Quality of Life Research (2006) 15:1597–1605
DOI 10.1007/s11136-006-9001-7

Quality of life in HIV subtype C infection among asymptomatic subjects and its association with CD4 counts and viral loads – a study from South India

Prabha S. Chandra[1], Charu Gandhi[1], P. Satishchandra[2], Anupa Kamat[3], Anita Desai[3], V. Ravi[3], Raymond L. Ownby[5], D.K. Subbakrishna[4] & Mahendra Kumar[5]
[1]*Department of Psychiatry, National Institute of Mental Health and Neuro Sciences, Bangalore, India;* [2]*Department of Neurology, National Institute of Mental Health and Neuro Sciences, Bangalore, India;* [3]*Department of Neurovirology, National Institute of Mental Health and Neuro Sciences, Bangalore, India;* [4]*Department of Bio-statistics, National Institute of Mental Health and Neuro Sciences, Bangalore, India;* [5]*Department of Psychiatry and Behavioral Sciences, University of Miami School of Medicine, Miami, Florida, USA*

Accepted in revised form 12 July 2006

Abstract

Objective: To study the association between quality of life (QOL) domains and biological markers of disease progression of HIV infection, i.e. viral load (VL) and CD4 counts among asymptomatic subjects with HIV subtype C infection in South India. *Design*: Quality of life was measured using the locally validated version of the WHOQOL HIV-BREF. The subjects were neurologically asymptomatic, non psychiatrically ill HIV infected men and women participating in a cohort study. *Results*: The results indicated mixed findings, with some QOL dimensions being associated with high VLs and low CD4 counts while several others did not show any associations. Significant associations were seen between low CD4 counts and the psychological and social relationships domain, with lower mean scores in these domains being reported by subjects having CD4 counts < 200 /mm. However, there were no significant differences between the CD4 subgroups for the domains related to physical health, level of independence, environment, and spirituality domains. Significant lower mean QOL scores were found in the highest VL subgroup compared to other groups for the following WHOQOL HIV-BREF domains: physical, psychological, level of independence, and environmental. *Conclusions*: In this sample of HAART naïve asymptomatic HIV infected subjects, some QOL dimensions were associated with the biological markers of disease progression i.e. VL and CD4 counts, while several were not. The associations were significant only in the high VL and low CD4 groups.

Key words: CD 4 Counts, HIV, India, Quality of Life, Viral load

Introduction

Studies of both generic and disease-specific quality of life (QOL) measures in HIV infected populations have revealed consistently that QOL appears to be associated with treatment [1, 2], physical symptoms [3–6], adverse event occurrences and markers of disease severity [4–6]. In countries such as India, QOL studies assume even greater relevance due to several reasons. Firstly, majority of HIV infected persons attend medical services only if they manifest health problems and little is known about asymptomatic subjects. Secondly, with the shifting paradigm of HIV/AIDS treatment and early detection,

many subjects are living longer and healthier lives with fewer physical symptoms. While in HIV infected persons with symptoms, physical health impacts QOL, in those early in the course of disease, social and psychological factors such as stigma, sexuality and disclosure might be factors that influence it. Finally, the presence of predominantly HIV subtype C infection in India precludes us from extrapolating QOL and immunological findings from western data to Indian subjects [7].

The last few years have witnessed an increasing use of biological markers of disease progression in AIDS research. The most powerful and widely used markers in HIV disease are plasma HIV VL (VL) and CD4 cell count, which serve as proxy measures for indications of disease progression [8–11]. Since disease progression and the health states that result are related to QOL, it is logical to suppose that VL and CD4 counts are closely associated with QOL. Nevertheless, the body of evidence supporting this link between QOL and biological markers is limited, especially among non-western and heterosexual populations. Among the biological markers, CD4 counts have been found to be better indicators of disease progression compared to VL [12], however their relationship with QOL has been addressed only by a few studies and results vary. Call et al. [13] in a direct analysis of this relationship, found an association between lower VL, higher CD4 counts, and higher QOL scores in a cohort of HIV-infected patients, but included only patients receiving HAART. Lamping [14] administered the SF-36 to 81 patients with HIV and found significant correlations of CD4 lymphocyte scores with the physical functioning and social functioning scales. Gill et al. [15] examined the relationship between health related quality of life (HRQOL) domains of physical functioning, role function, energy levels and health perceptions and found lower scores in three domains in the CD4 < 200 group. VL however, had an association only with physical functioning. In a prospective study on the same subject, Bing et al. [16] found that initial changes in viral burden predicted HRQOL better than initial changes in CD4 counts, however, long term change in CD4 count was a better predictor of HRQOL than long term change in viral burden. They proposed that the surrogate markers may have different relevance for QOL at different stages of disease and with different therapeutic regimens.

QOL research among HIV infected subjects in the Indian setting, is limited to a few studies [17–20]. Wig et al. [17] using the WHOQOL BREF-generic version found that psychological and physical QOL were poorest among those with most advanced disease. Two studies, which used a modified version of the MOS-QOL instrument, reported poorer emotional QOL among women compared to men. The study also reported lower scores on four QOL domains i.e. physical health, daily activities, social functioning and appetite in persons with CD4 counts < 199 [18, 19]. No differences were however found between different CD4 groups in cognitive functions, emotions, pain, sleep and sexual functioning. There is currently a need for more studies on QOL in India and its relationship to biological markers. This is particularly so among asymptomatic subjects with HIV infection who lead relatively stable lives and experience the illness in a different way compared to those with symptoms. In this paper, we present data from an exploratory study which examines the association of QOL with two markers of disease progression i.e. VL and CD4, using the WHOQOL HIV BREF scale as the measure of QOL, in an Indian cohort of HIV infected subjects who are free of physical symptoms and have no mental health problems.

Methodology

Study subjects

The study sample is part of an ongoing longitudinal study – HIV 1 and 2: Co infection and neurological progression, funded by NIH, USA and being conducted at National Institute of Mental Health and Neurosciences, (NIMHANS), Bangalore, India. The sample consisted of 82 HIV positive individuals, recruited after initial screening at a peripheral outpatient clinic for HIV positive people, and an HIV outpatient weekly clinic at NIMHANS, Bangalore. The subjects were recruited between October 2003 and December 2004, and are being followed up at 6 monthly intervals. Informed consent was obtained from all participants and the study had clearance from the Institutional Review Board at NIMHANS and from the University of Miami (Florida, USA) Human Subjects Research Office.

Seropositive subjects who were neurologically and psychiatrically asymptomatic, and were between 18 and 45 years of age were eligible for recruitment in the study. Those with a history of CNS infection, substance or alcohol abuse, subjects with clinical symptoms of depression or anxiety were also excluded from the study. Those on psychiatric medication were also excluded from recruitment. The primary study was a longitudinal study of neurocognitive and neurological progression of subjects with HIV 1 and HIV 2 infections. The need for neuropsychological assessments precluded any person with syndromal depression or significant psychiatric problems from being included in the study, as these would interfere with neurocognitive assessments.

Subjects whose HIV infection had been detected and who had undergone post test counseling and were informed about their status at least 6 months prior to recruitment were selected, to avoid the possible acute psychological effects of disclosure.

Data collection

At the baseline assessment after recruitment, all the subjects received a comprehensive general systemic, neurological, and psychiatric examination. The data collected included sociodemographic information (age, gender, residence, education, occupation, SE status, background, HIV risk factors), medication history, and systemic opportunistic infection history. The subjects also provided specimens for HIV-1 and 2 serological and immunological testing. CD4 cell counts and VLs (real time PCR) were assessed using standard laboratory procedures. QOL of the subjects was assessed using the WHOQOL HIV BREF scale and all interviews including QOL measures were conducted face-to-face by trained interviewers. Clinical charts and baseline data were reviewed and verified by the interviewers.

Measures

QOL

Quality of life was evaluated with the 31 item WHOQOL HIV BREF [19, 20] This is an HIV specific QOL measure that is based on the WHOQOL BREF and is the shorter form of WHOQOL HIV.

The WHOQOL-HIV BREF produces six domain scores, which denote an individual's subjective perception of QOL in the following domains-physical, psychological, level of independence, social relationships, environment, and spirituality. Individual items are rated on a 5-point Likert scale where one indicates low, negative perceptions and five indicates high, positive perceptions. There is one item to present each facet, and two items that examine general QOL. Domain scores are scaled in a positive direction where higher scores denote higher QOL. Items are organised by response scale (capacity, frequency, intensity or satisfaction). The mean score of items within each domain is used to calculate the domain score. Mean scores are then multiplied by 4, so that the scores range between 4 and 20.

The local language versions (Kannada, and Hindi) of WHO QOL HIV BREF have been used and validated in the Indian HIV/AIDS population [21, 22]. The local version was developed in Bangalore using a detailed research design as part of a WHO multicentric initiative in several countries to develop a cross cultural tool for measuring QOL in HIV. In brief, based on international consultations and focus group methods at each center, 115 items specific for HIV were added to the WHOQOL 100. This instrument was then translated into Kannada (the local language in Bangalore) and piloted among 150 HIV infected subjects at various stages of the disease. Corrected item to total correlations were carried out for each individual center to examine the content reliability of the facets. These were then subjected to item analysis and field testing and the Kannada versions of WHOQOL HIV and WHOQOL HIV BREF (brief version) were developed. The first author of this paper was the principal investigator of the project on WHOQOL HIV Kannada version. Details of methodology are available in two papers on this topic [21, 22].

Disease states based on CD4 and viral load

Disease states were classified by VL and CD4 cell counts, based on clinically meaningful cut-off points. Viral load subgroups were as follows: $\leq 20{,}000$,

20,001–100,000, 100,001–1,000,000, ≥1,000,000 copies/ml RNA, while CD4 cells counts were stratified into three groups: <200, 201–500, >500 cells/mm^3.

These cut points were used based on a consensus that these viral load levels and CD4 counts indicate differing degrees of progression and immunological states respectively and are often used by clinicians to guide initiation and changes in therapy.

Psychiatric assessment

Subjects with depression, anxiety or substance use disorder were excluded from the study, following detailed psychiatric assessment. The reasons for this have been mentioned earlier. The psychiatric assessment used for screening of each subject included a clinical mental status examination and rating of the psychiatric screening questionnaire derived from SCAN [23]. In addition, to assess presence and severity of depressive and anxiety symptoms in detail, Beck's depression Inventory (BDI) [24], Hospital Anxiety and Depression scale (HADS) [25], and the State-trait anxiety inventory (STAI) [26] were administered to each subject. AUDIT [27] was used to screen for alcohol abuse/dependence. Standard cut-off levels for scoring of BDI and HADS were used for diagnosis of Depressive and Anxiety disorders. All persons who scored above cut-off values for any of the psychiatric assessments were excluded from the study.

Analysis

The WHOQOL HIV BREF was scored using an SPSS syntax file provided by the WHO, which automatically checks, recodes data, and computes domain scores. Missing items were managed as recommended in the instructions. Descriptive statistics included percentages, mean or median values, standard deviations and ranges for sociodemographic characteristics, clinical characteristics, and QOL scores. Differences in QOL domain scores between subgroups of disease states were assessed by Analysis of Variance (ANOVA). *Post hoc* analysis was done to assess significant group differences in QOL domains associated with the two biological markers i.e. VL and CD4 groups. All statistical analysis were done using SPSS version 10.0.

Results

Sample characteristics

A total of 828 patients were screened for eligibility for cohort enrolment. These potential patients were identified through screening of all patients attending outpatient services at a peripheral community clinic for HIV patients, as well as weekly HIV outpatients clinic at NIMHANS, Bangalore. About 128 patients were enrolled into the study. Of the remaining 695 patients, 300 were ineligible by criteria and 395 refused enrolment. The final sample size was 128 subjects. At the time of this analysis, CD4 counts and VL were available for 82 of the 128 subjects.

The sample selected was predominantly from a community clinic and an outpatient of a large urban hospital. Subjects were self referred to these clinics and belonged to urban Bangalore, semi-urban and surrounding rural areas. Based on the sociodemographic details given below, especially income status, literacy and gender, it appears that they are representative of HIV infected subjects in urban areas of South India.

Sociodemographic characteristics of the 82 subjects are presented in Table 1. The mean age of the study sample at time of enrolment was 30.7 years (range: 20–44 years; SD: 5.7 years). The majority of patients were South-Indian (96%), Hindu (80.1%), female (51.8%), residents of urban or suburban areas (74%), and 58.5% belonged to lower socioeconomic status. A majority of subjects (81.7%) identified heterosexual intercourse as the probable route of infection. 51% were living in a nuclear family set-up, and 27% had received no education or less than primary school education. 57% subjects were married, 11% were single, while 32% were widowed/divorced or separated. The mean duration of known HIV seropositivity was 2.7 years (range 0.5–10 years; SD: 1.9).

Physical symptoms: Eight subjects (10%) reported minor physical symptoms, which included non-specific symptoms such as occasional pain, vaginal discharge and breathlessness. Two subjects of the eight had been treated for tuberculosis and were currently symptom free. 72 subjects did not report any physical problems and had no diagnosable opportunistic infection or HIV related or unrelated medical condition.

Table 1. Demographic characteristics

Age (years, mean)	30.74 years (range: 20–44; SD: 5.75)
Gender	
Male	39 (47.6%)
Female	43 (52.4%)
Locality	
Urban	24 (29.3%)
Rural	21 (25.6%)
Suburban	37 (45.1)
Religion	
Hindu	72 (87.8%)
Muslim	4 (4.9%)
Christians	6 (7.3%)
Background	
South Indian	79 (96.3%)
North Indian	3 (3.7%)
Education	
Primary or less	22 (26.8%)
Upto university	51 (62.2%)
University and higher	9 (11%)
Family type	
Nuclear	42 (51.2%)
Joint	24 (29.3%)
Extended/others	16 (19.5%)
Marital status	
Married	47 (57.3%)
Single	9 (11%)
Div/wid/sep	26 (31.7%)
SE status	
Lower (income <2000 /m)	48 (58.5%)
Middle (inc 2000–7000 /m)	17 (20.7%)
Upper (inc >7000 /m)	17 (20.7%)
Duration HIV-positive (years, mean)	2.70 years (range 0.5–10, SD 1.99)
Route of infection	
Heterosexual intercourse	67 (81.7%)
Blood products	2 (2.4%)
Others	13 (15.9%)

Clinical characteristics and QOL measures

Table 2 gives the clinical characteristics and QOL measures of the subjects. As noted in the table, all patients were naïve to antiretroviral therapy at enrolment. Further, as a function of the exclusion criteria used, none of them had major physical symptoms or could be given a syndromal psychiatric diagnosis.

About 19 subjects (23%) had CD4 counts lower than 200 /mm^3, while 13 subjects (16%) had more than 1,000,000 copies of HIV RNA. The mean QOL domain scores for the study sample were highest in the environmental domain and poorest in the spiritual domain.

QOL measures and disease state

CD4 cell count

Table 3 shows the analysis of relationship between mean QOL domain scores and each of the CD4 counts subgroups. Significant differences between CD4 count subgroups were observed for the psychological domain ($p = 0.014$), and Social relationships domain ($p = 0.021$). Lower mean scores in the psychological domain were reported by subjects having CD4 counts <200 compared to the other two groups, while lower scores on the social relationship domain were found in the lowest CD4 group compared only with those with CD4 counts >500. There were no significant differences between the CD4 subgroups for the domains related to physical health, level of independence, environment, and spirituality.

Viral load

Table 4 shows the association between mean QOL domain scores and each of the VL subgroups. Significant differences between VL subgroups were observed for the following WHOQOL HIV-BREF domains: Physical, ($p = 0.041$), Psychological, ($p = 0.000$), Level of independence, ($p = 0.010$), and Environment, ($p = 0.001$). Significantly lower mean scores in the above domains were found in the highest VL subgroup compared to other groups. However, the association was not linear and there did not appear to be much difference in QOL scores between other groups of VL. Notably, there were no significant differences between the VL subgroups for the social relationships and spiritual domains.

Discussion

The current goals of therapy for HIV-infected individuals focus on the traditional outcomes of increased life expectancy and reduction in occurrence of opportunistic infections and disease specific mortality rates. However, as we shift towards a new paradigm in the treatment of HIV-infection,

Table 2. Clinical characteristics and QOL measures

Clinical characteristic	No. of subjects
Receiving ART	0
CD4 counts: cells/mm^3 (n %)	
> 500	16 (19.5%)
200–500	47 (57.3%)
< 200	19 (23.2%)
Median CD4 cell count (cells/mm^3)	323 (37–996)
Viral load: HIV RNA copies/ml (n %)	
> 1,000,000	13 (15.9%)
100,001–1,000,000	39 (47.6%)
20,000–100,000	18 (22%)
< 20,000	12 (14.6%)
Median Viral load (HIV RNA copies/ml)	226,712 (3,613–1,550,000)
No. of patients with syndromal psychiatric diagnosis	0
No. of patients with neurological diagnosis	0
QOL domain (mean, SD)	
Physical	14.23 (2.78)
Psychological	13.74 (2.19)
Level of independence	14.74 (2.54)
Social relationships	14.04 (1.85)
Environmental	15.17 (1.53)
Spiritual	12.53 (3.09)

focusing on the long-term management of a chronic illness, emphasis must be placed on patient based outcomes. This study assessed the relationship between traditional objective markers of disease state (CD4 counts and HIV VL) and QOL, a subjective patient-focused measure. While prior studies have examined the relationship of other clinical parameters of HIV disease and QOL, only few studies have examined the association of QOL with direct measures of viral and immunological activity i.e. CD4 counts and VL, specially among those subjects who are asymptomatic [9, 10, 12, 18, 29].

In this sample of HIV-positive subjects, the results demonstrated an association of certain QOL domains with the two biological markers, only among those with most advanced disease i.e. in the highest VL and lowest CD4 count groups. The following QOL domains – physical, psychological, level of independence and environment, were poorest among subjects with ≥1,000,000 copies/ml RNA i.e. the highest VLs, while low CD4 counts <200 were associated with low psychological and social QOL. The latter association between low CD4 counts and psychosocial domains of QOL has been documented earlier [9, 10, 12, 18].

Quality of life domains in our sample were associated with viral load only in subjects with advanced disease and not among those with lower VLs. Similar findings have been reported by Call et al. [12] in their cohort. They explained the inconsistent relationship between higher VLs and HRQOL (except in most advanced disease) as an effect of treatment for more symptomatic states at higher VL levels. In our sample, this may not be an explanation as only two subjects were receiving any medical treatment. The association may be related to some reports that CD4 counts are a better predictor of disease progression compared to VLs [12, 30] and that CD4 and VL may have differential impact on progression and HRQOL at different stages of disease [16]. Some studies have found that QOL changes are less sensitive to immunological and virological changes compared to responsiveness to symptom changes in symptomatic subjects [31], while others report an association between improvements in CD4 counts and both the mental and physical components of QOL [32]. It appears from the above findings, that the relationship between biological markers is not yet clear and may vary with the stage of disease and symptom profile.

While poorer QOL in most domains was associated with the group with most advanced disease (based on biological markers), spiritual QOL did not appear to be related to either VL or CD4 counts. This might be related to inadequate measurement of the spiritual domain in the WHOQOL BREF. We recommend that more studies are needed to study this important aspect of QOL, using specific tools, such as the longer version of the WHOQOL HIV (which has more items on spirituality).

Recently published studies assessing the relationship between CD4 counts, VL and various QOL domains have presented varying results [12, 18, 26, 27]. Some studies have found robust relationship between biological markers and mainly the physical functioning HRQOL subscales while only a few studies have found an association between biological markers and

Table 3. QOL domain score and CD4 counts

Domains	CD4 counts 0–200 (n = 19) (I)	CD4 counts 201–500 (n = 47) (II)	CD4 counts >500 (n = 16) (III)	Level of significance ($p \leq 0.05$)	F value (df 2,79)
Physical	13.26 (2.78)	14.46 (2.66)	14.68 (3.04)	0.218	1.553
Psychological	12.50 (2.62)[a]	14.00 (1.94)	14.45 (1.88)	0.014	4.543
Level of independence	13.57 (2.89)	15.06 (2.29)	15.18 (2.56)	0.073	2.710
Social relationships	13.10 (1.76)[b]	14.19 (1.87)	14.75 (1.52)	0.021	4.003
Environment	14.78 (1.47)	15.28 (1.65)	15.31 (1.20)	0.458	0.788
Spirituality	11.57 (3.68)	12.55 (2.96)	13.62 (2.44)	0.149	1.948

[a]Group 1 significantly different from Group II and III.
[b]Group 1 significantly different from Group III.

Table 4. QOL domain score and viral load

Domains	VL 1 <20,000 (n = 12)	VL 2 20,000–100,000 (n = 18)	VL 3 100,001 = 1,000,000 (n = 39)	VL 4 >10,00,000 (n = 13)	Level of significance ($p \leq 0.05$)	F value (df 3,78)
Physical	14.75 (3.44)	14.44 (2.22)	14.64 (2.66)	12.23 (2.61)[a]	0.041	2.877
Psychological	13.93 (2.11)	13.68 (1.54)	14.46 (1.85)	11.50 (2.66)[b]	0.000	7.265
Level of independence	15.08 (3.11)	15.22 (1.83)	15.12 (2.14)	12.61 (3.12)[c]	0.010	4.005
Social relationships	14.33 (1.66)	13.88 (2.08)	14.33 (1.64)	13.15 (2.15)	0.225	1.484
Environment	15.20 (1.60)	15.61 (1.40)	15.47 (1.15)	13.65 (1.86)[b]	0.001	6.283
Spirituality	12.83 (2.51)	13.00 (2.91)	12.89 (2.96)	10.53 (2.71)	0.088	2.259

VL: viral load values in RNA copies per ml of plasma.
[a]Group 4 significantly different from group 3.
[b]Group 4 significantly different from groups 1, 2 & 3.
[c]Group 4 significantly different from groups 2 & 3.

psychosocial QOL dimensions [18, 19, 28, 29]. A recent study found no statistically significant association between CD4 counts and any summary or subscale scores of the two QOL measures, the MOS-HIV and the MQOL-HIV [28].

One reason why our study found an association between some psychosocial dimensions of QOL and biological markers of disease progression, might be related to the nature of the sample and the measure of QOL. The subjects in this sample had fewer physical symptoms compared to other studies and had not been started on HAART. The latter has been reported as one of the common reasons for poor QOL among subjects with advanced HIV infection. The fact that most subjects did not have significant symptoms, automatically makes other areas of QOL such as the psychosocial domains more important. That these have a strong association with biological markers is however, the most interesting finding. Secondly, the WHOQOL HIV BREF measures five domains of QOL measuring distinct QOL areas as in HIV opposed to the MOS-SF36 used in the above studies [12, 18], which has two subscales (the PCS and the MCS) and is generic in nature. More detailed assessments of multidimensional QOL specific to HIV might bring out more associations.

The strengths of our study include our use of a locally developed HIV specific tool the WHOQOL HIV BREF for measuring QOL. However, there might be merit in using the longer version of the WHOQOL HIV which may increase the sensitivity of measuring certain QOL associated factors (especially the facets related to pain, mobility and spirituality) [19, 20].

Further, the fact that not all domains of QOL were equally sensitive to changes in VL and CD4 cell counts (the direction of the effect was consistent for CD4 counts even though the magnitude of effect varied) is important because it reemphasizes that

the six domains of the QOL HIV-BREF measures distinct aspects of QOL. In addition, as part of the inclusion criteria we excluded subjects with harmful alcohol use and clinical depression. These might act as confounders and might have independent influences on immunological and QOL parameters.

Some limitations must be considered in interpreting the results of our study. The cross sectional nature of the study prevents us from making any speculations regarding the consistence of this relationship overtime. The exclusion of subjects with depression might have influenced the findings on the psychological domain of QOL. However, the population studied in all other aspects is representative socio-culturally and clinically, of the HIV infected population in South India, and the results may be generalisable to other HIV infected subjects in the region.

Conclusions

The study highlights associations between some dimensions of a patient focused measure like QOL and measures of disease state like CD4 cell count and VL in a population of relatively well, HAART naïve subjects with HIV infection from India. The results indicated mixed findings, with some QOL dimensions being associated with high VLs and low CD4 counts while several others did not show any associations. The associations were significant only in the high VL and low CD4 groups.

Acknowledgements

This study is supported by an NIH R01 NS-41205 grant from NIH, USA. We acknowledge the support by all the Research Officers and Co-investigators from NIMHANS, Bangalore, India and University of Miami, USA

References

1. Wilson IB, Cleary PD. Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. JAMA 1995; 23: 59–65.
2. Wilson IB, Kaplan S. Clinical practice and patients' health status: How are the two related? Med Care 1995; 33: AS209–14.
3. O'Keefe EA, Wood R. The impact of human immunodeficiency virus (HIV) infection on quality of life in a multicultural South African population. Qual Life Res 1996; 5: 275–280.
4. Tsevat J, Solzan JG, Kuntz KM, et al. Health values of patients infected with HIV: Relationship to mental health and physical functioning. Med care 1996; 34: 44–57.
5. Wu AW, Hays RD, Kelly S, Malitz F, Bozzette SA. Applications of the medical outcomes study health related quality of life measures in HIV/AIDS. Qual Life Res 1997; 6: 531–534.
6. Lubeck DP, Fries JF. Assessment of quality of life in early stage HIV-infected persons: Data from AIDS Time-oriented Health Outcome Study (ATHOS). Qual Life Res 1997; 6: 494–506.
7. Siddappa NB, Dash PK, Mahadevan A, Jayasuryan N, Hu F, Dice B, Keefe R, Satish KS, Satish B, Sreekanthan K, Chatterjee R, Venu K, Satishchandra P, Ravi V, Shankar SK, Shankarappa R, Ranga UJ. Identification of subtype C human immunodeficiency virus type 1 by subtype-specific PCR and its use in the characterization of viruses circulating in the southern parts of India. Clin Microbiology 2004; 42: 2742–2751.
8. Mellors JW, Rinaldo CR Jr, Gupta P, et al. Prognosis in HIV-1 infection predicted by the qulity of virus in plasma. Science 1996; 7: 1167–1170.
9. Mellors JW, Munoz A, Giorgi JV, et al. Plasma viral load and CD4 lymphocytes as prognostic markers of HIV-1 infection. Ann Intern Med 1997; 126: 946–954.
10. O'Brien WA, Hartigan PM, Daar ES, et al. Changes in plasma HIV RNA levels and CD4+ lymphocyte counts predict both response to antiretroviral therapy and therapeutic failure. Ann Intern Med 1997; 126: 939–945.
11. Lane HC, Laughon BE, Falloon J, et al. NIH Conference. Recent advances in the management of AIDS related opportunistic infections. Ann intern Med 1994; 120: 944–945.
12. Macarthur RD, Perez G, Walmsley S, Baxter JD, Mullin CM, Neaton JD. Terry Beirn community programs for clinical research on AIDS (CPCRA) 042/045; Canadian HIV trials network (CTN) 102 protocol teams. Comparison of prognostic importance of latest CD4+ cell count and HIV RNA levels in patients with advanced HIV infection on highly active antiretroviral therapy. HIV Clin Trials 2005; 6: 127–135.
13. Call SA, Kalpo JC, Stewert KE, et al. Health related quality of life and virologic outcomes in an HIV clinic. Qual Life Res 2000; 9: 977–985.
14. Lamping DL. Methods for measuring outcomes to evaluate interventions to improve health related quality of life in HIV infection. Psychol Health 1994; 9: 31–49.
15. Gill CJ, Griffith JL, Jacobson D, et al. Relationship of HIV Viral loads, CD4 counts and HAART use to Health-related Quality of Life. J AIDS 2002; 30: 485–492.
16. Bing EG, Hays RD, Jacobson LP, et al. Health-related quality of life among people with HIV disease: Results from the Multicenter AIDS Cohort Study. Qual Life Res 2000; 9: 55–63.
17. Wig N, Lekshmi R, Pal H, Ahuja V, Mittal CM, Agarwal SK. The impact of HIV/AIDS on the quality of life: A cross

sectional study in north India. Indian J Med Sci 2006; 60: 3–12.
18. Kohli RM, Sane S, Kumar K, Paranjape RS, Mehendele SM. Modification of medical outcome study (MOS) instrument for quality of life assessment & its validation in HIV infected individuals in India. Indian J Med Res 2005; 122: 297–304.
19. Kohli RM, Sane S, Kumar K, Paranjape RS, Mehendele SM. Assessment of quality of life among HIV-infected persons in Pune, India. Qual Life Res 2005; 14: 1641–1647.
20. Chandra PS, Deepthi V, Jairam KR, Thomas T. Relationship of psychological morbidity and quality of life to illness-related disclosure among HIV-infected persons. J Psychosom Res 2003; 54(3): 199–203.
21. WHOQOL HIV Group. Preliminary development of the World Health Organisation's Quality of Life HIV instrument (WHOQOL-HIV: Analysis of pilot version. Soc Sci Med 2003; 57: 1259–1275.
22. WHOQOL HIV Group. WHOQOL-HIV for quality of life assessment among people living with HIV and AIDS: Results from the field test. AIDS Care 2004; 16: 882–889.
23. Wing JK, Babor T, Brugha T, et al. SCAN. Schedules for Clinical Assessment in Neuropsychiatry. Arch Gen Psychiatry 1990; 47(6): 589–593.
24. Beck AT, Steer RA. Manual for the Beck Depression Inventory. San Antonio: Psychological Corporation, 1993.
25. Chaturvedi SK, Chandra PS, Channabsavanna SM, et al. Detection of Anxiety and Depression in Cancer Patients. NIMHANS J 1994; 12(2): 141–144.
26. Spielberger CD. State-Trait Anxiety Inventory: A Comprehensive Bibliography. Palo Alto, CA: Consultant Psychologists Press, 1984.
27. Saunders JB, Aasland OG, et al. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption-II.
28. Nieuwkerk PT, Grsolf EH, Colebunders R, et al. Quality of life in asymptomatic- and symptomatic HIV infected patients in a trial of ritonavir/saquinavir therapy. The Prometheus study group. AIDS 2004; 14: 181–187.
29. Revicki DA, Wu AW, Murray MI. Change in clinical status, health status and health utility outcomes in HIV-infected patients. Med Care 1995; 33: AS173–AS182.
30. Anastos K, Barron Y, Cohen MH, Greenblatt RM, Minkoff H, Levine A, Younge M. The prognostic importance of changes in CD4+ cell count and HIV-1 RNA level in women after initiating highly active antiretroviral therapy. Ann Intern Med 2004; 140: 256–264.
31. Burgoyne RW, Roerke SB, Behrens DM, Salit IE. Long-Term Quality of Life outcomes among adults living with HIV in the HAART Era: The interplay of changes in clinical factors and symptom profile. AIDS and Behavior 2004; 8(2): 151–163.
32. Weinfurt KP, Willke RJ, Glick HA, et al. Relationship between CD4 count, viral burden and quality of life over time in HIV-1 infected patients. Med care 2000; 38: 404–410.

Address for correspondence: Prabha S. Chandra, Department of Psychiatry, National Institute of Mental Health and Neuro Sciences, Bangalore, 560 029, India
Phone: +91-80-26995272; Fax: +91-80-26564830
E-mail: chandra@nimhans.kar.nic.in