Pregnant Women in Uganda: A Qualitative Study. *BMC Pregnancy and Childbirth*, **17**, Article No. 94. <https://doi.org/10.1186/s12884-017-1276-x>
- [18] Martin, F., Russell, S. and Seeley, J. (2014) Higher Quality of Life and Lower Depression for People on ART in Uganda as Compared to a Community Control Group. *PLoS ONE*, **9**, Article ID: e105154. <https://doi.org/10.1371/journal.pone.0105154>
- [19] Siefried, K.J., Mao, L., Kerr, S., Cysique, L.A., Gates, T.M., McAllister, J., *et al.* (2017) Socioeconomic Factors Explain Suboptimal Adherence to Antiretroviral Therapy among HIV Infected Australian Adults with Viral Suppression. *PLoS ONE*, **12**, Article ID: e0174613. <https://doi.org/10.1371/journal.pone.0174613>
- [20] Patel, S.V., Patel, S.N., Baxi, R.K., Golin, C.E., Mehta, M., Shringarpure, K., *et al.* (2012) HIV Serostatus Disclosure: Experiences and Perceptions of People Living with HIV/AIDS and Their Service Providers in Gujarat, India. *Industrial Psychiatry Journal*, **21**, 130-136. <https://doi.org/10.4103/0972-6748.119615>
- [21] Sarna, A., Sebastian, M., Bachani, D., Sogarwal, R. and Battala, M. (2014) Pretreatment Loss-to-Follow-up after HIV Diagnosis from 27 Counseling and Testing Centers across India: Findings from a Cohort Study. *Journal of the International Association of Providers of AIDS Care*, **13**, 223-231. <https://doi.org/10.1177/1545109712469686>
- [22] Ekstrand, M.L., Ramakrishna, J., Bharat, S. and Heylen, E. (2013) Prevalence and Drivers of HIV Stigma among Health Providers in Urban India: Implications for Interventions. *Journal of the International AIDS Society*, **16**, Article ID: 18717. <https://doi.org/10.7448/IAS.16.3.18717>
- [23] Venkatesh, K.K., Srikrishnan, A.K., Mayer, K.H., Kumarasamy, N., Raminani, S., Thamburaj, E., *et al.* (2010) Predictors of Nonadherence to Highly Active Antiretroviral Therapy among HIV-Infected South Indians in Clinical Care: Implications for Developing Adherence Interventions in Resource-Limited Settings. *AIDS Patient Care STDS*, **24**, 795-803. <https://doi.org/10.1089/apc.2010.0153>
- [24] Wasti, S.P., Simkhada, P., Randall, J., Freeman, J.V. and van Teijlingen, E. (2012) Barriers to and Facilitators of Antiretroviral Therapy Adherence in Nepal: A Qualitative Study. *Journal of Health, Population and Nutrition*, **30**, 410-419. <https://doi.org/10.3329/jhpn.v30i4.13294>
- [25] Figuero, L.S.B., Luque, P.B., Martín, T.P., Sagrado, M.G. and Bouza, J.M.E. (2011) Assessment of Factors Influencing Health-Related Quality of Life in HIV-Infected Patients. *HIV Medicine*, **12**, 22-30. <https://doi.org/10.1111/j.1468-1293.2010.00844.x>

- [26] Logie, C.H., Lacombe-Duncan, A., Wang, Y., Kaida, A., Conway, T., Webster, K., de Pokomandy, A. and Loutfy, M.R. (2018) Pathways From HIV-Related Stigma to Antiretroviral Therapy Measures in the HIV Care Cascade for Women Living With HIV in Canada. *Journal of Acquired Immune Deficiency Syndromes*, **77**, 144-153. <https://doi.org/10.1097/QAI.0000000000001589>
- [27] Katz, I.T., Annemarie, E., Ryu, A.E., Onuegbu, A.G., Psaros, C. and Weiser, S.D. (2013) Impact of HIV-Related Stigma on Treatment Adherence: Systematic Review and Meta-Synthesis. *Journal of the International AIDS Society*, **16**, Article ID: 18640. <https://doi.org/10.7448/IAS.16.3.18640>
- [28] Moosa, A., Gengiah, T.N., Lewis, L., *et al.* (2019) Long-Term Adherence to Antiretroviral Therapy in a South African Adult Patient Cohort: A Retrospective Study. *BMC Infectious Diseases*, **19**, Article No. 775. <https://doi.org/10.1186/s12879-019-4410-8>