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HEALTH-RELATED QUALITY OF LIFE AS PREDICTOR OF ADHERENCE WITH ANTIRETROVIRAL MEDICATION

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HEALTH-RELATED QUALITY OF LIFE AS PREDICTOR OF ADHERENCE WITH ANTIRETROVIRAL MEDICATION

BY

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ABSTRACT

Title of the Study: Health-related quality of life (HRQoL) as predictor of medication adherence in patients infected with Human Immune-deficiency Virus (HIV).

Summary: Quality of life (QoL) is a broad term which involves evaluation of all aspects of life including, health, education, family life, housing, friendship, marriage, standard of living, and work. Health is one of the domains that affect our quality of life. The measurement of HRQoL is becoming an increasingly common activity in healthcare systems around the world. Health-related quality of life or biological outcome of treatment might predict adherence to HIV medication. This research is aimed to study the effect of HRQoL on medication adherence in patients infected with HIV. The original study was funded by NIH and conducted by Dr. Cynthia Willey, at University of Rhode Island during the years 1995-98. The purpose of the original project was to assess the stages of changes for adherence with HIV-Related Medications. The sample consisted of 145 patients. The questionnaire was developed by AIDS Clinical Trial Group (AACTG). Questionnaires were distributed to the patients in Rhode Island at different sites affiliated with Brown University AIDS program. These sites included:

1. The Miriam Hospital Immunology Center: This center serves majority of the HIV positive women in Rhode Island.

2. Stanley Street Treatment and Resources: This center serves the Greater Fall River Massachusetts area and provides care to indigent and intravenous drug users.
3. Veteran Affairs Medical Center in Providence, RI: This center treats approximately 60 HIV positive men.

Methodology: The data was collected by administering a standardized self-reported questionnaire to the subjects to assess the compliance to HIV drugs. The questionnaire covered various aspects like, Demographic, Economic status, Coping, Quality of life, Medication, etc. Four domains of health-related quality of life were measured using 12 questions based on SF-36 included in the questionnaire. Medication adherence was assessed as self-reported adherence and also using Medication Adherence Scale. Univariate and bivariate tests were run to check for confounding variables in the data set. Logistic regression was used to determine any interaction between independent variables. The effect of Quality of life domains on medication adherence were assessed by running logistic regression model after controlling for potential confounding factors.

Results: The results of this study indicate that "vitality/fatigue" is significantly associated with 95% self-reported adherence in patients taking protease inhibitors. This study thus confirms that patients with better mental health are more likely to adhere to their medication regimen. This is consistent with

previous findings by other researchers. No other meaningful association was found between any other domain of QoL and medication adherence.

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INTRODUCTION

Acquired Immunodeficiency Syndrome (AIDS) is a significant healthcare, social, and psychological problem facing the mankind. When AIDS emerged from the shadows two decades ago, few people could predict how the epidemic would evolve, and fewer still could describe the best ways of combating it. As we face the third decade of AIDS epidemic, the impact of this disease is enormous. Human immunodeficiency virus is a major public health problem in all parts of the world [1].

Worldwide, nearly 40 million people are living with human immunodeficiency virus (HIV), which causes AIDS [2]. These include 19.6 million males, 17.6 million females, and 2.7 million children (less than 15 years of age). Globally, AIDS is a fourth leading cause of death [3]. In United States alone, approximately 1 million people live with HIV infection [2]. HIV/AIDS has become one of the highest expenditure infections in terms of cost of treatment and care provided, lost productivity hours, and disability [1].

Mankind faces multiple challenges in fighting AIDS. Social stigma and discrimination are the major obstacles to effective HIV/AIDS prevention and care. Fear of discrimination may prevent people from seeking treatment for AIDS or from acknowledging their HIV status.

Until quite recently, the disease was considered to carry an almost certain debilitating, downward course leading to early death from opportunistic infections. Not long ago,

zidovudine, a nucleoside analogue reverse transcriptase inhibitor, was the only drug used to treat HIV. This drug interferes with the actions of specific HIV enzyme involved in the replication of cycle of HIV.

But, the treatment of HIV virus has changed immensely. With advances in HIV treatment regimens, HIV has become a treatable chronic illness that requires extensive clinical management [4]. New potent drugs are prolonging the lives of thousands of patients infected with HIV. There are now dozens of medications available to attack different enzymes in HIV virus lifecycles. These drugs can be classified into three categories depending on the enzymes they target in HIV lifecycle. These are:

1. Nucleoside reverse transcriptase inhibitors (NRTI's)
2. Non-nucleoside reverse transcriptase inhibitors. (NNRTI's)
3. Protease inhibitors (PI's)

Since the potential for mutation is very high with HIV, drugs are more effective when used in combination. Convergent therapy uses drugs from same class to target same enzyme, while divergent therapy used drugs from different class to target different enzymes. The combination of both convergent and divergent therapy is called highly active anti-retroviral therapy (HAART). The first of protease inhibitors were introduced in 1995. Since the late 1997, when HAART was first introduced, the combination of protease and reverse transcriptase inhibitors had proven effective in driving HIV viral loads to very low or undetectable levels [5]. The most commonly used combination includes one potent protease inhibitor and two NRTI's. The impact

of protease inhibitor based combination therapy has resulted in astonishing improvements in survival [6]. The survival rates have increased with both longer AIDS free survival and lower mortality [7]. This shift to the use of HAART for treating HIV has led to increasingly complex drug regimen [8]. Adherence has been often called the "Achilles' heel" of highly active anti-retroviral therapy.

HAART is highly effective but the drugs have short half-lives and are highly selective, leading to drug resistant strains if therapeutic levels are not maintained [9]. The long-term effectiveness of HAART is dependent upon achieving maximum and durable suppression of HIV plasma viral load [9, 10]. Even in successfully suppressed patients, HIV replication will rapidly rebound if HAART is discontinued. One of the major challenges to good adherence to HAART has been complexity of regimens. HIV medication regimens are complicated and require extensive time and effort from the patient [11]. Many drugs need to be taken three times a day and the pill burden is overwhelming i.e. 15 –20 pills daily. Some drugs need to be taken with food, some without food and still others with dietary supplements. The complexity of HAART regimen sometimes requires patients to change their eating and sleeping pattern. This level of lifestyle change and accommodation may result in frustration and treatment failure [12]. Non-adherence to HIV treatment regimen is a primary cause of treatment failure now. As a result of the pivotal role that adherence plays in the success of HAART, a tremendous amount has been written emphasizing the importance of adherence [5].

Adherence, often used interchangeably with compliance, is "an act, action, or quality of being consistent [13] with administration of prescribed medication". The term adherence is preferred over compliance because it affirms patient's active participation in choosing and maintaining a treatment regimen. The concept of adherence additionally extends beyond medication management, to encompass a comprehensive treatment plan.

Adherence simply means how accurately patients take their medications. One hundred percent adherence to any medication regimen is not easy to achieve. One recent study on adherence behavior in HIV has shown that only 55-62% of patients are highly adherent to their medication therapy [14]. Many factors have been shown to affect patient's adherence.

Patient Factors and Health Beliefs: Demographic characteristics (like, age, gender, race, etc.) have not been consistently found to be predictive of adherence [15, 16]. However, other factors like heavy alcohol use, drug abuse, and depression have been found to be associated with adherence [17, 18]. Various aspects of patients' beliefs about the nature of their disease [11], perceived importance of medication used [12], the health care system, and cultural factors affect medication adherence. Patients who perceive that their disease is a "serious health problem" and believe that the prescribed medications are necessary are more likely to adhere to prescribed medication regimens [12]. In general, increased knowledge about disease and purposes of therapies increase

adherence [11]. However, concerns regarding safety of the medication on long term and the medication side effects could decrease medication adherence.

Disease Factors: Investigations have found little relationship between type of illness and level of adherence [16]. Patients experiencing extreme pain or who are symptomatic are more likely to be adherent to their medications than patients who are asymptomatic. Many patients interrupt or stop taking their medications when they are asymptomatic.

Provider Factors: General satisfaction with medical care appears to have no bearing on adherence. However, patient's dissatisfaction and unfulfilled expectations with the treatment and the doctor results in low adherence rates [11, 19]. The quality of interaction between doctor and patient can have major influence on health outcomes. Provider-patient relationship, especially communication about chronic nature of disease, the need for regular therapy, the role of medications, and discussion of side effects improves patient adherence. Poor provider-patient communication is associated with poor adherence. Affordability of medication, insurance coverage, and cost of therapy is a barrier to achieving adherence.

Treatment complexities: Adherence is poorer in patients treated with more complex regimens [11, 20]. It has also been shown that adherence normally decreases over time and with greater number of pills that one is required to take [11]. One study measuring compliance with inhaled medication in asthma showed that as medication dosing

became more frequent, the adherence decreased from 71% twice a day to 18% four times a day [20]. Anticipatory fear of side effects and secondary effects of illness such as nausea and dizziness can also reduce patient adherence.

Psychosocial Factors: Given the complexity of human behavior, multiple determinants including patient characteristics may affect medication adherence. Behavior associated with chaotic lifestyle, depression, alcohol and elicit drug use often reduce adherence [11]. Patients with positive adaptive coping have been found to be more adherent to their medications [21]. Other factors like, presence of stress, lack of motivation, pessimism, and depression appears to result in non-adherence. Patients having sufficient levels of practical, emotional, and cognitive social support show higher level of adherence [11, 22].

Adherence is an important factor to achieve best outcomes in HIV disease management. Although it is not known how adherent patients have to be to achieve best results, but it is believed that more adherent the patients, the more likely he is to have best results. Strict adherence to medication regimen yields high success. As more emphasis is laid on maintaining low viral count in HIV-infected patients, adherence to medication regiment has become an important issue [23]. Sub-optimal patient adherence has been shown to be related to inadequate viral suppression [24], reduced exposure to anti-retroviral drugs [25], the emergence to viral resistance [26], and HIV disease progression and mortality [26]. Since the virus has the ability to mutate rapidly in absence of drug, taking anti-retroviral medication exactly as prescribed is the key

for success of therapy. HAART is very effective but drugs have short half-life and are highly selective favoring drug-resistant strains if therapeutic levels are not maintained. The rate of virologic failure sharply increases when less than 95% of prescribed dose of drug is actually taken [17]. In addition to taking adequate prescribed medication, anti-retroviral and protease inhibitors need to be taken according to correct time-schedule, and for several drugs, dietary prescription. For most HIV-infected individuals, the alternative to lifelong adherent therapy may be devastating complication, often resulting in death.

Measuring Adherence:

One problem of measuring adherence is the lack of a standard measurement [15]. The methods commonly used to measure adherence can be classified as direct or indirect methods. Direct methods include pill count, biological assay, and electronic monitoring method, whereas indirect methods use questionnaire, interviews, or diary to estimate self reported adherence. All these methods have their respective advantages and disadvantages as discussed below.

Self-Reported Medication Adherence**:** This is one of the simplest methods used to measure adherence. Three main types of self reports have been used including surveys, interviews and diaries. These involve asking patients how often they took (or missed) their medications by use of variety of surveys. However, reports of non-adherence could be more reliable than reports of adherence. For example, the AIDS Clinical Trials Groups survey asks patients how many medication doses they missed

during previous day, 2 days or, 4 days. Despite the ease of administration, the self reported adherence measure has several limitations. Investigations have revealed that patients tend to overstate the actual adherence [27]. The patients want to present socially acceptable responses. Even if the patients are truthful, there is no data to prove how long the patients can remember what doses were missed several days ago [27].

Pill Count: Many investigators use pill count as method of measuring adherence. The pill count is generally done by study personnel like nurse, physician or, other health care practitioner. Although pill count avoids the subjective evaluation of adherence and has been demonstrate to correlate more highly with electronically measured adherence [28], the proportion of doses measured by pill count often exceeds actual number of doses taken. This method has several other limitations. Patients may forget to bring the bottles to the pharmacy. Patents also 'pill dump' and dispose extra medication doses to appear more adherent [29].

Biological Assays: Biological markers and tracer compounds indicate patient compliance over an extended period [30]. Plasma levels of antiretroviral drugs provide unequivocal evidence that the medication has been taken. To assess adherence using this method, the time and dose of the medication must be noted. Also, repeated plasma levels need to be withdrawn from the patient to improve the sensitivity of the test. This measure also has some drawbacks. Firstly, plasma levels only measure adherence to a dose prior to the visit or sample drawn [31]. Also, studies in many disease states

have demonstrated, patients who are aware that they may have a clinical sample like blood drawn to measure adherence will be more likely to adhere to the dose immediately prior to the visit than to other doses [32]. Besides, the pharmacokinetics of many drugs, especially protease inhibitors, varies significantly from person to person [32].

Electronic Monitors: MEMS (Medication event monitoring system) and eDEM are two commercially available monitors to measure adherence [15]. These devices are fitted with special pill bottle caps equipped with electronic chip that records each time a patient opens the bottle. This method has various advantages over subjective and other measures. Over estimation of self-reported adherence and pill dumping can be detected by this method. Additionally, this method also provides the time and date the pill bottle was opened each time. However, the cost of these high-tech devices is a problem for some investigators. Moreover, patient may open the bottle but not ingest the medicine. Some patients make a cache of medicine to be taken at office. This may not be recorded by this measure.

The Importance of Health-related Quality of Life:

The term "quality of life" was first used in 1943, in a novel about working in aircraft factory. However, it became popular with social scientists in the 1970's, as US cities and states tried to rate the "quality of life" they offered. World Health Organization (WHO) Quality of Life group defines quality of life as "an individual's perception of their positions in the life in context of the culture and value systems in which they live

and in relation to their goals, expectations, standards and concerns. Quality of life is an evaluation of all aspects of life including, health, education, family life, community, housing, friendship, marriage, nation, neighborhood, standard of living, and work. Some authors also add spiritual security to the list of domains affecting quality of life. Health is one of the domains that affect our quality of life. WHO defined health in its constitution as "The state of optimum, physical, mental, and social well-being, and not merely the absence of disease or infirmity." The term health-related quality of life (HRQoL) encompasses multiple dimensions, including physical functioning, psychological state, general health status, family situational interaction, social ability, and somatic sensation.

The measurement of HRQoL is becoming an increasingly common activity in healthcare systems around the world. These measurements are taken for variety of reasons including, as indicators of population health status, outcome measures in clinical trials, in economic evaluation of new technologies, and in some cases, for individual patient management. There are two basic approaches to measuring HRQoL. The first involves use of generic instruments that measure broad aspects of HRQoL. These instruments are not designed to assess HRQoL relative to particular medical condition, but rather to provide a general sense of the effects of an illness. Medical outcomes study Short-Form Health Survey (SF-36) is an example of generic HRQoL instrument. It measures HRQoL along 8 different domains: physical functioning, role limitation due to physical problems, bodily pain, general health, vitality, social functioning, role limitation due to emotional problems, and mental health. It assesses

both physical and mental health scores of the individual and measures both positive and negative aspects of Physical and Mental Health [33].

Generic measures can be administered to different populations to examine the impact of various healthcare/therapeutic programs on HRQoL. These measures allow for comparisons of HRQoL across a variety of medical conditions. The major limitation of generic instruments is that may not be sensitive enough to detect subtle treatment effects specific to a particular disease.

The second approach involves the use of instruments that are specific to a disease (e.g., osteoporosis), a population (e.g., the elderly), or clinical problem (e.g., pain). These measures are more sensitive towards specific disease or population, and therefore to have greater relevance to practicing clinician. The Arthritis Impact Measurement Scale (AIMS) is an example of disease-specific instrument that measures HRQoL specific to arthritis.

Information about Quality of life of patients gathered systematically and routinely directly before consultation could be integrated in complex medical decision-making process [34]. Health related quality of life has been shown to be related with patient satisfaction and the main determinants of the health service quality improvement [35].

Health-related quality of life or biologic outcome of treatment might predict adherence to HIV medication. The correlation between HRQoL and adherence is complex and

merits careful study [36]. Many authors have reported the impact of HRQoL on patient's ability to adhere to treatment. Quality of life (QoL) may be an important consideration in maximizing treatment consideration in Hepatitis patient [37]. Sub-optimal patient adherence was shown to be related to inadequate viral suppression [38]. Previous research suggests that patients with higher symptoms (poor physical health) and depression are more likely to be non-adherent to medications [21, 39]. The patients with better quality of life, do feel better about themselves and world, and are more likely to be adherent. Research data also supports the belief that survival and biomedical outcomes increase when the patient's perception of the impact of treatment on quality of life is taken into consideration [40].

Most Highly Active Anti-Retroviral Treatment (HAART) regimens are far from convenient for patients. HAART may have negative impact on patient's quality of life [41]. Short-term and long-term toxicities frequently occur which may have negative impact on the patient's Health-related quality of life (HRQoL). In addition, need for strict adherence to substantial number of pills, rigid time schedule, and dietary prescription may interfere with patient's daily activity. In patients with symptomatic HIV infection or AIDS, opportunistic infection could significantly affect HRQoL. In addition, social stigma associated with the disease and associated pain caused interferes with patient's ability to perform daily activities. It is therefore assumed that most people infected with HIV/AIDS do not feel well and that disease has an effect on their quality of life.

METHODOLOGY

Study Design:

The original study was conducted by Dr Cynthia Willey, Professor, Department of Pharmacoeconomics and Pharmacoepidemiology, University of Rhode Island, during the year 1995-98. The purpose of the original study was to develop measure of stages of change for medication adherence. National Institute of Health (NIH) funded the study. This is a descriptive cross-sectional study of self-reported adherence to prescribed HIV medication adherence.

Sample Population:

The sample consisted of 145 patients who responded to the survey. All individuals were infected with HIV and currently prescribed approved HIV medication. The sample comprised 71% males and 29% females. The patients were aged between the ages 24-57. Mean age was 39. The sample comprised 62% whites and 38% non-whites. Average level of education was 12 years.

Data Collection:

The data was collected by administering a standardized self-reported questionnaire to the subjects to assess the compliance to HIV drugs. Questionnaires were distributed to the patients in Rhode Island at different sites affiliated with Brown University AIDS program. These sites include:

1. The Miriam Hospital Immunology Center: This center serves majority of the HIV positive women in Rhode Island.
2. Stanley Street Treatment and Resources: This center serves the Greater Fall River Massachusetts area and provides care to indigent and intravenous drug users.
3. Veteran Affairs Medical Center in Providence, RI: This center treats approximately 60 HIV positive men.

The questionnaire covered following aspects:

- Demographic: Age, gender, ethnicity, years of education, living status, and employment status.
- Economic status: Family income, job, type of health insurance coverage, and cost of treatment.
- Coping: ways of coping with HIV.
- Social support: Social, financial and emotional support provided by family and friends.
- Quality of Life: Physical and mental functioning, general health, number of days spend in hospital in past two weeks, social ability and psychological health (as measured by SF-36).
- Medication used: Adherence levels, number of doses missed in past one month and three months, side effects, etc.

Measure of Health-related Quality of Life:

HRQoL is generally measured with a collection items, scales and domains. An item is a single question in an instrument. A domain identifies a particular focus of attention, like bodily pain, vitality, etc. SF-36 is a reliable, precise, and validated method of measuring quality of life [33, 42]. There is a strong basis for interpreting SF-36 scales as measure of health and health-related quality of life. A positive correlation (ranging from 0.43 to 0.69) has been found between SF-36 scales and general measure of quality of life [33]. The four domains of physical and mental health were measured for the purpose of this study. This enabled the production of scores with the same reliability and validity as those reported here and in other Medical Outcome Studies. Following set of questions were used to measure four domains of physical and mental health.

Physical Health:

Two domains of physical health were assessed by using the responses to the following questions.

1. General Health Status:

Q1. How would you describe your current health status?

2. Bodily Pain:

Q1. How much bodily pain have you had during the past four weeks?

Q2. During the past 4 weeks, how much did pain interferes with your normal work (including both work outside the home and housework)?

Mental Health:

Two domains of mental health were assessed by using the responses to the following questions.

1. General Mental Health:

Q1. During the past 4 weeks, have you been a very nervous person?

Q2. During the past 4 weeks, have you felt so down in dumps that nothing could cheer you up?

Q3. During the past 4 week, have you been a happy person?

Q4. During the past 4 weeks, have you felt downhearted and blue?

Q5. During the past 4 weeks, have you felt calm and peaceful?

2. Vitality/Fatigue:

Q1. During the past 4 weeks, did you have a lot of energy?

Q2. During the past 4 weeks, did you feel full of prep?

Q3. During the past 4 weeks, did you feel worn out?

Q4. During the past 4 weeks, did you feel tired?

HRQoL scales are scored so that higher score indicates better health state. The scoring involves following steps:

Data Entry: The responses to all these questions are based on Likert Scale. All the responses were key punched as coded in the questionnaire. The response options were coded as 1, 2, 3, 4, and 5.

Item Recoding: All questions were checked for out of range values. All out of range values were recoded as missing data. The next step after data entry was the recoding of response choices so that a higher score indicates a better health state. Hereby, question

#1 to 4 in Mental health and question #3 to 4 were reverse coded so that higher score indicates better health.

Item Recalibration: Two questions require recalibration to satisfy linear relationship between item scores (John ware et al, SF-36 health survey, manual and interpretation guide).

General health: The responses were recoded as suggested in SF-36 scoring manual.

Precoded item Value	Final Item value
1	5.0
2	4.4
3	3.4
4	2.0
5	1.0

Bodily Pain: The recommended recoding for two questions pertaining to bodily pain was followed. The administration of second question depends on the response to first question. The two questions in bodily pain had unequal number of response choices. This recoding method helped to convert second question to a six-level item of roughly equal variance to first question.

Computing Raw Scores: After item recoding, raw scores were computed for each four scales i.e. General health, Bodily pain, vitality, and Mental Health individually. The raw score is the algebric sum of responses for all items in that scale. For example, the raw scale score for the mental health scale is the sum of the scores for all five

responses pertaining to general mental health. As recommended, if any respondent has missed more than one question on any domain, the score for that domain was not calculated. Finally each raw score was transformed to a 0 to 100 scale using the formula shown below.

$$\text{Transformed Score} = \left[\frac{(\text{Actual raw score} - \text{lowest possible raw score})}{\text{Possible raw score range}}\right] * 100$$

This transformation converts the lowest and highest possible scores to zero and 100, respectively. This transformation enables comparison of scores with norms derived from national health surveys and other published and forthcoming results. The scores were calculated separately for anti-retroviral and protease inhibitors drugs for the ease in analysis.

Measure of Adherence:

1. Percentage Adherence:

Percentage adherence was calculated separately for anti-retroviral drugs and protease inhibitors. Percentage adherence in past three months was calculated using two sets of questions from the questionnaire. The number of doses missed was determined by using the response to question, "During the past three months, about how many times did you miss a dose of this medication"? The response to question, "How often do you take this medication" was used to determine the total number of doses the patient is supposed to take in three month period.

Percentage adherence was calculated by dividing total number of doses missed in the past three month by the total number of prescribed doses using the formula:

$$\text{Percentage adherence} = 1 - \left[\frac{\text{Number of doses missed in past three months}}{\text{Total number of doses in three months}} \right] \times 100$$

The questionnaire has separate questions for different class of drugs, thus percentage adherence was calculated separately for anti-retroviral and protease inhibitors drugs. The average percentage adherence for the past three months was calculated for both anti-retroviral and protease inhibitors.

No measure of adherence is perfect, and self-reported measures like questionnaires, often present the disadvantage of over reporting [43]. Although most literature suggests a cut-off limit of 80% in chronic conditions, successful HIV therapy requires higher level of adherence. The rate of virologic failure sharply increases when less than 95% of prescribed dose of drug is actually taken [17]. Thus, a cut-off limit of 95% adherence was selected to dichotomize respondents. All patients showing greater than or equal to 95% adherence were classified as "adherent" and those showing less than 95% adherence were classified as "non-adherent". The adherents were coded as "1" and non-adherents were coded as "0".

2. Medication adherence scale: This is a previously validated scale to measure compliance. It contains six questions that are answered yes or no. Positive response indicates less medication adherence. A "Yes" was recoded as "1" and a "No" was recoded as "2". The aggregate score for each respondent was obtained by taking the

sum of all six responses. The aggregate score ranged from 6 to 12 with higher score indicating poor adherence. This scale includes following questions:

- During the last 3 months, have you ever stopped taking your protease inhibitor/antiretroviral medication because you felt worse?
- During the last 3 months, have you ever forgotten to take your protease inhibitor/antiretroviral medication?
- During the last 3 months, have you at times been careless about taking your protease inhibitor/antiretroviral medication?
- During the last 3 months, have you ever taken less of your protease inhibitor/antiretroviral medication than your doctor prescribed because you felt better?
- During the last 3 months, have you ever taken less of your protease inhibitor/antiretroviral medication than your doctor prescribed because you felt worse?
- Since you began taking protease inhibitors/antiretroviral medications, have you ever purposely taken more/less of the medication than your physician prescribed or discontinued your medications?

The MAS scores were calculated separately for Anti-retroviral and protease inhibitor drugs. The MAS score was not calculated (coded as missing) if any respondent has missed more than one question in six item scale. Also, the average score of anti-retroviral and protease inhibitors were individually calculated. Respondents with a score of 6 were classified as "adherent" and respondents with a score of more than 6

were classified as "non-adherent". Thus any respondent who has marked "yes" to at least one of the six questions was classified as non-adherent. This rather strict cut-off level of adherence was selected to offset over-reporting of adherence in self-reported measure.

Statistical Analysis:

Dependent Variable:

- Adherence to anti-retroviral drugs in the past three months (dichotomous with 95% cut-off level).
- Adherence to protease inhibitors in the past three months (dichotomous with 95% cut-off level)
- Adherence as measured using MAS for anti-retroviral drugs
- Adherence as determined using MAS for protease inhibitors.

Independent Variable: On the basis of literature review, these variables were included in this research. The IVs of primary interest were-

- Bodily Pain
- General Health
- Mental Health
- Vitality/Fatigue

Demographic variable:

- Age (Categorical variable)

< 35 years= 1

≥ 35 and < 42 years= 2

≥ 42 years= 3

- Gender (Categorical variable)

Male= 1

Female= 0

- Ethnicity (Categorical variable)

Whites= 1

Non-whites= 0

- Years of Education (Categorical variable)

$\geq$ 12 years= 1

< 12 years= 0

- IV Drug use (Categorical variable)

Occasionally to regular= 1

Not at all or twice in 6 months= 0

- CD4 count (Categorical variable)

$\leq$ 200= 1

> 200= 0

- Time since Diagnosis (Categorical variable)

Less than 1 month to 2 years= 1

3 to 4 years= 2

5 years or more= 3

- Insurance (Categorical variable)

Insured= 1

Uninsured= 0

- Annual income (Categorical variable)

< $15000= 1

≥ $15000= 0

Of these, four domains of QoL are the IVs of primary interest. The other variables may act as confounders. Univariate analyses were run on all dependent and independent variables. The data was tested for normality, linearity, skewness, and homoscedasticity. The primary independent variables were categorized into four categories and logistic regression was run between each independent variables and each dependent variable to assess parametric form. No linear relation was found between independent variable and dependent variable. The primary independent variables were thus categorized into two or three categories for the final model.

Bivariate tests were run between dependent variables and all independent variables excluding variables of primary interest. Similar bivariate test were also run between primary independent variables and other independent variables. These include:

1. Chi-square tests were performed between dependent variable i.e. 95% AV, 95% PI, MAS AV and MAS PI; and other independent variables like, age groups, gender, race, annual family income, years of education, time since diagnosis, CD4 count, injection drug use, and insurance.
2. Chi-square tests were performed between each primary independent variable i.e. GH, BP, V, and MH; and other independent variables like, age, gender, race, annual family income, years of education, time since diagnosis, CD4 count, injection drug use, and insurance.

All categorical variables, which had more than two categories, were dummy coded for purpose of final logistic model for e.g. The primary independent variable "mental health" was dummy coded as Low MH-score below 28, Med MH-score between 28 and 40. Patients with MH score more than 40 were treated as reference group. Test for collinearity was performed between each dependent variable and each independent variable. No collinearity was detected between any variables. Logistic model were run between each dependent variable and each independent variable. A maximum Likelihood ratio test (Chunk test) was performed to assess the significance of interaction terms in the model. The full model with all interaction terms and reduced model without interaction terms were compared for its log likelihood values. Any significant change in value suggested interaction in the model.

The confounding effect of each independent variable was assessed as described by David Kleinbaum. Starting with the "Gold model" i.e. model with all independent variables, each variable was sequentially dropped with replacement and its effect on the odds ratio and confidence interval was studied. The variables which did not have any effect on the odds ratio were dropped from the model. Separate models were run for each primary independent variables due to high correlation between them.

RESULTS

Table 1: Demographics and Clinical Characteristics of Patient Population on Anti-retroviral Medication:

Total number of patients on anti-retroviral medication was 137. Age of these patients was between 24 and 57. The mean age was 38. Males constituted 73.0% of the sample while females constituted 26.9% of the sample. Majority of the patients were whites. Native Americans, Hispanics, Asians, African-American, and others together constituted 35.8% of the population.

Majority of respondents had at least 12 years of education. About 29.0% of the patients reported that they lived alone while majority of them (70.9%) reported living with others. 60.5% reported that their annual income was more than $15,000. Majority of patients also had some kind of insurance, while only 16.0% of patients had no insurance. 64.6% of the patients had been diagnosed of HIV for more than 5 years. 47.6% had a T-cell count of less than 200 and 52.3% of the patients had a T-cell count of more than 200. Surprisingly, only 3.8% of the patients reported that they used intravenous drugs, while the majority of patients denied use of intravenous drugs in past 6 months.

Table 2: Demographics and Clinical Characteristics of Patient Population on Protease-inhibitor Medication:

Total number of patients on anti-retroviral medication was 77. Age of these patients was between 24 and 57. The mean age was 38. Males constituted 74.3% of the sample while females constituted 25.6% of the sample. Majority of the patients were whites.

Native Americans, Hispanics, Asians, African-American, and others together constituted only 22.9% of the population.

Majority of respondents had at least 12 years of education. About 27.0% of the patients reported that they lived alone while majority of them (72.9%) reported living with others.57.3% reported that their annual income was more than $15,000. Majority of patients also had some kind of insurance, while only 12.1% of patients had no insurance. 63.5% of the patients had been diagnosed of HIV for more than 5 years. 54.9% had a T-cell count of less than 200 and 45.1% of the patients had a T-cell count of more than 200. Interestingly, only 2.6% of the patients reported that they used intravenous drugs, while the majority of patients denied use of intravenous drugs in past 6 months.

Table 3: Adherence with Anti-retroviral (A.V.) Medications (Dependent Variable):

Patients with adherence levels of more than 95% were classified as adherent, while patients with adherence level of less than 95% were classified as non-adherence. Using this cut-off, 87.7% (N= 115) of the patients were found to be adherent, while 12.2% (N= 169) were found to be non-adherent.

Medication Adherence Scale reported 42.2% (N= 62) being adherent, while 54.7% (N=75) reported not being adherent to their medication

Table 4: Adherence with Protease Inhibitor (P.I.) Medications (Dependent Variable)

Patients with adherence levels of more than 95% were classified as adherent, while patients with adherence level of less than 95% were classified as non-adherence. Using this cut-off, 83.7% (N= 62) of the patients were found to be adherent, while 16.2% (N= 12) were found to be non-adherent.

Medication Adherence Scale showed that 48.0% (N= 37) have bee adherent, while 51.9% (N=40) reported not being adherent to their medication

Table 5: Mean and Range values of Quality of life domains (Primary IV) in patient on anti-retroviral drugs compared with general US population.

As suggested in the literature, the patients scored significantly below the US general population on all four scales of Quality of life. This suggests lower physical as well as mental health reported by HIV patients compared to US general population.

Table 6: Mean and Range values of Quality of life domains (Primary IV) in patients on protease inhibitors compared with general US population.

As suggested in the literature, the patients prescribed protease inhibitors scored significantly below the US general population on all four scales of Quality of life. This suggests lower physical as well as mental health reported by HIV patients compared to US general population.

Table 7: Multiple Chi-Square Tests done on the Adherence to Antiretroviral Medications with 95% Cut off (Categorical Dependent Variable) and other Categorical Independent Variables.

Chi square test showed no significant association between the adherence and other independent variables. This is consistent with past research that has shown that demographic variables are not associated with HIV adherence.

Table 8: Multiple Chi-Square Tests done on the Adherence to Antiretroviral Medications using MAS (Categorical Dependent Variable) and other Categorical Independent Variables.

Chi square test showed no significant association between the adherence and other independent variables. This is consistent with past research that has shown that demographic variables are not associated with HIV adherence.

Table 9: Multiple Chi-Square Tests done on the Adherence to Protease Inhibitor Medications with 95% cut off (categorical Dependent Variable) and other Categorical Independent Variables.

Chi square test showed no significant difference between the adherence and other independent variable except for variable "gender". Males were found to be more adherent than females.

Table 10: Multiple Chi-Square Tests done on the Adherence to Protease Inhibitor Medications using MAS (categorical Dependent Variable) and other Categorical Independent Variables.

The variable "annual family income", and "T-cell count" were found to be significantly associated with MAS adherence. Patients with annual income more than $15,000 were found to be more adherent than their poorer counterparts. Similarly, patients with T-cell count of less than 200 were found to be more adherent than

patients with T-cell count of more than 200. This is found to be consistent with previous research.

Table. 11: Multiple Chi-Square tests done on "General Health" (Categorical) and other Independent Variables (Categorical) for people on anti-retroviral medication.

The variable "ethnicity" and "annual family income" were found to be significantly associated with "general health". Whites reported better general health compared to non-whites. Similarly, patients with annual income greater than $15,000 had better mean score on general health compared to patients with annual income less than $15,000.

Table. 12: Multiple Chi-Square tests done on "Bodily Pain" (Categorical) and other Independent Variables (Categorical) for people on anti-retroviral medication.

The variable "ethnicity" was found to be significantly associated with "bodily pain". Whites reported better mean score on bodily pain compared to non-whites. This difference was significant at a p-value of 0.0327. No other variable of interest show any significant association with bodily pain.

Table. 13: Multiple Chi-Square tests done on "Vitality/Fatigue" (Categorical) and other Independent Variables (Categorical) for people on anti-retroviral medication.

The variable "gender" was found to be significantly associated with "vitality" (p-value= 0.0047). Females had better score on vitality than their male counterparts. No other variable show any significant association with vitality.

Table. 14: Multiple Chi-Square tests done on "Mental Health" (Categorical) and other Independent Variables (Categorical) for people on anti-retroviral medication.

No variable show any significant association with the variable "mental health".

Table. 15: Multiple Chi-Square tests done on "General Health" (Categorical) and other Independent Variables (Categorical) for people on Protease Inhibitors medication.

The variable "years of education" was found to be significantly associated with "general health". Patients with more than 12 years of education had better mean score of general health than patients with less than 12 years of education (p-value= 0.026).

Table. 16: Multiple Chi-Square tests done on "Bodily Pain" (Categorical) and other Independent Variables (Categorical) for people on Protease Inhibitor medication.

The variable "annual family income" was found to be significantly associated with "bodily pain". Patents with annual family income more than $15,000 reported better mean score on bodily pain compared to patients with annual income less than $15,000. No other variable of interest show any significant association with bodily pain.

Table. 17: Multiple Chi-Square tests done on "Vitality/Fatigue" (Categorical) and other Independent Variables (Categorical) for people on Protease Inhibitor medication:

No variable show any significant association with the variable "vitality/fatigue".

Table. 18: Multiple Chi-Square tests done on "Mental Health" (Categorical) and other Independent Variables (Categorical) for people on Protease Inhibitor medication.

The variable "gender" was found to be significantly associated with "mental health".

Females reported better mental health compared to males (p-value= 0.032). No other variable of interest show any significant association with bodily pain.

Table. 19: Logistic Regression Analysis between Adherence to Anti-retroviral Medication with a 95% cut-off (Dependent Variable) and Independent Variables of Primary Interest.

This table summarizes the final logistic model run between dependent variable (95% adherence) and each of primary independent variable controlling for the confounding variables as described by Kleinbaum [44].

Table. 20: Logistic Regression Analysis between Adherence to Anti-retroviral Medication using MAS (Dependent Variable) and Independent Variables of Primary Interest.

This table summarizes the final logistic model run between dependent variable (MAS adherence) and each of primary independent variable controlling for the confounding variables (as described by Kleinbaum).

Table. 21: Logistic Regression Analysis between Adherence to Protease-inhibitor Medication with a 95% cut-off (Dependent Variable) and Independent Variables of Primary Interest.

This table summarizes the final logistic model run between dependent variable (95% adherence) and each of primary independent variable controlling for the confounding variables. The variable "gender" was found to be significantly associated with both 95% adherence and mental health.

Table. 22: Logistic Regression Analysis between Adherence to Protease-inhibitor Medication using MAS (Dependent Variable) and Independent Variables of Primary Interest.

This table summarizes the final logistic model run between dependent variable (MAS adherence) and each of primary independent variable controlling for the confounding variables. The variable "annual family income" was found to be significantly associated with both MAS adherence and bodily pain.

Table 1: Demographics and Clinical Characteristics of Patient Population on Anti-retroviral Medication:

Demographic Variables	N(%)	
Age		
<35 years	39(29.77)	Mean=39.38 Median=38
35-41 years	45(34.35)	Min=24 Max=57
>41 years	47(35.88)	S.D.= 7.51
Years of Education		Mean=12.12 Median=12
<12 years	43(32.82)	Min=0 Max=22
≥12 years	88(67.18)	S.D.=2.85
Gender		
Female	35(26.92)	
Male	95(73.08)	
Race		
Whites	84(64.12)	
Non-whites:	47(35.88)	
-Native American		
-Hispanic		
-Asian		
-African American		
-others		
Living arrangement		
Alone	38(29.01)	
With others	93(70.99)	
Annual Household Income	75(60.48)	
<15,000	49 (39.52)	
> 15,000		
Insurance		
Some	110(83.97)	
None	21(16.03)	

Clinical Variable	**N(%)**	
Current Health Status		
Excellent-Good	100(72.99)	
Fair-Poor	37(27.01)	
Time Since Diagnosis		
<1month-2years	22(16.92)	
3-4 years	24(18.46)	
≥ 5 years	84(64.62)	
T-cell Count		
≤200	60(47.62)	
>200	66(52.38)	
IV Drug Use		
Never or not in past 6 months	126(96.18)	
Occasionally	5(3.82)	

Table 2: Demographics and Clinical Characteristics of Patient Population on Protease-inhibitor Medication:

Demographic Variables	N(%)	
Age		
<35 years	18(24.32)	Mean=39.37 Median=38
35-41 years	27(36.49)	Min=24 Max=57
>41 years	29(39.19)	S.D.= 7.44
Years of Education		Mean=12.88 Median=12
<12 years	17(22.97)	Min=0 Max=22
≥12 years	57(77.03)	S.D.=3.19
Gender		
Female	19(25.68)	
Male	55(74.32)	
Race		
Whites	57(77.03)	
Non-whites:	17 (22.97)	
-Native American		
-Hispanic		
-Asian		
-African American		
-others		
Living arrangement		
Alone	20(27.03)	
With others	54(72.97)	
Annual Household Income		
<15,000	43(57.33)	
>15,000	32(42.67)	
Insurance		
Some	9(12.16)	
None	65(87.84)	

Clinical Variable	N(%)	
Current Health Status		
Excellent-Good	62(80.52)	
Fair-Poor	15(19.48)	
Time Since Diagnosis		
<1month-2years	13(17.57)	
3-4 years	14(18.92)	
≥ 5 years	47(63.51)	
T-cell Count		
≤200	39(54.93)	
>200	32(45.07)	
IV Drug Use		
Never or not in past 6 months	72(97.40)	
Occasionally	2(2.60)	

Table 3: Self-reported Quality of life of patients on antiretroviral medication by medication adherence:

Primary Independent Variable	95% Self-reported Adherence		Medication Adherence Scale	
	Non-adherent N (%)	Adherent N (%)	Non-adherent N (%)	Adherent N (%)
Low Gen Health	6(13.64)	38(86.36)	26(55.32)	21(44.68)
High Gen Health	10(11.49)	77(88.51)	49(54.44)	41(45.56)
Low Bodily Pain	7(11.86)	52(88.14)	33(53.23)	29(46.77)
High Bodily Pain	9(12.50)	63(87.50)	42(56.00)	33(44.00)
Low Vitality	10(16.67)	50(83.33)	22(56.41)	17(43.59)
High Vitality	6(8.45)	65(91.55)	53(54.08)	45(45.92)
Low Mental Health	5(13.64)	30(86.36)	31(63.27)	18(36.73)
High Mental Health	11(12.49)	85(87.51)	44(50.00)	44(50.00)

Table 4: Self-reported Quality of life of patients on protease inhibitors by medication adherence:

Primary Independent Variable	95% Self-reported Adherence		Medication Adherence Scale	
	Non-adherent N (%)	Adherent N (%)	Non-adherent N (%)	Adherent N (%)
Low Gen Health	4(17.39)	19(82.61)	12(52.17)	11(47.83)
High Gen Health	8(15.69)	43(84.31)	28(51.85)	26(48.15)
Low Bodily Pain	6(17.65)	28(82.35)	20(58.82)	14(41.18)
High Bodily Pain	6(15.00)	34(85.00)	20(46.51)	23(53.49)
Low Vitality	7(35.00)	13(65.00)	13(65.00)	7(35.00)
High Vitality	5(9.26)	49(90.74)	27 (47.37)	30(52.63)
Low Mental Health	9(25.71)	26(74.29)	22(61.11)	14(38.89)
High Mental Health	3(7.69)	36(92.31)	18(43.90)	23(56.10)

Table 5: Mean and Range values of Quality of life domains (Primary IV) in patient on anti-retroviral drugs compared with general US population.

Patients on Anti-retroviral drugs:

QoL Scales	Mean	Std Deviation	Range
General Health	51.29	28.01	5-85
Bodily Pain	38.83	13.64	0-64
Vitality	31.91	13.27	0-55
Mental Health	31.76	9.93	0-60

General US Population:

QoL Scales	Mean	Std Deviation	Range
General Health	71.95	20.34	5-100
Bodily Pain	75.15	23.69	0-100
Vitality	60.86	20.96	0-100
Mental Health	74.74	18.05	0-100

Table 6: Mean and Range values of Quality of life domains (Primary IV) in patients on protease inhibitors compared with general US population.

Patients on Protease Inhibitors:

QoL Scales	Mean	Std Deviation	Range
General Health	50.81	27.46	5-85
Bodily Pain	39.08	13.33	0-64
Vitality	33.19	12.40	0-55
Mental Health	32.79	9.91	0-60

General US Population:

QoL Scales	Mean	Std Deviation	Range
General Health	71.95	20.34	5-100
Bodily Pain	75.15	23.69	0-100
Vitality	60.86	20.96	0-100
Mental Health	74.74	18.05	0-100

Table 7: Multiple Chi-Square Tests done on the Adherence to Antiretroviral Medications with 95% Cut off (Categorical Dependent Variable) and other Categorical Independent Variables.

Categorical I.V.	Non-Adherent N (%)	Adherent N (%)	Chi-square p-value
Age			
<35 years	7(17.95)	32(82.05)	2.7392
35-41 years	6(13.33)	39(86.67)	0.2543
>41 years	3(6.38)	44(93.62)	
Years of Education			
<12 years	5(11.63)	38(88.37)	0.0204
≥12 years	11(12.50)	77(87.50)	0.8862
Gender			
Male	11(11.58)	84(88.42)	0.1736
Female	5(14.29)	30(85.71)	0.6762
Insurance			
None	1(4.76)	20(95.24)	1.2952
Some	15(13.64))	95(86.36)	0.2551
Ethnicity			
Whites	15(17.76)	69(82.14)	6.9546
Non-Whites	1(2.13)	46(97.87)	0.0084*
Living Arrangement			
Alone	5(13.16)	33(86.84)	0.0442
With Others	11(11.83)	82(88.17)	0.8329
Annual Family Income			
<15,000	66(85.71)	9(14.29)	0.0017
≥15,000	43(88.42)	6(11.58)	0.9674
Time Since Diagnosis			
<1 month-2 years	2(9.09)	20(90.91)	
3-4 years	6(25.00)	18(75.00)	4.3973
≥ 5 years	8(9.52)	76(90.48)	0.1110
T-Cell Count			
≤ 200	5(8.33)	55(91.67)	1.3931
>200	10(15.15)	56(84.85)	0.2379
IV Drug Use			
No	1(20.00)	4(80.00)	0.2939
Yes	15(11.90)	111(88.10)	0.5877

* If $\alpha \leq 0.05$, then p- value is significant

Table 8: Multiple Chi-Square Tests done on the Adherence to Antiretroviral Medications using MAS (Categorical Dependent Variable) and other Categorical Independent Variables.

Categorical I.V.	Non-Adherent N (%)	Adherent N (%)	Chi-square p-value
Age			
<35 years	22(52.38)	20(47.62)	1.9000
35-41 years	23(48.94)	24(51.06)	0.3867
>41 years	30(62.50)	18(37.50)	
Years of Education			
<12 years	25(53.19)	22(46.81)	0.0697
≥12 years	50(55.56)	40(44.54)	0.7918
Gender			
Male	55(56.12)	43(43.18)	0.1349
Female	20(52.63)	18(47.37)	0.7134
Insurance			
None	12(55.55)	10(44.45)	0.0004
Some	63(54.78))	52(45.22)	0.9837
Ethnicity			
Whites	45(51.72)	42(48.28)	0.8788
Non-Whites	30(60.00)	20(40.00)	0.3488
Living Arrangement			
Alone	24(60.00)	16(40.00)	0.6298
With Others	51(52.58)	46(47.42)	0.4274
Annual Family Income			
<15,000	27(54.00)	23(46.00)	0.0356
≥15,000	44(55.70)	35(44.30)	0.8503
Time Since Diagnosis			
<1 month-2 years	12(52.17)	11(47.83)	0.1047
3-4 years	14(56.00)	11(44.00)	0.9490
≥ 5 years	48(55.81)	38(44.19)	
T-Cell Count			
≤ 200	42(60.87)	27(39.13)	1.7903
>200	30(49.18)	31(50.82)	0.1809
IV Drug Use			
No	5(100.00)	0(00.00)	4.2899
Yes	70(53.03)	62(46.97)	0.0383*

* If $\alpha \leq 0.05$, then p- value is significant

Table 9: Multiple Chi-Square Tests done on the Adherence to Protease Inhibitor Medications with 95% cut off (categorical Dependent Variable) and other Categorical Independent Variables.

Categorical I.V.	Non-Adherent N (%)	Adherent N (%)	Chi-square p-value
Age			
<35 years	5(27.78)	13(72.22)	2.4142
35-41 years	3(11.11)	24(88.89)	0.2991
>41 years	4(13.79)	25(86.21)	
Years of Education			
<12 years	4(23.53)	13 (76.47)	0.8688
≥12 years	8(14.04)	49(85.96)	0.3513
Gender			
Male	6(10.91)	49(89.09)	4.4407
Female	6(31.58)	13(68.42)	0.0351*
Insurance			
None	12(18.46)	53(81.54)	1.9831
Some	0(0.00)	9(100.00)	0.1591
Ethnicity			
Whites	1(5.88)	16(94.12)	1.7347
Non-Whites	11(19.30)	46(81.70)	0.1878
Living Arrangement			
Alone	8(14.81)	46(85.19)	0.2888
With Others	4(20.00)	16(80.00)	0.5910
Annual Family Income			
<15,000	8(19.51)	33(81.49)	0.6434
≥15,000	4(12.50)	28(87.50)	0.4225
Time Since Diagnosis			
<1 month-2 years	2(15.38)	11(84.62)	0.0674
3-4 years	2(14.29)	11(85.71)	0.9668
≥ 5 years	8(17.02)	39(82.98)	
T-Cell Count			
≤ 200	6(15.38)	33(84.62)	0.1417
>200	6(18.75)	26(81.25)	0.7066
IV Drug Use			
No	1(50.00)	1(50.00)	1.7268
Yes	11(15.28)	61(84.72)	0.1888

* If $\alpha \leq 0.05$, then p- value is significant

Table 10: Multiple Chi-Square Tests done on the Adherence to Protease Inhibitor Medications using MAS (categorical Dependent Variable) and other Categorical Independent Variables.

Categorical I.V.	Non-Adherent N (%)	Adherent N (%)	Chi-square p-value
Age			
<35 years	11(50.00)	11(50.00)	0.2168
35-41 years	15(55.56)	12(44.45)	0.8973
>41 years	14(50.00)	14(50.00)	
Years of Education			
<12 years	10(58.82)	7 (41.18)	0.4132
≥12 years	30(50.00)	30(50.00)	0.5204
Gender			
Male	28(49.12)	29(50.88)	1.1279
Female	12(63.16)	7(36.84)	0.2886
Insurance			
None	5(50.00)	5(50.00)	0.0175
Some	35(52.24)	32(47.76)	0.8948
Ethnicity			
Whites	28(48.28)	30(51.72)	1.2698
Non-Whites	12(63.16)	7(36.84)	0.2598
Living Arrangement			
Alone	12(54.55)	10(45.45)	0.0832
With Others	28(50.91)	27(49.09)	0.7729
Annual Family Income			
<15,000	26(60.47)	17(39.53)	2.0595
≥15,000	14(43.75)	18(56.25)	0.0151*
Time Since Diagnosis			
<1 month-2 years	7(46.67)	8(53.33)	0.2981
3-4 years	8(50.00)	8(50.00)	0.8615
≥ 5 years	25(54.35)	21(45.65)	
T-Cell Count			
≤ 200	16(42.11)	22(57.89)	4.4904
>200	24(66.67)	12(33.33)	0.0341*
IV Drug Use			
No	1(50.00)	1(50.00)	0.0031
Yes	39(52.00)	36(48.00)	0.9954

* If $\alpha \leq 0.05$, then p- value is significant

Table. 11: Multiple Chi-Square tests done on "General Health" (Categorical) and other Independent Variables (Categorical) for people on anti-retroviral medication:

Independent Variables	Poor Health N (%)	Good Health N (%)	Chi-square p-value
Age			
<35 years	13(33.33)	26(66.67)	0.0068
35-41 years	15(33.33)	30(66.67)	0.9966
>41 years	16(34.04)	31(65.96)	
Years of Education			
<12 years	19(44.19)	24 (55.81)	3.2233
≥12 years	25(28.41)	63(71.59)	0.0726
Gender			
Male	29(30.53)	66(69.47)	1.0370
Female	14(40.00)	21(60.00)	0.3085
Insurance			
None	10(47.62)	11(52.38)	2.2073
Some	34(30.91)	76(69.09)	0.1374
Ethnicity			
Whites	22(5.88)	62(94.12)	5.7434
Non-Whites	22(19.30)	25(81.70)	0.0166
Living Arrangement			
Alone	11(28.95)	27(71.05)	0.5167
With Others	33(35.48)	60(64.52)	0.4722
Annual Family Income			
<15,000	32(42.67)	43(57.33)	4.9097
≥15,000	8(16.33)	41(83.67)	0.0022*
IV Drug User			
No	3(60.00)	2(40.00)	1.6257
Yes	41(32.54)	85(67.46)	0.2023
Time Since Diagnosis			
0-2 years	6(27.27)	16(72.73)	0.5849
3-4 years	9(37.50)	15(62.50)	0.7464
≥5 years	29(34.52)	55(65.48)	
T-Cell Count			
≤ 200	21(31.82)	45(68.18)	0.0329
>200	20(33.33)	40(66.67)	0.8561

* If $\alpha \leq 0.05$, then p- value is significant

Table. 12: Multiple Chi-Square tests done on "Bodily Pain" (Categorical) and other Independent Variables (Categorical) for people on anti-retroviral medication:

Independent Variables	Poor Health N (%)	Good Health N (%)	Chi-square p-value
Age			
<35 years	14(35.90)	25(64.10)	2.0540
35-41 years	21(46.67)	24(53.33)	0.3581
>41 years	24(51.06)	23(48.94)	
Years of Education			
<12 years	22(51.16)	21 (48.84)	0.9700
≥12 years	37(42.05)	51(57.95)	0.3247
Gender			
Male	44(46.32)	51(53.68)	0.1234
Female	15(42.86)	20(57.14)	0.7253
Insurance			
None	11(52.38)	10(47.62)	0.5447
Some	48(30.91)	62(69.09)	0.4605
Ethnicity			
Whites	32(38.10)	52(61.90)	4.5593
Non-Whites	27(57.45)	20(42.55)	0.0327*
Living Arrangement			
Alone	19(50.00)	19(50.00)	0.5324
With Others	42(43.01)	53(56.99)	0.4656
Annual Family Income			
<15,000	44(58.67)	31(41.33)	13.9781
≥15,000	12(24.49)	37(75.51)	0.0002
IV Drug User			
No	2(40.00)	3(60.00)	0.0533
Yes	57(45.24)	69(54.76)	0.8174
Time Since Diagnosis			
0-2 years	8(36.36)	14(63.64)	2.0461
3-4 years	9(37.50)	15(62.50)	0.3595
≥5 years	42(50.00)	42(50.00)	
T-Cell Count			
≤ 200	29(48.33)	31(51.67)	0.4430
>200	28(48.33)	38(57.67)	0.5057

* If $\alpha \leq 0.05$, then p- value is significant

Table. 13: Multiple Chi-Square tests done on "Vitality/Fatigue" (Categorical) and other Independent Variables (Categorical) for people on anti-retroviral medication:

Independent Variables	Poor Health N (%)	Good Health N (%)	Chi-square p-value
Age			
<35 years	19(48.72)	20(51.28)	0.8536
35-41 years	22(48.89)	23(51.11)	0.6526
>41 years	19(40.43)	28(59.57)	
Years of Education			
<12 years	22(51.16)	21 (48.84)	0.7412
≥12 years	38(43.18)	50(56.82)	0.3893
Gender			
Male	36(37.89)	59(62.11)	7.8997
Female	23(65.71)	12(34.29)	0.0047*
Insurance			
None	9(46.36)	12(53.67)	0.0873
Some	51(42.86)	59(57.14)	0.7676
Ethnicity			
Whites	39(46.43)	45(53.57)	0.0371
Non-Whites	21(44.68)	26(55.32)	0.8473
Living Arrangement			
Alone	15(39.47)	23(60.53)	0.8634
With Others	45(48.39)	48(51.61)	0.3528
Annual Family Income			
<15,000	42(56.00)	33(44.00)	6.4888
≥15,000	16(32.65)	33(67.35)	0.0109*
IV Drug User			
No	4(80.00)	1(20.00)	2.4492
Yes	56(44.44)	70(55.56)	0.1176
Time Since Diagnosis			
0-2 years	11(27.27)	11(72.73)	1.4043
3-4 years	13(37.50)	11(62.50)	0.4995
≥5 years	35(41.67)	49(58.33)	
T-Cell Count			
≤ 200	26(39.39)	40(60.61)	1.9108
>200	31(51.67)	29(48.33)	0.1669

* If $\alpha \leq 0.05$, then p- value is significant

Table. 14: Multiple Chi-Square tests done on "Mental Health" (Categorical) and other Independent Variables (Categorical) for people on anti-retroviral medication:

Independent Variables	Poor Health N (%)	Fair Health N (%)	Good Health N (%)	Chi-square p-value
Age				
<35 years	12(30.71)	22(56.41)	5(12.82)	4.1061
35-41 years	12(26.67)	21(46.67)	12(26.67)	0.1283
>41 years	11(23.40)	20(42.55)	16(34.04)	
Years of Education				
<12 years	11(25.58)	21 (48.84)	11 (25.58)	0.0089
≥12 years	24(27.27)	42(47.73)	22(25.00)	0.9248
Gender				
Male	21(22.11)	48(50.53)	26(27.37)	2.7903
Female	14(40.00)	14(40.00)	7(20.00)	0.0948
Insurance				
None	7(33.33)	10(47.62)	4(19.05)	0.4162
Some	28(25.45)	53(48.18)	29(26.36)	0.5188
Ethnicity				
Whites	22(26.19)	41(48.81)	21(25.00)	0.0070
Non-Whites	13(27.66)	22(46.81)	12(25.53)	0.9333
Living Arrangement				
Alone	12(31.58)	18(47.37)	8(21.05)	1.5111
With Others	23(24.73)	45(48.39)	25(26.88)	0.2191
Annual Family Income				
<15,000	22(29.33)	33(44.00)	20(26.67)	0.8399
≥15,000	9(18.37)	28(57.14)	12(24.49)	0.3594
IV Drug User				
No	0(00.00)	5(100.00)	0(00.00)	1.2218
Yes	35(27.78)	58(46.03)	33(26.19)	0.2690
Time Since Diagnosis				
0-2 years	7(31.82)	9(40.91)	6(27.27)	0.4131
3-4 years	6(25.00)	13(54.17)	5(20.83)	0.8134
≥5 years	21(25.00)	41(48.81)	22(26.19)	
T-Cell Count				
≤ 200	21(31.82)	31(46.97)	14(21.21)	1.5551
>200	13(21.67)	31(51.67)	16(26.67)	0.2124

* If $\alpha \leq 0.05$, then p- value is significant

Table. 15: Multiple Chi-Square tests done on "General Health" (Categorical) and other Independent Variables (Categorical) for people on Protease Inhibitors medication:

Independent Variables	Poor Health N (%)	Good Health N (%)	Chi-square p-value
Age			
<35 years	8(44.44)	10(55.56)	2.0009
35-41 years	7(25.93)	20(74.07)	0.3667
>41 years	8(27.59)	21(72.41)	
Years of Education			
<12 years	9(52.94)	8 (47.06)	4.9235
≥12 years	14(24.56)	43(75.44)	0.0265*
Gender			
Male	16(29.09)	39(70.91)	0.3961
Female	7(36.84)	12(63.16)	0.5291
Insurance			
None	3(33.33)	6(66.67)	0.0243
Some	20(30.77)	45(69.23)	0.8762
Ethnicity			
Whites	15(26.32)	42(73.68)	2.6303
Non-Whites	8(47.06)	9(52.94)	0.1048
Living Arrangement			
Alone	5(25.00)	15(75.00)	0.4731
With Others	18(33.33)	36(66.67)	0.4915
Annual Family Income			
<15,000	16(39.02)	25(60.98)	3.5088
≥15,000	6(18.75)	26(81.25)	0.0610
IV Drug User			
No	1(50.00)	1(50.00)	0.3435
Yes	22(30.56)	50(69.44)	0.5578
Time Since Diagnosis			
0-2 years	5(38.46)	8(61.54)	0.7277
3-4 years	5(35.71)	9(64.29)	0.6950
≥5 years	13(27.66)	34(72.34)	
T-Cell Count			
≤ 200	10(31.25)	22(68.75)	0.0782
>200	11(28.21)	28(71.79)	0.7797

* If $\alpha \leq 0.05$, then p- value is significant

Table. 16: Multiple Chi-Square tests done on "Bodily Pain" (Categorical) and other Independent Variables (Categorical) for people on Protease Inhibitor medication:

Independent Variables	Poor Health N (%)	Good Health N (%)	Chi-square p-value
Age			
<35 years	10(55.56)	8(44.44)	0.9784
35-41 years	11(40.74)	16(59.26)	0.6131
>41 years	13(44.83)	16(55.17)	
Years of Education			
<12 years	9(52.94)	18 (47.06)	0.4348
≥12 years	25(43.86)	32(56.14)	0.5096
Gender			
Male	24(43.64)	31(56.36)	0.4601
Female	10(52.63)	9(47.37)	0.4976
Insurance			
None	4(44.44)	5(55.56)	0.0093
Some	20(46.15)	35(53.85)	0.9232
Ethnicity			
Whites	24(42.11)	33(57.89)	1.4737
Non-Whites	10(58.82)	7(41.18)	0.2248
Living Arrangement			
Alone	9(45.00)	11(55.00)	0.0099
With Others	25(46.30)	29(53.70)	0.9208
Annual Family Income			
<15,000	25(60.98)	16(39.02)	7.7947
≥15,000	9(28.13)	23(71.88)	0.0052*
IV Drug User			
No	1(50.00)	1(50.00)	0.0136
Yes	33(45.83)	39(54.17)	0.9072
Time Since Diagnosis			
0-2 years	4(30.77)	9(69.23)	1.4675
3-4 years	7(50.00)	7(50.00)	0.4801
≥5 years	23(48.94)	24(51.06)	
T-Cell Count			
≤ 200	15(46.88)	17(53.13)	0.0766
>200	17(43.59)	22(56.41)	0.7819

* If $\alpha \leq 0.05$, then p- value is significant

Table. 17: Multiple Chi-Square tests done on "Vitality/Fatigue" (Categorical) and other Independent Variables (Categorical) for people on Protease Inhibitor medication:

Independent Variables	Poor Health N (%)	Good Health N (%)	Chi-square p-value
Age			
<35 years	8(44.44)	10(55.56)	3.6753
35-41 years	6(22.22)	21(77.78)	0.1592
>41 years	6(20.69)	23(79.31)	
Years of Education			
<12 years	6(35.29)	11 (64.71)	0.7648
≥12 years	14(24.56)	43(75.44)	0.3818
Gender			
Male	12(21.82)	43(78.18)	2.9469
Female	8(42.11)	11(57.89)	0.0860
Insurance			
None	3(33.33)	6(66.67)	0.2066
Some	17(26.15)	48(73.85)	0.6494
Ethnicity			
Whites	15(26.32)	42(73.68)	0.0636
Non-Whites	5(29.41)	12(70.59)	0.8008
Living Arrangement			
Alone	6(30.00)	14(70.00)	0.1228
With Others	14(25.93)	40(74.07)	0.7260
Annual Family Income			
<15,000	14(34.15)	27(65.85)	2.1418
≥15,000	6(18.75)	26(81.25)	0.1433
IV Drug User			
No	1(50.00)	1(50.00)	0.5509
Yes	19(26.39)	53(73.61)	0.4583
Time Since Diagnosis			
0-2 years	6(46.15)	7(53.85)	3.2163
3-4 years	4(28.57)	10(71.43)	0.2003
≥5 years	10(21.28)	37(78.72)	
T-Cell Count			
≤ 200	7(21.88)	25(78.13)	0.1406
>200	13(33.33)	26(66.67)	0.2855

* If $\alpha \leq 0.05$, then p- value is significant

Table. 18: Multiple Chi-Square tests done on "Mental Health" (Categorical) and other Independent Variables (Categorical) for people on Protease Inhibitor medication:

Independent Variables	Poor Health N (%)	Good Health N (%)	Chi-square p-value
Age			
<35 years	12(66.67)	6(33.33)	
35-41 years	11(40.74)	16(59.26)	3.5822
>41 years	12(41.38)	17(58.62)	0.1668
Years of Education			
<12 years	9(52.94)	8 (47.06)	0.2820
≥12 years	26(45.61)	31(54.39)	0.5954
Gender			
Male	22(40.00)	33(60.00)	4.5761
Female	13(68.42)	6(31.58)	0.0324*
Insurance			
None	3(33.33)	6(33.67)	0.8013
Some	32(49.23)	33(50.77)	0.3706
Ethnicity			
Whites	29(50.88)	28(49.12)	1.2756
Non-Whites	6(35.29)	11(64.71)	0.2587
Living Arrangement			
Alone	11(55.00)	9(45.00)	0.6524
With Others	24(44.44)	30(55.56)	0.4193
Annual Family Income			
<15,000	21(51.22)	20(48.78)	04018
≥15,000	14(43.75)	18(56.25)	0.5262
IV Drug User			
No	1(50.00)	1(50.00)	0.0060
Yes	34(47.22)	38(52.78)	0.9381
Time Since Diagnosis			
0-2 years	7(53.85)	6(46.15)	1.0278
3-4 years	5(35.71)	9(64.29)	0.5981
≥5 years	23(48.94)	24(51.06)	
T-Cell Count			
≤ 200	15(46.88)	17(53.13)	0.0239
>200	19(48.72)	20(51.28)	0.8771

* If $\alpha \leq 0.05$, then p- value is significant

Table. 19: Logistic Regression Analysis between Adherence to Anti-retroviral Medication with a 95% cut-off (Dependent Variable) and Independent Variables of Primary Interest

Independent Variables	Odds ratio		Para estimate	Wald p-value
	Point estimate	95% C.I.		
General Health (high=1, low=0)	0.778	0.19-3.10	-0.251	0.7219
Gender (M=1, F=0)	0.753	0.21-3.60	-0.284	0.6540
Education (≥12yrs=1, <12yrs=0)	1.056	0.28-3.86	-0.054	0.9344
Family Income (<15,000=1, ≥15,000=0)	0.792	0.212-2.87	-0.233	0.7225
Ref-Low diag time (<2 yrs)				
Med diag time (3-4yrs=1, else=0)	0.330	0.05-1.98	0.109	0.2258
High diag time (≥5 yrs=1, else=0)	1.425	0.25-7.84	0.354	0.6840
T-cell Count (≤200=1, >200=0)	1.458	0.42-4.99	0.376	0.5487
Bodily Pain (high=1, low=0)	0.972	0.28-3.31	-0.027	0.9644
Ref-Low age (<35yrs)				
Med age (35-41yrs=1, else=0)	1.153	0.32-4.04	0.142	0.8241
High age (>41yrs=1, else=0)	3.401	0.61-18.78	0.223	0.1600
Family Income (<15,000=1, ≥15,000=0)	1.103	0.29-3.61	0.036	0.9543
T-cell Count (≤200=1, >200=0)	1.387	0.41-4.66	0.327	0.5966
Vitality/Fatigue (high=1, low=0)	2.421	0.66-8.81	0.884	0.1799
Gender (M=1, F=0)	0.940	0.26-3.38	-0.061	0.9249
Family Income (<15,000=1, ≥15,000=0)	1.041	0.30-3.61	0.041	0.9479
Ref-Low diag time (<2 yrs)				
Med diag time (3-4yrs=1, else=0)	0.323	0.05-1.94	-1.131	0.2168
High diag time (≥5 yrs=1, else=0)	1.311	0.23-7.36	0.270	0.7584
T-cell Count (≤200=1, >200=0)	1.630	0.46-5.68	0.488	0.4424
Mental Health				
Ref-High MH				
Low MH =1, else=0	0.289	0.29-2.83	-1.241	0.2863
Med MH =1, else=0	0.228	0.27-1.94	-1.478	0.1766
Ref-Low age (<35yrs)				
Med age (35-41yrs=1, else=0)	1.045	0.29-3.66	0.043	0.9457
High age (>41yrs=1, else=0)	2.837	051-15.58	1.048	0.2307
Family Income (<15,000=1, ≥15,000=0)	0.973	0.29-3.21	-0.012	0.9838
T-cell Count (≤200=1, >200=0)	1.490	0.43-5.01	0.398	0.5257

* If $\alpha \leq 0.05$, then p- value is significant

Table. 20: Logistic Regression Analysis between Adherence to Protease Inhibitors with a 95% cut-off (Dependent Variable) and Independent Variables of Primary Interest

Independent Variables	Odds ratio		Para estimate	Wald p-value
	Point estimate	95% C.I.		
General Health (high=1, low=0)	1.788	0.36-8.75	0.581	0.4735
Gender (M=1, F=0)	0.214	0.04-0.96	-1.539	0.0451
Race (whites=1, others=0)	0.200	.02-1.94	-1.608	0.1659
Living Status (alone=1, other=0)	0.412	0.08-2.11	-0.886	0.2855
Family Income (<15,000=1, ≥15,000=0)	0.870	0.18-4.16	-0.136	0.8658
T-cell Count (≤200=1, >200=0)	1.252	0.30-5.19	0.225	0.5764
Bodily Pain (high=1, low=0)	0.999	0.26-3.73	-0.001	0.9986
Living Status (alone=1, other=0)	0.709	0.17-2.96	-0.343	0.6378
Family Income (<15,000=1, ≥15,000=0)	0521	0.12-2.17	-0.652	0.3709
T-cell Count (≤200=1, >200=0)	1.543	0.39-5.98	0.433	0.5307
Vitality/ Fatigue (high=1, low=0)	4.482	1.10-18.13	1.500	0.0354
Gender (M=1, F=0)	0.310	0.07-1.30	-1.171	0.1108
Race (whites=1, others=0)	0.185	0.19-1.83	-1.688	0.1469
Education (≥12yrs=1, <12yrs=0)	1.954	0.42-9.02	0.670	0.3901
Family Income (<15,000=1, ≥15,000=0)	0.921	0.21-4.01	-0.082	0.9126
Mental Health (high=1, low=0)	3.382	0.79-14.38	1.218	0.0990
Gender (M=1, F=0)	0.327	0.08-1.26	-1.119	0.1045
T-cell Count (≤200=1, >200=0)	1.175	0.31-4.42	0.161	0.8117

* If $\alpha \leq 0.05$, then p- value is significant

Table. 21: Logistic Regression Analysis between Adherence to Anti-retroviral drugs using MAS Scale and Independent Variables of Primary Interest

Independent Variables	Odds ratio		Para estimate	Wald p-value
	Point estimate	95% C.I.		
General Health (high=1, low=0))	0.948	0.41-2.18	-0.053	0.9008
Race (whites=1, others=0)	1.246	0.56-2.76	0.219	0.5889
Family Income (<15,000=1, ≥15,000=0)	0.827	0.38-1.78	-0.189	0.6298
T-cell Count (≤200=1, >200=0)	1.743	0.83-3.64	0.555	0.1392
Bodily Pain (high=1, low=0)	0.623	0.28-1.36	-0.472	0.2371
Family Income (<15,000=1, ≥15,000=0)	0.687	0.30-1.53	-0.375	0.3593
T-cell Count (≤200=1, >200=0)	1.726	0.82-3.80	0.545	0.1458
Vitality/ Fatigue (high=1, low=0)	1.136	0.52-4.47	0.127	0.7473
T-cell Count (≤200=1, >200=0)	1.625	0.80-3.27	0.485	0.1744
Mental Health (high=1, low=0)	1.836	0.81-4.13	0.607	0.1421
Ref-Low age (<35yrs)				
Med age (35-41yrs=1, else=0)	1.019	0.40-2.54	0.019	0.9672
High age (>41yrs=1, else=0)	0.542	0.20-1.44	-0.613	0.2209
Living Status (alone=1, other=0)	0.744	0.32-1.72	-0.295	0.4913
Family Income (<15,000=1, ≥15,000=0)	0.841	0.39-1.80	-0.173	0.6567
T-cell Count (≤200=1, >200=0)	1.891	0.87-4.01	0.636	0.1075

* If $\alpha \leq 0.05$, then p- value is significant

Table. 22: Logistic Regression Analysis between Adherence to Protease Inhibitors using MAS Scale and Independent Variables of Primary Interest

Independent Variables	Odds ratio		Para estimate	Wald p-value
	Point estimate	95% C.I.		
General Health (high=1, low=0)	0.962	0.29-3.19	-0.038	0.9499
Ref-Low age (<35yrs)				
Med age (35-41yrs=1, else=0)	1.013	0.28-3.58	0.013	0.9839
High age (>41yrs=1, else=0)	0.739	0.20-2.67	-0.302	0.6453
Race (whites=1, others=0)	2.719	0.74-9.93	1.000	0.1305
T-cell Count (≤200=1, >200=0)	3.500	1.26-9.71	1.252	0.0161
Bodily Pain (high=1, low=0)	1.241	0.42-3.59	0.2163	0.6900
Gender (M=1, F=0)	0.797	0.23-3.72	-0.2263	0.7184
Race (whites=1, others=0)	2.241	0.62-7.71	0.8070	0.2004
Family Income (<15,000=1, ≥15,000=0)	0.399	0.13-1.20	-0.9184	0.1021
T-cell Count (≤200=1, >200=0)	3.381	1.14-10.03	1.2183	0.0281
Vitality/Fatigue (high=1, low=0)	2.468	0.67-9.02	0.903	0.1720
Ref-Low age (<35yrs)				
Med age (35-41yrs=1, else=0)	0.591	0.15-2.29	-0.526	0.4466
High age (>41yrs=1, else=0)	0.374	0.08-1.16	-0.984	0.1868
Race (whites=1, others=0)	2.248	0.60-8.35	0.810	0.2238
Family Income (<15,000=1, ≥15,000=0)	0.311	0.10-0.96	-1.168	0.0423
T-cell Count (≤200=1, >200=0)	4.884	1.47-16.18	1.586	0.0095
Mental Health (high=1, low=0)	2.849	0.92-8.73	1.046	0.0690
Ref-Low age (<35yrs)				
Med age (35-41yrs=1, else=0)	0.542	0.27-1.22	-0.613	0.3872
High age (>41yrs=1, else=0)	0.336	0.14-1.02	-1.090	0.1520
Race (whites=1, others=0)	2.393	0.64-9.12	0.872	0.2032
Education (≥12yrs=1, <12yrs=0)	1.823	0.49-6.70	0.600	0.3663
Family Income (<15,000=1, ≥15,000=0)	0.274	0.08-0.87	-1.295	0.0290
T-cell Count (≤200=1, >200=0)	4.931	1.50-16.44	1.595	0.0094

* If $\alpha \leq 0.05$, then p- value is significant

DISCUSSION

Adherence is an important factor to achieve the best outcomes in HIV disease management [14]. Strict adherence to medication regimen in HIV therapy is important for maintaining low viral loads. The purpose of this study was to assess HRQoL as a predictor of medication adherence. Medication adherence scale and percentage adherence were used as measures of adherence in this study. A rather strict 95% cut-off mark was selected to define adherence based on recent studies and literature review [17, 45]. Given the complexities of HIV therapy and viral response, the alternative to strict adherence for many patients could be death.

Various factors affect patient's ability and desire to adhere to medication regimens. Two demographic factors, namely "gender" and "annual family income", were found to be associated with 95% adherence and MAS adherence respectively in patients taking protease inhibitors. Males reported more adherence compared to females. This could be because HIV positive females might feel more depressed, anxious, and distressed than HIV positive males [46]. Similarly, patients with high family income reported more adherence compared to patients with low family income. This association is difficult to interpret, as the cost per prescription is not known. Although wealthy patients have more financial access to medications then low-income patients, this advantage is offset by prescription coverage available to poor patients through Medicaid. No other meaningful association was found between any other demographic variable (age, years of education, living status, ethnicity, duration of

illness, etc) and medication adherence in anti-retroviral or protease inhibitor drugs. This is consistent with previous studies and research [39, 47]. Any inconsistency could be explained by study limitations discussed later.

In recent years, interest has increased in the measurement of HRQoL, in relation to health-care. In a chronic disease like HIV, the patients' physical and mental health is significantly affected. The opportunistic infections experienced by AIDS patients often have detrimental effect on their physical and mental health. Fatigue, emotional and psychological stress is often associated with HIV infection. In this study, many demographic and clinical factors were found to be associated with HRQoL domains.

For patients on anti-retroviral medications: Physical health domains like "general health" and "bodily pain" were significantly associated with "ethnicity". Whites reported better "general health" and lower "bodily pain" than non-whites. Patients with high annual family income reported better general health and vitality that patients with annual family income of less than $15,000. This is consistent with Center for Disease Control findings [48]. Also, males reported better vitality and low fatigue than females. Previous research also confirms similar difference in perceived quality of life between males and females [33, 49].

For patients on protease inhibitors: "Years of education" and "annual family income" were significantly associated with both "general health" and "bodily pain". Patients with higher level of education and annual family income of more than

$15,000 reported better general health and low bodily pain than their counterparts. This could be because educated people are less likely to adopt risk-taking behavior such as smoking, drugs, and unprotected sex [48]. Also, education and family income increases self-esteem and confidence, life opportunities and social support. It allows people to adopt healthier lifestyle and seek better treatment. As with patients on anti-retroviral medications, gender was found to be significantly associated with "mental health" in patients on protease inhibitors.

The patients in this study scored significantly lower on all domains of HRQoL than general US population (Results: Table 5 & 6). This suggests low HRQoL of HIV patients. The results of this study indicate that "vitality/fatigue" is a significant predictor of medication adherence in patients taking protease inhibitors. However, no other domain of HRQoL showed any meaningful association with medication adherence. Patients with high vitality score were found to be more adherent and patients with low vitality score were found to be less adherent to their medication. This is consistent with the results of previous studies, which suggest association of poor mental health, particularly depression, with medication adherence [39]. Although, other domains of quality of life, especially physical health, were expected to be associated with medication adherence, the result of the study does not confirm the same. The limitations of the study could have affected results significantly.

Limitations:

Measurement of adherence: There is no way to measure adherence in the outpatient setting with absolute precision and accuracy [50]. Although no measure of adherence is perfect, self-reporting method, often, tends to overestimate medication adherence. Recall bias and patients subjectivity often influence patients responses to questions. This could lead to inaccurate statistical analysis and inaccurate results.

Sample: A sample population of 145, although fairly large, could have led to sampling errors. Sex, IV drug users and race distribution was not typical of HIV population. The center for Disease control and prevention (CDC) reported that 18% were women; in this sample 27% of patients were women. The CDC reported 35% as intravenous drug users; in this sample only 4.3% reported IV drug use. The CDC reported 41% White, 38% Black, 19% Latinos and 1% Asians. Many variables were found to be skewed. Statistical techniques were used to rectify this shortcoming.

The data was collected in 96-97, when combination therapies were recently introduced. This study precedes many currently available anti-retroviral drugs and HAART. Thus, the results of this study may not be generalizable to today.

CONCLUSION

Though overestimation of self-reported medication adherence cannot be ruled out, patients in this study group reported good level of adherence. Approximately 85% of the patients were adherent based on 95% cut-off limit. This high level of adherence is necessary for the successful management of HIV. In-contrast, MAS showed that only 55% of the patients were adherent to their medication. One of the mental health domains i.e. vitality/fatigue was found to be significantly associated with 95% self reported adherence in patients taking protease inhibitors. This study confirms that patients with good mental health are more likely to adhere to their medication regimen, using 95% cut-off adherence in patients taking protease inhibitors.

All HIV patients scored considerably low on all health domains when compared with US general population. Interestingly, HIV patients scored lower on all domains when compared with medical conditions like diabetes, hypertension, arthritis, CHF, and clinical depression [33]. These scores suggest that HIV patients suffer from strong physical and mental impairments, and have low quality of life. Stable demographic factors, like sex, race, years of education, and annual income were found to predict HRQoL. These factors precede medication adherence. The society as well as public health professionals should take a note of this, designing new policies and interventions to improve patient's HRQoL.

Many clinicians and clinical investigators now recognise the importance of incorporating HRQoL into their routine clinical practice and into clinical studies. One of the aims of treating patients is to make them feel better and to function better in their day-to-day activities. This would positively change their beliefs and perceptions about disease and importance of treatment. The findings of this study could help us in designing interventions to enhance adherence. Improving quality of life, particularly controlling depression and improving vitality, appears to be the key for better medication adherence.

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APPENDIX

/*SAS PROGRAM TO MEASURE ADHERENCE USING 95% CUT-OFF LIMTI FOR PATIENTS ON ANTI-RETROVIRAL DRUGS*/

```
options nocenter linesize=72;
libname rakesh 'c:\Windows\Desktop\rakesh';
data rakesh1;
set rakesh.hivsurv;
if qii1x=  'bactrim' then qii1x2a=0;
if qii1x=  'acyclovir' then qii1x2a=0;
if qii1x=  'pentamidine' then qii1x2a=0;
if qii1x=  'zoloft' then qii1x2a=0;
if qii1x=  'crixivan' then qii1x2a=0;
if qii1x=  'ritonavir' then qii1x2a=0;
if qii1x=  'saquinavir' then qii1x2a=0;
if qii1x2a=0 then qii1x14=.;
if qii1x14=99 then qii1x2a=.;
if qii1x2a=1 then qii1x2a=24;
if qii1x2a=2 then qii1x2a=36;
if qii1x2a=3 then qii1x2a=45;
if qii1x2a=4 then qii1x2a=90;
if qii1x2a=5 then qii1x2a=180;
if qii1x2a=6 then qii1x2a=270;
if qii1x2a=7 then qii1x2a=360;
if qii1x2a=8 then qii1x2a=450;

med1= qii1x14/qii1x2a;
comp1=1-med1;
percomp1=comp1*100;

if qii2x= 'dapsone' then qii2x2a=0;
if qii2x= 'leucovorin' then qii2x2a=0;
if qii2x= 'ms contin' then qii2x2a=0;
if qii2x= 'bactrim' then qii2x2a=0;
if qii2x= 'theodur' then qii2x2a=0;
if qii2x= 'crixivan' then qii2x2a=0;
if qii2x= 'saquinavir' then qii2x2a=0;
if qii2x= 'indinavir' then qii2x2a=0;
if qii2x= 'ritonavir' then qii2x2a=0;

if qii2x2a=0 then qii2x14=.;
if qii2x14=99 then qii2x2a=.;
if qii2x2a=1 then qii2x2a=24;
if qii2x2a=2 then qii2x2a=36;
if qii2x2a=3 then qii2x2a=45;
```

```
if qii2x2a=4 then qii2x2a=90;
if qii2x2a=5 then qii2x2a=180;
if qii2x2a=6 then qii2x2a=270;
if qii2x2a=7 then qii2x2a=360;
if qii2x2a=8 then qii2x2a=450;

med2= qii2x14/qii2x2a;
comp2=1-med2;
percomp2=comp2*100;

if qii3x= 'acyclovir' then qii3x2a=0;
if qii3x= 'bactrim' then qii3x2a=0;
if qii3x= 'biaxin' then qii3x2a=0;
if qii3x= 'clotrimazole' then qii3x2a=0;
if qii3x= 'compazine' then qii3x2a=0;
if qii3x= 'dapsone' then qii3x2a=0;
if qii3x= 'diltiazem' then qii3x2a=0;
if qii3x= 'fluconazole' then qii3x2a=0;
if qii3x= 'mellaril' then qii3x2a=0;
if qii3x= 'minocycline' then qii3x2a=0;
if qii3x= 'motrin' then qii3x2a=0;
if qii3x= 'oxandrin' then qii3x2a=0;
if qii3x= 'vasotec' then qii3x2a=0;
if qii3x= 'zantac' then qii3x2a=0;
if qii3x= 'zovirax' then qii3x2a=0;
if qii3x= 'crixivan' then qii3x2a=0;
if qii3x= 'indinavir' then qii3x2a=0;
if qii3x= 'invirase' then qii3x2a=0;

if qii3x= 'norvir' then qii3x2a=0;
if qii3x= 'ritonavir' then qii3x2a=0;
if qii3x= 'saquinavir' then qii3x2a=0;

if qii3x2a=0 then qii3x14=.;
if qii3x14=99 then qii3x2a=.;
if qii3x2a=1 then qii3x2a=24;
if qii3x2a=2 then qii3x2a=36;
if qii3x2a=3 then qii3x2a=45;
if qii3x2a=4 then qii3x2a=90;
if qii3x2a=5 then qii3x2a=180;
if qii3x2a=6 then qii3x2a=270;
if qii3x2a=7 then qii3x2a=360;
if qii3x2a=8 then qii3x2a=450;

med3= qii3x14/qii3x2a;
comp3=1-med3;
```

```
percomp3=comp3*100;
if percomp1=. then percomp1=0;
if percomp2=. then percomp2=0;
if percomp3=. then percomp3=0;

totcomp= percomp1+percomp2+percomp3;

if percomp1=0 and percomp2 NE 0 and percomp3 NE 0 then totcomp= totcomp/2;
if percomp1 NE 0 and percomp2= 0 and percomp3 NE 0 then totcomp= totcomp/2;
if percomp1 NE 0 and percomp2 NE 0 and percomp3= 0 then totcomp=totcomp/2;
if percomp1 NE 0 and percomp2 NE 0 and percomp3 NE 0 then totcomp=totcomp/3;
if percomp1 NE 0 and percomp2=0 and percomp3= 0 then totcomp= totcomp;
if percomp1=0 and percomp2 NE 0 and percomp3= 0 then totcomp= totcomp;
if percomp1=0 and percomp2=0 and percomp3 NE 0 then totcomp= totcomp;
if totcomp=0 then delete;

compb=totcomp GE 95;
noncompb=totcomp LT 95;

/*PROGRAM TO CATEGORIZE INDEPENDENT VARIABLES*/
if qi4=1 then qi4=1;
else if qi4=2 or qi4=3 or qi4=4 or qi4=5 or qi4=6 then qi4=0;
if qi5=0 then qi5=.;
if qi29= 1 or qi29=2 or qi29=3 or qi29=4 then qi29=1;
if qi29=5 then qi29=2;
if qi29=6 then qi29=3;
if qi29=0 then qi29=.;
if qi31=0 then qi31=.;
else if qi31= 1 or qi31=2  then qi31=0;
else if qi31= 3 or  qi31=4 then qi31=1;
if qvi52= 0 or qvi52=1 then qvi52=1;
else if qvi52= 2 or qvi52=3 then qvi52=0;
if qi1 GE 24 and qi1 Lt 35 then qi1=1;
else if qi1 GE 35 and qi1 LE 41 then qi1=2;
else if qi1 GT 41 then qi1=3;
if qi5 LT 12 then qi5=0;
else if qi5 GE 12 then qi5=1;
if qi19=0 then qi19=.;
if qi19=1 then qi19=1;
if qi19=2 then qi19=0;
if qi19=3 then qi19=0;
if qi19=4 then qi19=0;
if qi19=5 then qi19=0;
if qi18a=1 then qi18a=0;
if qi18a=2 then qi18a=1;
if qi7=1 then qi7=1;
```

```
else if qi7=2 then qi7=0;
sex=.;
if qi2='f' then sex=0;
if qi2='m' then sex=1;
if qi2=0 then sex=.;

Mqi1=.;
if qi1=2 then Mqi1=1;
else if qi1=1 or qi1=3 then Mqi1=0;
Hqi1=.;
if qi1=3 then Hqi1=1;
else if qi1=2 or qi1=1 then Hqi1=0;

Mqi29=.;
if qi29=2 then Mqi29=1;
else if qi29=1 or qi29=3 then Mqi29=0;
Hqi29=.;
if qi29=3 then Hqi29=1;
else if qi29=1 or qi29=2 then Hqi29=0;

/*PROGRAM TO MEASURE HRQoL*/
if qi3=1 then qi3=5.0;
if qi3=2 then qi3=4.4;
if qi3=3 then qi3=3.4;
if qi3=4 then qi3=2.0;
if qi3=5 then qi3=1.0;
if qi24=1 then qi24=6.0;
if qi24=2 then qi24=5.4;
if qi24=3 then qi24=4.2;
if qi24=4 then qi24=3.1;
if qi24=5 then qi24=2.2;
if qi24=6 then qi24=1.0;
if qi25=0 then qi25=.;
if qi25=1 and qi24=99 then qi25=6.0;
if qi25=2 and qi24=99 then qi25=4.75;
if qi25=3 and qi24=99 then qi25=3.5;
if qi25=4 and qi24=99 then qi25=2.25;
if qi25=5 and qi24=99 then qi25=1.0;
if qi25=1 and qi24=1 then qi25=6.0;
if qi25=1 and qi24 GE 2 and qi24 LE 6 then qi25=5;
if qi25=2 and qi24 GE 1 and qi24 LE 6 then qi25=4;
if qi25=3 and qi24 GE 1 and qi24 LE 6 then qi25=3;
if qi25=4 and qi24 GE 1 and qi24 LE 6 then qi25=2;
if qi25=5 and qi24 GE 1 and qi24 LE 6 then qi25=1;
if qi26=0 then qi26=6;
if qi26=1 then qi26=5;
```

```
if qi26=2 then qi26=4;
if qi26 GE 3 and qi26 LE 5 then qi26=3;
if qi26 GE 6 and qi26 LE 7 then qi26=2;
if qi26 GE 7 and qi26 LE 28 then qi26=1;
if qi26=99 then qi26=.;
if qi28a=0 then qi28a=99;
if qi28b=0 then qi28b=99;
if qi28c=0 then qi28c=99;
if qi28d=0 then qi28d=99;
if qi28e=0 then qi28e=99;
if qi28f=0 then qi28f=99;
if qi28g=0 then qi28g=99;
if qi28h=0 then qi28h=99;
if qi28i=0 then qi28i=99;
if qi28g=1 then qi28g=6;
if qi28g=2 then qi28g=5;
if qi28g=3 then qi28g=4;
if qi28g=4 then qi28g=3;
if qi28g=5 then qi28g=2;
if qi28g=6 then qi28g=1;
if qi28i=1 then qi28i=6;
if qi28i=2 then qi28i=5;
if qi28i=3 then qi28i=4;
if qi28i=4 then qi28i=3;
if qi28i=5 then qi28i=2;
if qi28i=6 then qi28i=1;
if qi28b=1 then qi28b=6;
if qi28b=2 then qi28b=5;
if qi28b=3 then qi28b=4;
if qi28b=4 then qi28b=3;
if qi28b=5 then qi28b=2;
if qi28b=6 then qi28b=1;
if qi28c=1 then qi28c=6;
if qi28c=2 then qi28c=5;
if qi28c=3 then qi28c=4;
if qi28c=4 then qi28c=3;
if qi28c=5 then qi28c=2;
if qi28c=6 then qi28c=1;
if qi28f=1 then qi28f=6;
if qi28f=2 then qi28f=5;
if qi28f=3 then qi28f=4;
if qi28f=4 then qi28f=3;
if qi28f=5 then qi28f=2;
if qi28f=6 then qi28f=1;
```

```
GHr=qi3;
BPr=qi24+qi25;
RPr=qi26;
Vr1=qi28a+qi28e+qi28g+qi28i;
if Vr1 GE 117 then Vr1=0;
MHr1=qi28b+qi28c+qi28d+qi28f+qi28h;
if MHr1 GE 123 then MHr1=0;

data rakesh2;
set rakesh1;

if qi28a=99 then qi28a=(qi28e+qi28g+qi28i)/3;
if qi28b=99 then qi28b=(qi28c+qi28d+qi28f+qi28h)/4;
if qi28c=99 then qi28c=(qi28b+qi28d+qi28f+qi28h)/4;;
if qi28d=99 then qi28d=(qi28b+qi28c+qi28f+qi28h)/4;
if qi28e=99 then qi28e=(qi28a+qi28g+qi28i)/3;
if qi28f=99 then qi28f=(qi28b+qi28c+qi28d+qi28h)/4;
if qi28g=99 then qi28g=(qi28a+qi28e+qi28i/3);
if qi28h=99 then qi28h=(qi28b+qi28c+qi28d+qi28f)/4;
if qi28i=99 then qi28i=(qi28a+qi28e+qi28g/3);

Vr=qi28a+qi28e+qi28g+qi28i;
if Vr1=0 then Vr=.;
MHr=qi28b+qi28c+qi28d+qi28f+qi28h;
if MHr1=0 then MHr=.;


GH=(GHr-1)/4*100;
BP=(BPr-2)/10*100;
RP=(RPr-1)/5*100;
V=(Vr-4)/20*100;
MH=(MHr-5)/25*100;

if GH LT 60 then GH=0;
else if GH GE 60 then GH=1;
if BP LT 42 then BP=0;
else if BP GE 42 then BP=1;
if V LT 35 then V=0;
else if V GE 35 then V=1;
if MH LT 28 then MH=0;
if MH GE 28 and MH LT 40 then MH=1;
else if MH GE 40 then MH=2;

LMH=.;
if MH=0 then LMH=1;
else if MH=1 or MH=2 then LMH=0;
```

```
MMH=.;
if MH=1 then MMH=1;
else if MH=0 or MH=2 then MMH=0;

keep Mqi1 Hqi1 sex qi4 qi5 qi7 qi18a qi19 Mqi29 Hqi29 qi31 qvi52 GH BP V LMH
MMH compa compb;

/*proc freq;
proc univariate normal plot;

proc freq;
tables MH*qi1/all;
tables MH*sex/all;
tables MH*qi4/all;
tables MH*qi5/all;
tables MH*qi7/all;
tables MH*qi18a/all;
tables MH*qi19/all;
tables MH*qi29/all;
tables MH*qi31/all;*/

proc logistic descending;
model compb = LMH MMH Mqi1 Hqi1 qi19 qi31/ctable pprob=(0 to 1 by .1) lackfit
risklimits;
run;
```

/*SAS PROGRAM TO MEASURE ADHERENCE USING 95% CUT-OFF LIMIT FOR PATIENTS TAKING PROTEASE INHIBITORS*/

```
options nocenter linesize=72;
libname rakesh 'c:\Windows\Desktop\rakesh';
data rakesh1;
set rakesh.hivsurv;
if qii1x= 'acyclovir' then qii1x2a=0;
if qii1x= 'pentamidine' then qii1x2a=0;
if qii1x= 'bactrim' then qii1x2a=0;
if qii1x= 'zoloft' then qii1x2a=0;
if qii1x= '3tc' then qii1x2a=0;
if qii1x= 'azt' then qii1x2a=0;
if qii1x= 'd4t' then qii1x2a=0;
if qii1x= 'ddc' then qii1x2a=0;
if qii1x= 'ddi' then qii1x2a=0;
if qii1x= 'zerit' then qii1x2a=0;
if qii1x= 'epivir' then qii1x1a=0;
if qii1x2a=0 then qii1x14=.;
if qii1x14=99 then qii1x2a=.;
if qii1x2a=1 then qii1x2a=24;
if qii1x2a=2 then qii1x2a=36;
if qii1x2a=3 then qii1x2a=45;
if qii1x2a=4 then qii1x2a=90;
if qii1x2a=5 then qii1x2a=180;
if qii1x2a=6 then qii1x2a=270;
if qii1x2a=7 then qii1x2a=360;
if qii1x2a=8 then qii1x2a=450;

med1= qii1x14/qii1x2a;
comp1=1-med1;
percomp1=comp1*100;

if qii2x= 'bactrim' then qii2x2a=0;
if qii2x= 'dapsone' then qii2x2a=0;
if qii2x= 'leucovorin' then qii2x2a=0;
if qii2x= 'ms contin' then qii2x2a=0;
if qii2x= 'theodur' then qii2x2a=0;
if qii2x= '3tc' then qii2x2a=0;
if qii2x= 'azt' then qii2x2a=0;
if qii2x= 'd4t' then qii2x2a=0;

if qii2x= 'ddc' then qii2x2a=0;
if qii2x= 'ddi' then qii2x2a=0;
if qii2x= 'epivir' then qii2x2a=0;
if qii2x= 'zerit' then qii2x2a=0;
```

```
if qii2x2a=0 then qii2x14=.;
if qii2x14=99 then qii2x2a=.;
if qii2x2a=1 then qii2x2a=24;
if qii2x2a=2 then qii2x2a=36;
if qii2x2a=3 then qii2x2a=45;
if qii2x2a=4 then qii2x2a=90;
if qii2x2a=5 then qii2x2a=180;
if qii2x2a=6 then qii2x2a=270;
if qii2x2a=7 then qii2x2a=360;
if qii2x2a=8 then qii2x2a=450;

med2= qii2x14/qii2x2a;
comp2=1-med2;
percomp2=comp2*100;

if qii3x= 'acyclovir' then qii3x2a=0;
if qii3x= 'bactrim' then qii3x2a=0;
if qii3x= 'biaxin' then qii3x2a=0;
if qii3x= 'clotrimazole' then qii3x2a=0;
if qii3x= 'compazine' then qii3x2a=0;
if qii3x= 'dapsone' then qii3x2a=0;
if qii3x= 'diltiazem' then qii3x2a=0;
if qii3x= 'fluconazole' then qii3x2a=0;
if qii3x= 'mellaril' then qii3x2a=0;
if qii3x= 'minocycline' then qii3x2a=0;
if qii3x= 'motrin' then qii3x2a=0;
if qii3x= 'oxandrin' then qii3x2a=0;
if qii3x= 'vasotec' then qii3x2a=0;
if qii3x= 'zantac' then qii3x2a=0;
if qii3x= 'zovirax' then qii3x2a=0;
if qii1x=  'azt' then qii1x2a=0;
if qii1x=  '3tc' then qii1x2a=0;
if qii1x=  'd4t' then qii1x2a=0;
if qii1x=  'epivir' then qii1x2a=0;

if qii3x2a=0 then qii3x14=.;
if qii3x14=99 then qii3x2a=.;

if qii3x2a=1 then qii3x2a=24;
if qii3x2a=2 then qii3x2a=36;
if qii3x2a=3 then qii3x2a=45;
if qii3x2a=4 then qii3x2a=90;
if qii3x2a=5 then qii3x2a=180;
if qii3x2a=6 then qii3x2a=270;
if qii3x2a=7 then qii3x2a=360;
```

```
if qii3x2a=8 then qii3x2a=450;

med3= qii3x14/qii3x2a;
comp3=1-med3;
percomp3=comp3*100;

if percomp1=. then percomp1=0;
if percomp2=. then percomp2=0;
if percomp3=. then percomp3=0;

totcomp= percomp1+percomp2+percomp3;

if percomp1=0 and percomp2 NE 0 and percomp3 NE 0 then totcomp= totcomp/2;
if percomp1 NE 0 and percomp2= 0 and percomp3 NE 0 then totcomp= totcomp/2;
if percomp1 NE 0 and percomp2 NE 0 and percomp3= 0 then totcomp=totcomp/2;
if percomp1 NE 0 and percomp2 NE 0 and percomp3 NE 0 then totcomp=totcomp/3;
if percomp1 NE 0 and percomp2=0 and percomp3= 0 then totcomp= totcomp;
if percomp1=0 and percomp2 NE 0 and percomp3= 0 then totcomp= totcomp;
if percomp1=0 and percomp2=0 and percomp3 NE 0 then totcomp= totcomp;
if totcomp=0 then delete;
compb=totcomp GE 95;

/*PROGRAM TO CATEGORIZE INDEPENDENT VARIABLES*/
if qi4=1 then qi4=1;
else if qi4=2 or qi4=3 or qi4=4 or qi4=5 or qi4=6 then qi4=0;
if qi5=0 then qi5=.;
if qi29= 1 or qi29=2 or qi29=3 or qi29=4 then qi29=1;
if qi29=5 then qi29=2;
if qi29=6 then qi29=3;
if qi29=0 then qi29=.;
if qi31=0 then qi31=.;
else if qi31= 1 or qi31=2  then qi31=0;
else if qi31= 3 or  qi31=4 then qi31=1;
if qvi52= 0 or qvi52=1 then qvi52=1;
else if qvi52= 2 or qvi52=3 then qvi52=0;
if qi1 GE 24 and qi1 Lt 35 then qi1=1;
else if qi1 GE 35 and qi1 LE 41 then qi1=2;
else if qi1 GT 41 then qi1=3;
if qi5 LT 12 then qi5=0;
else if qi5 GE 12 then qi5=1;
if qi19=0 then qi19=.;
if qi19=1 then qi19=1;
if qi19=2 then qi19=0;
if qi19=3 then qi19=0;
if qi19=4 then qi19=0;
if qi19=5 then qi19=0;
```

```
sex=.;
if qi2='m' then sex=1;
else  if qi2='f' then sex=0;
if qi7=1 then qi7=1;
else if qi7=2 then qi7=0;
if qi18a=1 the qi18a=0;
if qi18a=2 then qi18a=1;

Mqi1=.;
if qi1=2 then Mqi1=1;
else if qi1=1 or qi1=3 then Mqi1=0;
Hqi1=.;
if qi1=3 then Hqi1=1;
else if qi1=2 or qi1=1 then Hqi1=0;

Mqi29=.;
if qi29=2 then Mqi29=1;
else if qi29=1 or qi29=3 then Mqi29=0;
Hqi29=.;
if qi29=3 then Hqi29=1;
else if qi29=1 or qi29=2 then Hqi29=0;

/*PROGRAM TO MEASURE HRQoL*/
if qi3=1 then qi3=5.0;
if qi3=2 then qi3=4.4;
if qi3=3 then qi3=3.4;
if qi3=4 then qi3=2.0;
if qi3=5 then qi3=1.0;
if qi24=1 then qi24=6.0;
if qi24=2 then qi24=5.4;
if qi24=3 then qi24=4.2;
if qi24=4 then qi24=3.1;
if qi24=5 then qi24=2.2;
if qi24=6 then qi24=1.0;
if qi25=0 then qi25=.;
if qi25=1 and qi24=99 then qi25=6.0;
if qi25=2 and qi24=99 then qi25=4.75;
if qi25=3 and qi24=99 then qi25=3.5;
if qi25=4 and qi24=99 then qi25=2.25;
if qi25=5 and qi24=99 then qi25=1.0;
if qi25=1 and qi24=1 then qi25=6.0;
if qi25=1 and qi24 GE 2 and qi24 LE 6 then qi25=5;
if qi25=2 and qi24 GE 1 and qi24 LE 6 then qi25=4;
if qi25=3 and qi24 GE 1 and qi24 LE 6 then qi25=3;
if qi25=4 and qi24 GE 1 and qi24 LE 6 then qi25=2;
if qi25=5 and qi24 GE 1 and qi24 LE 6 then qi25=1;
```

```
if qi26=0 then qi26=6;
if qi26=1 then qi26=5;
if qi26=2 then qi26=4;
if qi26 GE 3 and qi26 LE 5 then qi26=3;
if qi26 GE 6 and qi26 LE 7 then qi26=2;
if qi26 GE 7 and qi26 LE 28 then qi26=1;
if qi26=99 then qi26=.;
if qi28a=0 then qi28a=99;
if qi28b=0 then qi28b=99;
if qi28c=0 then qi28c=99;
if qi28d=0 then qi28d=99;
if qi28e=0 then qi28e=99;
if qi28f=0 then qi28f=99;
if qi28g=0 then qi28g=99;
if qi28h=0 then qi28h=99;
if qi28i=0 then qi28i=99;
if qi28g=1 then qi28g=6;
if qi28g=2 then qi28g=5;
if qi28g=3 then qi28g=4;
if qi28g=4 then qi28g=3;
if qi28g=5 then qi28g=2;
if qi28g=6 then qi28g=1;
if qi28i=1 then qi28i=6;
if qi28i=2 then qi28i=5;
if qi28i=3 then qi28i=4;
if qi28i=4 then qi28i=3;
if qi28i=5 then qi28i=2;
if qi28i=6 then qi28i=1;
if qi28b=1 then qi28b=6;
if qi28b=2 then qi28b=5;
if qi28b=3 then qi28b=4;
if qi28b=4 then qi28b=3;
if qi28b=5 then qi28b=2;
if qi28b=6 then qi28b=1;
if qi28c=1 then qi28c=6;
if qi28c=2 then qi28c=5;
if qi28c=3 then qi28c=4;
if qi28c=4 then qi28c=3;
if qi28c=5 then qi28c=2;
if qi28c=6 then qi28c=1;
if qi28f=1 then qi28f=6;
if qi28f=2 then qi28f=5;
if qi28f=3 then qi28f=4;
if qi28f=4 then qi28f=3;
if qi28f=5 then qi28f=2;
if qi28f=6 then qi28f=1;
```

```
GHr=qi3;
BPr=qi24+qi25;
RPr=qi26;
Vr1=qi28a+qi28e+qi28g+qi28i;
if Vr1 GE 117 then Vr1=0;
MHr1=qi28b+qi28c+qi28d+qi28f+qi28h;
if MHr1 GE 123 then MHr1=0;

data rakesh2;
set rakesh1;

if qi28a=99 then qi28a=(qi28e+qi28g+qi28i)/3;
if qi28b=99 then qi28b=(qi28c+qi28d+qi28f+qi28h)/4;
if qi28c=99 then qi28c=(qi28b+qi28d+qi28f+qi28h)/4;;
if qi28d=99 then qi28d=(qi28b+qi28c+qi28f+qi28h)/4;
if qi28e=99 then qi28e=(qi28a+qi28g+qi28i)/3;
if qi28f=99 then qi28f=(qi28b+qi28c+qi28d+qi28h)/4;
if qi28g=99 then qi28g=(qi28a+qi28e+qi28i/3);
if qi28h=99 then qi28h=(qi28b+qi28c+qi28d+qi28f)/4;
if qi28i=99 then qi28i=(qi28a+qi28e+qi28g/3);

Vr=qi28a+qi28e+qi28g+qi28i;
if Vr1=0 then Vr=.;
MHr=qi28b+qi28c+qi28d+qi28f+qi28h;
if MHr1=0 then MHr=.;

GH=(GHr-1)/4*100;
BP=(BPr-2)/10*100;
RP=(RPr-1)/5*100;
V=(Vr-4)/20*100;
MH=(MHr-5)/25*100;

if GH LE 25 then GH=0;
else if GH GT 25 then GH=1;
if BP LT 42 then BP=0;
else if BP GE 42 then BP=1;
if V LE 20 then V=0;
else if V GT 20 then V=1;
if MH LT 36 then MH=0;
else if MH GE 36 then MH=1;

keep  Mqi1 Hqi1 sex qi4 qi5 qi7 qi18a qi19 Mqi29 Hqi29 qi31 qvi52 GH BP V MH
compa compb;
/*proc freq;
proc univariate normal plot;
```

```
proc freq;
tables MH*qi1/all;
tables MH*sex/all;
tables MH*qi4/all;
tables MH*qi5/all;
tables MH*qi7/all;
tables MH*qi18a/all;
tables MH*qi19/all;
tables MH*qi29/all;
tables MH*qi31/all;*/

proc logistic descending;
model compb = MH sex qi31/ctable pprob=(0 to 1 by .1) lackfit
risklimits;
run;
```

/*SAS PROGRAM TO MEASURE ADHERENCE USING MEDICATION ADHERENCE SCALE FOR PATIENTS ON ANTI-RETROVIRAL DRUGS*/

```
options nocenter linesize=72;
libname rakesh 'c:\Windows\Desktop\rakesh';
data rakesh1;
set rakesh.hivsurv;

if qii1x4=0 then qii1x4=99;
if qii1x5=0 then qii1x5=99;
if qii1x6=0 then qii1x6=99;
if qii1x7=0 then qii1x7=99;
if qii1x8=0 then qii1x8=99;
if qii1x9=0 then qii1x9=99;
if qii2x4=0 then qii2x4=99;
if qii2x5=0 then qii2x5=99;
if qii2x6=0 then qii2x6=99;
if qii2x7=0 then qii2x7=99;
if qii2x8=0 then qii2x8=99;
if qii2x9=0 then qii2x9=99;
if qii3x4=0 then qii3x4=99;
if qii3x5=0 then qii3x5=99;
if qii3x6=0 then qii3x6=99;
if qii3x7=0 then qii3x7=99;
if qii3x8=0 then qii3x8=99;
if qii3x9=0 then qii3x9=99;

mas1x= qii1x4+qii1x5+qii1x6+qii1x7+qii1x8+qii1x9;
if mas1 GE 109 then mas1=0;
mas2x= qii2x4+qii2x5+qii2x6+qii2x7+qii2x8+qii2x9;
if mas2x GE 109 then mas2=0;
mas3x= qii3x4+qii3x5+qii3x6+qii3x7+qii3x8+qii3x9;
if mas3x GE 109 then mas3=0;
data rakesh2;
set rakesh1;

if qii1x4=99 then qii1x4=0;
if qii1x5=99 then qii1x5=0;
if qii1x6=99 then qii1x6=0;
if qii1x7=99 then qii1x7=0;
if qii1x8=99 then qii1x8=0;
if qii1x9=99 then qii1x9=0;
mas1=qii1x4+qii1x5+qii1x6+qii1x7+qii1x8+qii1x9;
if mas1x=0 then mas1=0;

if qii2x4=99 then qii2x4=0;
```

```
if qii2x5=99 then qii2x5=0;
if qii2x6=99 then qii2x6=0;
if qii2x7=99 then qii2x7=0;
if qii2x8=99 then qii2x8=0;
if qii2x9=99 then qii2x9=0;
mas2=qii2x4+qii2x5+qii2x6+qii2x7+qii2x8+qii2x9;
if mas2x=0 then mas2=0;

if qii3x4=99 then qii3x4=0;
if qii3x5=99 then qii3x5=0;
if qii3x6=99 then qii3x6=0;
if qii3x7=99 then qii3x7=0;
if qii3x8=99 then qii3x8=0;
if qii3x9=99 then qii3x9=0;
mas3=qii3x4+qii3x5+qii3x6+qii3x7+qii3x8+qii3x9;
if mas3x=0 then mas3=0;

if qii1x=  'bactrim' then mas1=0;
if qii1x=  'acyclovir' then mas1=0;
if qii1x=  'pentamidine' then mas1=0;
if qii1x=  'zoloft' then mas1=0;
if qii1x=  'crixivan' then mas1=0;
if qii1x=  'ritonavir' then mas1=0;
if qii1x=  'saquinavir' then mas1=0;
if qii2x= 'bactrim' then mas2=0;
if qii2x= 'dapsone' then mas2=0;
if qii2x= 'leucovorin' then mas2=0;
if qii2x= 'ms contin' then mas2=0;
if qii2x= 'theodur' then mas2=0;
if qii2x= 'crixivan' then mas2=0;
if qii2x= 'saquinavir' then mas2=0;
if qii2x= 'indinavir' then mas2=0;
if qii2x= 'ritonavir' then mas2=0;
if qii3x= 'acyclovir' then mas3=0;
if qii3x= 'bactrim' then mas3=0;
if qii3x= 'biaxin' then mas3=0;
if qii3x= 'clotrimazole' then mas3=0;
if qii3x= 'compazine' then mas3=0;
if qii3x= 'dapsone' then mas3=0;
if qii3x= 'diltiazem' then mas3=0;
if qii3x= 'fluconazole' then mas3=0;
if qii3x= 'mellaril' then mas3=0;
if qii3x= 'minocycline' then mas3=0;
if qii3x= 'motrin' then mas3=0;
if qii3x= 'oxandrin' then mas3=0;
if qii3x= 'vasotec' then mas3=0;
```

```
if qii3x= 'zantac' then mas3=0;
if qii3x= 'zovirax' then mas3=0;
if qii3x= 'crixivan' then mas3=0;
if qii3x= 'indinavir' then mas3=0;
if qii3x= 'invirase' then mas3=0;
if qii3x= 'norvir' then mas3=0;
if qii3x= 'ritonavir' then mas3=0;
if qii3x= 'saquinavir' then mas3=0;

totmas=mas1+mas2+mas3;

if mas1 NE 0 and mas2 NE 0 and mas3 NE 0 then totmas= totmas/3;
if mas1 NE 0 and mas2= 0 and mas3 NE 0 then totmas= totmas/2;
if mas1=0 and mas2 NE 0 and mas3 NE 0 then totmas= totmas/2;
if mas1 NE 0 and mas2 NE 0 and mas3=0 then totmas= totmas/2;
if mas1 NE 0 and mas2=0 and mas3=0 then totmas=totmas;
if mas1=0 and mas2 NE 0 and mas3=0 then totmas=totmas;
if mas1=0 and mas2=0 and mas3 NE 0 then totmas=totmas;
if totmas LT 6 then delete;

totmas1=12-totmas;
if totmas1 = 6 then totmas1=1;
else if totmas1 LT 6 then totmas1 = 0;

/*PROGRAM TO CATEGORIZE INDEPENDENT VARIABLES*/
if qi4=1 then qi4=1;
else if qi4=2 or qi4=3 or qi4=4 or qi4=5 or qi4=6 then qi4=0;
if qi5=0 then qi5=.;
if qi29= 1 or qi29=2 or qi29=3 or qi29=4 then qi29=1;
if qi29=5 then qi29=2;
if qi29=6 then qi29=3;
if qi29=0 then qi29=.;
if qi31=0 then qi31=.;
else if qi31= 1 or qi31=2  then qi31=0;
else if qi31= 3 or  qi31=4 then qi31=1;
if qvi52= 0 or qvi52=1 then qvi52=1;
else if qvi52= 2 or qvi52=3 then qvi52=0;
if qi1 GE 24 and qi1 Lt 35 then qi1=1;
else if qi1 GE 35 and qi1 LE 41 then qi1=2;
else if qi1 GT 41 then qi1=3;
if qi5 LT 12 then qi5=0;
else if qi5 GE 12 then qi5=1;
if qi19=0 then qi19=.;
if qi19=1 then qi19=1;
if qi19=2 then qi19=0;
if qi19=3 then qi19=0;
```

```
if qi19=4 then qi19=0;
if qi19=5 then qi19=0;
if qi2=0 then qi2=.;
sex=.;
if qi2='f' then sex=0;
if qi2='m' then sex=1;
if qi7=1 then qi7=1;
else if qi7=2 then qi7=0;
if qi18a=1 then qi18a=0;
if qi18a=2 then qi18a=1;

Mqi1=.;
if qi1=2 then Mqi1=1;
else if qi1=1 or qi1=3 then Mqi1=0;
Hqi1=.;
if qi1=3 then Hqi1=1;
else if qi1=2 or qi1=1 then Hqi1=0;

Mqi29=.;
if qi29=2 then Mqi29=1;
else if qi29=1 or qi29=3 then Mqi29=0;
Hqi29=.;
if qi29=3 then Hqi29=1;
else if qi29=1 or qi29=2 then Hqi29=0;

/*PROGRAM TO MEASURE HRQoL*/
if qi3=1 then qi3=5.0;
if qi3=2 then qi3=4.4;
if qi3=3 then qi3=3.4;
if qi3=4 then qi3=2.0;
if qi3=5 then qi3=1.0;
if qi24=1 then qi24=6.0;
if qi24=2 then qi24=5.4;
if qi24=3 then qi24=4.2;
if qi24=4 then qi24=3.1;
if qi24=5 then qi24=2.2;
if qi24=6 then qi24=1.0;
if qi25=0 then qi25=.;
if qi25=1 and qi24=99 then qi25=6.0;
if qi25=2 and qi24=99 then qi25=4.75;
if qi25=3 and qi24=99 then qi25=3.5;
if qi25=4 and qi24=99 then qi25=2.25;
if qi25=5 and qi24=99 then qi25=1.0;
if qi25=1 and qi24=1 then qi25=6.0;
if qi25=1 and qi24 GE 2 and qi24 LE 6 then qi25=5;
if qi25=2 and qi24 GE 1 and qi24 LE 6 then qi25=4;
```

```
if qi25=3 and qi24 GE 1 and qi24 LE 6 then qi25=3;
if qi25=4 and qi24 GE 1 and qi24 LE 6 then qi25=2;
if qi25=5 and qi24 GE 1 and qi24 LE 6 then qi25=1;
if qi26=0 then qi26=6;
if qi26=1 then qi26=5;
if qi26=2 then qi26=4;
if qi26 GE 3 and qi26 LE 5 then qi26=3;
if qi26 GE 6 and qi26 LE 7 then qi26=2;
if qi26 GE 7 and qi26 LE 28 then qi26=1;
if qi26=99 then qi26=.;
if qi28a=0 then qi28a=99;
if qi28b=0 then qi28b=99;
if qi28c=0 then qi28c=99;
if qi28d=0 then qi28d=99;
if qi28e=0 then qi28e=99;
if qi28f=0 then qi28f=99;
if qi28g=0 then qi28g=99;
if qi28h=0 then qi28h=99;
if qi28i=0 then qi28i=99;
if qi28g=1 then qi28g=6;
if qi28g=2 then qi28g=5;
if qi28g=3 then qi28g=4;
if qi28g=4 then qi28g=3;
if qi28g=5 then qi28g=2;
if qi28g=6 then qi28g=1;
if qi28i=1 then qi28i=6;
if qi28i=2 then qi28i=5;
if qi28i=3 then qi28i=4;
if qi28i=4 then qi28i=3;
if qi28i=5 then qi28i=2;
if qi28i=6 then qi28i=1;
if qi28b=1 then qi28b=6;
if qi28b=2 then qi28b=5;
if qi28b=3 then qi28b=4;
if qi28b=4 then qi28b=3;
if qi28b=5 then qi28b=2;
if qi28b=6 then qi28b=1;
if qi28c=1 then qi28c=6;
if qi28c=2 then qi28c=5;
if qi28c=3 then qi28c=4;
if qi28c=4 then qi28c=3;
if qi28c=5 then qi28c=2;
if qi28c=6 then qi28c=1;
if qi28f=1 then qi28f=6;
if qi28f=2 then qi28f=5;
if qi28f=3 then qi28f=4;
```

```
if qi28f=4 then qi28f=3;
if qi28f=5 then qi28f=2;
if qi28f=6 then qi28f=1;


GHr=qi3;
BPr=qi24+qi25;
RPr=qi26;
Vr1=qi28a+qi28e+qi28g+qi28i;
if Vr1 GE 117 then Vr1=0;
MHr1=qi28b+qi28c+qi28d+qi28f+qi28h;
if MHr1 GE 123 then MHr1=0;

data rakesh3;
set rakesh2;

if qi28a=99 then qi28a=(qi28e+qi28g+qi28i)/3;
if qi28b=99 then qi28b=(qi28c+qi28d+qi28f+qi28h)/4;
if qi28c=99 then qi28c=(qi28b+qi28d+qi28f+qi28h)/4;;
if qi28d=99 then qi28d=(qi28b+qi28c+qi28f+qi28h)/4;
if qi28e=99 then qi28e=(qi28a+qi28g+qi28i)/3;
if qi28f=99 then qi28f=(qi28b+qi28c+qi28d+qi28h)/4;
if qi28g=99 then qi28g=(qi28a+qi28e+qi28i/3);
if qi28h=99 then qi28h=(qi28b+qi28c+qi28d+qi28f)/4;
if qi28i=99 then qi28i=(qi28a+qi28e+qi28g/3);

Vr=qi28a+qi28e+qi28g+qi28i;
if Vr1=0 then Vr=.;
MHr=qi28b+qi28c+qi28d+qi28f+qi28h;
if MHr1=0 then MHr=.;

GH=(GHr-1)/4*100;
BP=(BPr-2)/10*100;
RP=(RPr-1)/5*100;
V=(Vr-4)/20*100;
MH=(MHr-5)/25*100;

if GH LT 60 then GH=0;
else if GH GE 60 then GH=1;
if BP LT 42 then BP=0;
else if BP GE 42 then BP=1;
if V LE 20 then V=0;
else if V GT 20 then V=1;
if MH LT 32 then MH=0;
else if MH GE 32 then MH=1;
```

```
keep  Mqi1 Hqi1 sex qi4 qi5 qi7 qi18a qi19 Mqi29 Hqi29 qi31 qvi52 GH BP V MH
totmas1;

/*proc freq;
proc univariate normal plot;

proc freq;
tables MH*qi1/all;
tables MH*sex/all;
tables MH*qi4/all;
tables MH*qi5/all;
tables MH*qi7/all;
tables MH*qi18a/all;
tables MH*qi19/all;
tables MH*qi29/all;
tables MH*qi31/all;*/

proc logistic descending;
model totmas1 =  MH Mqi1 Hqi1 qi7 qi19 qi31 /ctable pprob=(0 to 1 by .1) lackfit
risklimits;
run;
```

/*SAS PROGRAM TO MEASURE ADHERENCE USING MEDICATION ADHERENCE SCALE FOR PATIENTS TAKING PROTEASE INHIBITORS*/

```
options nocenter linesize=72;
libname rakesh 'c:\Windows\Desktop\rakesh';
data rakesh1;
set rakesh.hivsurv;

if  qii1x4=0 then qii1x4=99;
if qii1x5=0 then qii1x5=99;
if qii1x6=0 then qii1x6=99;
if qii1x7=0 then qii1x7=99;
if qii1x8=0 then qii1x8=99;
if qii1x9=0 then qii1x9=99;
if qii2x4=0 then qii2x4=99;
if qii2x5=0 then qii2x5=99;
if qii2x6=0 then qii2x6=99;
if qii2x7=0 then qii2x7=99;
if qii2x8=0 then qii2x8=99;
if qii2x9=0 then qii2x9=99;
if qii3x4=0 then qii3x4=99;
if qii3x5=0 then qii3x5=99;
if qii3x6=0 then qii3x6=99;
if qii3x7=0 then qii3x7=99;
if qii3x8=0 then qii3x8=99;
if qii3x9=0 then qii3x9=99;

mas1x= qii1x4+qii1x5+qii1x6+qii1x7+qii1x8+qii1x9;
if mas1x GE 109 then mas1=0;
mas2x= qii2x4+qii2x5+qii2x6+qii2x7+qii2x8+qii2x9;
if mas2x GE 109 then mas2=0;
mas3x= qii3x4+qii3x5+qii3x6+qii3x7+qii3x8+qii3x9;
if mas3x GE 109 then mas3=0;

data rakesh2;
set rakesh1;
if  qii1x4=99 then qii1x4=0;
if qii1x5=99 then qii1x5=0;

if qii1x6=99 then qii1x6=0;
if qii1x7=99 then qii1x7=0;
if qii1x8=99 then qii1x8=0;
if qii1x9=99 then qii1x9=0;
mas1=qii1x4+qii1x5+qii1x6+qii1x7+qii1x8+qii1x9;
if mas1x=0 then mas1=0;
```

```
if qii2x4=99 then qii2x4=0;
if qii2x5=99 then qii2x5=0;

if qii2x6=99 then qii2x6=0;
if qii2x7=99 then qii2x7=0;
if qii2x8=99 then qii2x8=0;
if qii2x9=99 then qii2x9=0;
mas2=qii2x4+qii2x5+qii2x6+qii2x7+qii2x8+qii2x9;
if mas2x=0 then mas2=0;

if qii3x4=99 then qii3x4=0;
if qii3x5=99 then qii3x5=0;
if qii3x6=99 then qii3x6=0;
if qii3x7=99 then qii3x7=0;
if qii3x8=99 then qii3x8=0;
if qii3x9=99 then qii3x9=0;
mas3=qii3x4+qii3x5+qii3x6+qii3x7+qii3x8+qii3x9;
if mas3x=0 then mas3=0;


if qii1x=  'bactrim' then mas1=0;
if qii1x=  'acyclovir' then mas1=0;
if qii1x=  'pentamidine' then mas1=0;
if qii1x=  'zoloft' then mas1=0;
if qii1x=  '3tc' then mas1=0;
if qii1x=  'azt' then mas1=0;
if qii1x=  'd4t' then mas1=0;
if qii1x=  'ddi' then mas1=0;
if qii1x=  'ddc' then mas1=0;
if qii1x=  'epivir' then mas1=0;
if qii1x=  'zerit' then mas1=0;

if qii2x= 'bactrim' then mas2=0;
if qii2x= 'dapsone' then mas2=0;
if qii2x= 'leucovorin' then mas2=0;
if qii2x= 'ms contin' then mas2=0;
if qii2x= 'theodur' then mas2=0;

if qii2x= '3tc' then mas2=0;
if qii2x= 'azt' then mas2=0;
if qii2x= 'd4t' then mas2=0;
if qii2x= 'ddc' then mas2=0;
if qii1x= 'ddi' then mas1=0;
if qii1x=  'epivir' then mas1=0;
if qii1x=  'zerit' then mas1=0;
```

```
if qii3x= 'acyclovir' then mas3=0;
if qii3x= 'bactrim' then mas3=0;
if qii3x= 'biaxin' then mas3=0;
if qii3x= 'clotrimazole' then mas3=0;
if qii3x= 'compazine' then mas3=0;
if qii3x= 'dapsone' then mas3=0;
if qii3x= 'diltiazem' then mas3=0;
if qii3x= 'fluconazole' then mas3=0;
if qii3x= 'mellaril' then mas3=0;
if qii3x= 'minocycline' then mas3=0;
if qii3x= 'motrin' then mas3=0;
if qii3x= 'oxandrin' then mas3=0;
if qii3x= 'vasotec' then mas3=0;
if qii3x= 'zantac' then mas3=0;
if qii3x= 'zovirax' then mas3=0;

if qii3x= '3tc' then mas3=0;
if qii3x= 'azt' then mas3=0;
if qii3x= 'd4t' then mas3=0;
if qii3x= 'epivir' then mas3=0;

totmas=mas1+mas2+mas3;

if mas1 NE 0 and mas2 NE 0 and mas3 NE 0 then totmas= totmas/3;
if mas1 NE 0 and mas2= 0 and mas3 NE 0 then totmas= totmas/2;

if mas1=0 and mas2 NE 0 and mas3 NE 0 then totmas= totmas/2;

if mas1 NE 0 and mas2 NE 0 and mas3=0 then totmas= totmas/2;
if mas1 NE 0 and mas2=0 and mas3=0 then totmas=totmas;
if mas1=0 and mas2 NE 0 and mas3=0 then totmas=totmas;
if mas1=0 and mas2=0 and mas3 NE 0 then totmas=totmas;
if totmas LT 6 then delete;

totmas1= 12-totmas;
if totmas1 = 6 then totmas1=1;
else if totmas1 LT 6 then totmas1 = 0;

/*PROGRAM TO CATEGORIZE INDEPENDENT VARIABLES*/
if qi4=1 then qi4=1;
else if qi4=2 or qi4=3 or qi4=4 or qi4=5 or qi4=6 then qi4=0;
if qi5=0 then qi5=.;
if qi29= 1 or qi29=2 or qi29=3 or qi29=4 then qi29=1;
if qi29=5 then qi29=2;
if qi29=6 then qi29=3;
if qi29=0 then qi29=.;
```

```
if qi31=0 then qi31=.;
else if qi31= 1 or qi31=2  then qi31=0;
else if qi31= 3 or  qi31=4 then qi31=1;
if qvi52= 0 or qvi52=1 then qvi52=1;
else if qvi52= 2 or qvi52=3 then qvi52=0;
if qi1 GE 24 and qi1 Lt 35 then qi1=1;
else if qi1 GE 35 and qi1 LE 41 then qi1=2;
else if qi1 GT 41 then qi1=3;
if qi5 LT 12 then qi5=0;
else if qi5 GE 12 then qi5=1;
if qi19=0 then qi19=.;
if qi19=1 then qi19=1;
if qi19=2 then qi19=0;
if qi19=3 then qi19=0;
if qi19=4 then qi19=0;
if qi19=5 then qi19=0;
if qi2=0 then qi2=.;
sex=.;
if qi2='f' then sex=0;
if qi2='m' then sex=1;
if qi7=1 then qi7=1;
else if qi7=2 then qi7=0;
if qi18a=1 then qi18a=0;
if qi18a=2 then qi18a=1;

Mqi1=.;
if qi1=2 then Mqi1=1;
else if qi1=1 or qi1=3 then Mqi1=0;
Hqi1=.;
if qi1=3 then Hqi1=1;
else if qi1=2 or qi1=1 then Hqi1=0;

Mqi29=.;
if qi29=2 then Mqi29=1;
else if qi29=1 or qi29=3 then Mqi29=0;
Hqi29=.;
if qi29=3 then Hqi29=1;
else if qi29=1 or qi29=2 then Hqi29=0;

/*PROGRAM TO MEASURE HRQoL*/
if qi3=1 then qi3=5.0;
if qi3=2 then qi3=4.4;
if qi3=3 then qi3=3.4;
if qi3=4 then qi3=2.0;
if qi3=5 then qi3=1.0;
if qi24=1 then qi24=6.0;
```

```
if qi24=2 then qi24=5.4;
if qi24=3 then qi24=4.2;
if qi24=4 then qi24=3.1;
if qi24=5 then qi24=2.2;
if qi24=6 then qi24=1.0;
if qi25=0 then qi25=.;
if qi25=1 and qi24=99 then qi25=6.0;
if qi25=2 and qi24=99 then qi25=4.75;
if qi25=3 and qi24=99 then qi25=3.5;
if qi25=4 and qi24=99 then qi25=2.25;
if qi25=5 and qi24=99 then qi25=1.0;
if qi25=1 and qi24=1 then qi25=6.0;
if qi25=1 and qi24 GE 2 and qi24 LE 6 then qi25=5;
if qi25=2 and qi24 GE 1 and qi24 LE 6 then qi25=4;
if qi25=3 and qi24 GE 1 and qi24 LE 6 then qi25=3;
if qi25=4 and qi24 GE 1 and qi24 LE 6 then qi25=2;
if qi25=5 and qi24 GE 1 and qi24 LE 6 then qi25=1;
if qi26=0 then qi26=6;
if qi26=1 then qi26=5;
if qi26=2 then qi26=4;
if qi26 GE 3 and qi26 LE 5 then qi26=3;
if qi26 GE 6 and qi26 LE 7 then qi26=2;
if qi26 GE 7 and qi26 LE 28 then qi26=1;
if qi26=99 then qi26=.;
if qi28a=0 then qi28a=99;
if qi28b=0 then qi28b=99;
if qi28c=0 then qi28c=99;
if qi28d=0 then qi28d=99;
if qi28e=0 then qi28e=99;
if qi28f=0 then qi28f=99;
if qi28g=0 then qi28g=99;
if qi28h=0 then qi28h=99;
if qi28i=0 then qi28i=99;
if qi28g=1 then qi28g=6;
if qi28g=2 then qi28g=5;
if qi28g=3 then qi28g=4;
if qi28g=4 then qi28g=3;
if qi28g=5 then qi28g=2;
if qi28g=6 then qi28g=1;
if qi28i=1 then qi28i=6;
if qi28i=2 then qi28i=5;
if qi28i=3 then qi28i=4;
if qi28i=4 then qi28i=3;
if qi28i=5 then qi28i=2;
if qi28i=6 then qi28i=1;
if qi28b=1 then qi28b=6;
```

```
if qi28b=2 then qi28b=5;
if qi28b=3 then qi28b=4;
if qi28b=4 then qi28b=3;
if qi28b=5 then qi28b=2;
if qi28b=6 then qi28b=1;
if qi28c=1 then qi28c=6;
if qi28c=2 then qi28c=5;
if qi28c=3 then qi28c=4;
if qi28c=4 then qi28c=3;
if qi28c=5 then qi28c=2;
if qi28c=6 then qi28c=1;
if qi28f=1 then qi28f=6;
if qi28f=2 then qi28f=5;
if qi28f=3 then qi28f=4;
if qi28f=4 then qi28f=3;
if qi28f=5 then qi28f=2;
if qi28f=6 then qi28f=1;

GHr=qi3;
BPr=qi24+qi25;
RPr=qi26;
Vr1=qi28a+qi28e+qi28g+qi28i;
if Vr1 GE 117 then Vr1=0;
MHr1=qi28b+qi28c+qi28d+qi28f+qi28h;
if MHr1 GE 123 then MHr1=0;

data rakesh3;
set rakesh2;

if qi28a=99 then qi28a=(qi28e+qi28g+qi28i)/3;
if qi28b=99 then qi28b=(qi28c+qi28d+qi28f+qi28h)/4;
if qi28c=99 then qi28c=(qi28b+qi28d+qi28f+qi28h)/4;;
if qi28d=99 then qi28d=(qi28b+qi28c+qi28f+qi28h)/4;
if qi28e=99 then qi28e=(qi28a+qi28g+qi28i)/3;
if qi28f=99 then qi28f=(qi28b+qi28c+qi28d+qi28h)/4;
if qi28g=99 then qi28g=(qi28a+qi28e+qi28i/3);
if qi28h=99 then qi28h=(qi28b+qi28c+qi28d+qi28f)/4;
if qi28i=99 then qi28i=(qi28a+qi28e+qi28g/3);

Vr=qi28a+qi28e+qi28g+qi28i;
if Vr1=0 then Vr=.;
MHr=qi28b+qi28c+qi28d+qi28f+qi28h;
if MHr1=0 then MHr=.;


GH=(GHr-1)/4*100;
```

```
BP=(BPr-2)/10*100;
RP=(RPr-1)/5*100;
V=(Vr-4)/20*100;
MH=(MHr-5)/25*100;

if GH LE 25 then GH=0;
else if GH GT 25 then GH=1;
if BP LT 42 then BP=0;
else if BP GE 42 then BP=1;
if V LE 20 then V=0;
else if V GT 20 then V=1;
if MH LT 36 then MH=0;
else if MH GE 36 then MH=1;

keep  Mqi1 Hqi1 sex qi4 qi5 qi7 qi18a qi19 Mqi29 Hqi29 qi31 qvi52 GH BP V MH
totmas1;

/*proc freq;
proc univariate normal plot;

proc freq;
tables MH*qi1/all;
tables MH*sex/all;
tables MH*qi4/all;
tables MH*qi5/all;
tables MH*qi7/all;
tables MH*qi18a/all;
tables MH*qi19/all;
tables MH*qi29/all;
tables MH*qi31/all;*/

proc logistic descending;
model totmas1 = MH Mqi1 Hqi1 qi4 qi5 qi19 qi31 /ctable pprob=(0 to 1 by .1) lackfit
risklimits;
run;
```

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