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Title: **The importance of the family: a longitudinal study of the predictors of depression in HIV patients in South Africa**

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The importance of the family: a longitudinal study of the predictors of depression in HIV patients in South Africa

ABSTRACT

As a chronic illness, HIV/AIDS requires life-long treatment adherence and retention – and thus sufficient attention to the psychosocial dimensions of chronic disease care in order to produce favourable antiretroviral treatment (ART) outcomes in a sustainable manner. Given the high prevalence of depression in chronic HIV patients, there is a clear need for further research into the determinants of depression in this population. In order to comprehensively study the predictors of depressive symptoms in HIV patients on ART, the socio-ecological theory postulates to not only incorporate the dominant individual-level and the more recent community-level approaches, but also incorporate the intermediate, but crucial family-level approach.

The present study aims to extend the current literature by simultaneously investigating the impact of a wide range individual-level, family-level and community-level determinants of depression in a sample of 435 patients enrolled in the Free State Province of South Africa public-sector ART program. Structural equation modeling is used to explore the relationships between both latent and manifest variables at two time points.

Besides a number of individual-level correlates – namely education, internalized and external stigma, and avoidant and seeking social support coping styles – of depressive symptoms in HIV patients on ART, the study also revealed the important role of family functioning in predicting depression. While family attachment emerged as the only factor to continuously and negatively impact depression at both time points, the second dimension of family functioning, changeability, was the only factor to produce a negative cross-lagged effect on depression.

The immediate and long-term impact of family functioning on depression draws attention to the role of family dynamics in the mental health of people living with HIV/AIDS. In addition to individual-level and community-based factors, future research activities should also incorporate the role of the family context in research into the mental health of HIV patients, as our results demonstrate that the

familial context in which a person with HIV on ART resides is inextricably interconnected with his/her health outcomes.

INTRODUCTION

The HIV/AIDS epidemic is one of the largest health problems of current times. The virus has already killed nearly 30 million people, and another 34 million are currently infected. In absolute figures, South Africa, with its generalized epidemic, has been the most severely affected, with 6.3 million seropositive inhabitants (1). Nevertheless, there is hope: the South African public-sector ART program has become the largest and most costly public health program ever introduced in the country, with approximately 2.5 million people currently receiving antiretroviral treatment – or 80% of women, 65% of children and 65% of men eligible for ART (using the CD4 > 350 cells/mm³ criterion) (2). The short-to-mid-term results of this public-sector ART program are promising, with the proportions of patients with on-treatment success after two years of first-line therapy being comparable to those from developed countries (3, 4). A recent study by Johnson and colleagues demonstrated that South African HIV-positive adults can have a near-normal life expectancy, provided that they start ART before their CD4 count drops below 200 cells/μl (5). These favorable outcomes have led medical sociologists to conclude that, even in the developing world, HIV/AIDS has undergone a transition from a terminal illness to a controllable chronic condition, at least for those accessing (and adherent to) treatment (6).

However, merely initiating life-saving ART in all eligible HIV/AIDS patients is not sufficient. As a chronic illness, HIV/AIDS requires life-long treatment adherence and retention – and thus sufficient attention to the psychosocial dimensions of chronic disease care (6, 7) – in order to produce favourable outcomes in a sustainable manner. A large body of literature has demonstrated the important role of a wide range of psychosocial factors, including substance abuse, stress and traumatic life experiences, and especially depression in influencing ART adherence and treatment outcomes for PLWHA (8).

HIV/AIDS and depression are intricately intertwined. HIV/AIDS can induce depressive symptoms: on receiving a diagnosis of HIV/AIDS, people often suffer from depressive feelings as they adjust to the diagnosis, struggle with the meaning of a positive HIV test result, anticipate and receive news of the

disease's advance, and witness the death of friends and family (9). After treatment initiation, people have to adapt to life with a chronic, life-threatening illness. The difficulties associated with ART, amongst others side-effects, treatment fatigue and stigmatisation have been shown to negatively impact the mental health of chronic HIV patients (9-11). A recent review study on the prevalence of depressive symptoms and major depression among ART patients in sub-Saharan Africa reported that the prevalence estimates were 31% and 18% respectively – estimates much higher than prevalence estimates of depression symptoms and major depression in community studies in Uganda and South Africa (12-14). Conversely, depression can negatively impact treatment outcomes. Recent review studies showed that global depression was significantly associated with lower adherence and that reduced depression over time was associated with improved adherence (15, 16). In addition, an editorial review by Venkatesh and colleagues indicated that ART patients suffering from depression may be more likely to engage in risky sexual behaviour, and they are therefore at greater risk of infecting others and re-infecting themselves (17).

Given the high prevalence of depression in this population, there is a clear need for further research into the determinants of depressive symptoms in HIV patients on ART in South Africa (18). The majority of research on this topic has focused its attention on individual-level determinants of depression. Research on the individual determinants of depression in HIV patients (on ART) has revealed a range of potential predictors and correlates, including gender, coping strategies, HIV-related stigma, health status, and poverty (11, 19-22). In order to address the public health problem, these studies consistently stress the great need for appropriate mental health services for this vulnerable patient group (11, 19-22). In particular, experts call for intervention strategies that provide appropriate psychosocial support for ART patients at risk for developing depressive symptoms (11, 18).

However, against the daunting challenge of providing additional psychosocial care to increasingly growing patient groups, one could well ask: who will do the job? (23). The inadequate supply and poor retention of skilled health professionals is deplored as the single most serious obstacle for

implementing the national treatment plan in sub-Saharan Africa (23). Of recent, experts are increasingly exploring the potential of *community-based support* in mental health care in South Africa. Petersen and Lund (2011) stress the need for community health worker involvement in mental health care in a context of limited human resources as a range of studies have demonstrated that trained community-based lay health workers can play a key role in focused mental health interventions under the supervision of a mental health specialist (24-28). In addition, community-based peer support interventions have been shown to both improve ART outcomes (7, 29, 30) and reduce symptoms of depression (31). This community-based approach to mental health care fits within a broader *task-shifting approach* to primary mental health care, where specific tasks are moved, where appropriate, from highly qualified health workers to health workers with shorter training and fewer qualifications in order to make more efficient use of the available human resources (32).

These two research streams – the dominant individual-level approach and the more recent community-level approach – do, however, not represent a comprehensive framework for psychosocial research on depression in HIV patients. When studying the impact of HIV/AIDS using a comprehensive socio-ecological approach, one cannot restrict the research focus to the affected individual and his/her community. A crucial level of the social context surrounding the patient, namely the household or family-level, is systematically omitted in studies in high HIV-prevalence resource-limited settings, where the family plays an especially important role in the lives of people. Individuals seldom live in isolation from their kin, certainly in the South African context where evolving African family patterns prevail (33). As indicated by the *Individual-Family-Community framework for HIV research* developed by Wouters (2012) (34), social sciences research needs to incorporate the role of families in order to comprehensively study the predictors of depressive symptoms in HIV patients on ART. To date, however, the perspective that family dynamics can impact chronic illness outcomes has found very little resonance in HIV/AIDS research. Only very few studies have investigated the impact of family functioning on depression in HIV patients (35-37): these

studies consistently observed that poor family functioning was associated with elevated depression in the HIV patients. However, none of these studies employed a longitudinal study design, focused their attention on HIV patients on ART, nor were they performed in a high HIV-prevalence, resource-limited setting, where this knowledge is needed most.

The present study aims to extend the current literature by simultaneously investigating the impact of a wide range of individual-level, family-level and community-level determinants of depression in a sample of 435 patients enrolled in the Free State Province of South Africa public-sector ART-program at two different time points. In this way, the study aims to produce valuable information to optimize future interventions for mental health problems in HIV patients on ART in high HIV-prevalence and resource-limited settings.

METHODS

Setting

The study is part of a three-year, prospective cohort study entitled “Effective AIDS Treatment and Support in the Free State” (FEATS), which was conducted by the Centre for Health Systems Research & Development of the University of the Free State (UFS). The study was approved by the Ethics Committee of the Faculty of Health Sciences of the UFS [ETOVS 145/07 DOH-27-0907-2025] and authorized by the Free State Department of Health. The FEATS study is registered in the trial register of the National Institutes of Health [NCT00821366]. The study has two aims, namely, (a) to investigate the benefits of ART to patients, to the family members of patients on ART, and to communities at large and (b) to investigate the impact of a peer adherence support and a nutritional intervention on measures of treatment success. A Zelen-type double randomized consent design was adopted in the RCT component of the study (Kaptchuk, 2001; MacLehose et al., 2001; Rains & Penzien, 2005). Within such design, study participants are only offered the treatment to which they are randomized and can accept or reject treatment.

In order to yield statistically significant outcomes, 655 study participants were recruited into the study from 12 public ART clinics across five districts in the Free State Province of South Africa in 2007/08. Inclusion criteria included a minimum age of 18 years, having commenced ART within the past five weeks and residing in the town or village in which the particular health facility was located. Data collection at pre-trial baseline and at post-trial follow-up (two waves), comprised a patient interview and a household interview, inclusive of an adult questionnaire, conducted by trained enumerators using a structured questionnaire, in all cases only after informed consent was obtained from study participants. The two follow-up waves yielded 500 (Wave 1) and 435 (Wave 2) completed interviews, respectively. Survey attrition was primarily due to mortality among study participants (42.4%) and unknown whereabouts (34.1%). A full description of the randomized controlled trial can be found in the CONSORT (CONsolidated Standards Of Reporting Trials) statement (including checklist and flowchart) of the overarching FEATS study added to the article as a supplementary file. The

current study employs data for the 435 patients interviewed at both follow-up waves as data on family functioning was not gathered at baseline.

Study variables

Based on the literature, we selected a wide range of *individual-level variables* that have been significantly associated with depressive symptoms in HIV patients on ART (11, 18-20, 22, 38). Because ample studies have reported a significant impact of demographic characteristics on depression, data on *age*, *sex* and *educational level* were collected (11, 18, 20, 22). Educational level was measured according to five categories: no education, primary education, some secondary education, matric education (grade 12) or tertiary/post-matric education. Economic status was assessed using three dummy variables: the patient (a) *being employed* and (b) having access to a *disability grant* or someone in the patient's household receiving (c) *an old-age pension*. In addition and in accordance with the literature, we included health- and treatment-related variables, namely patients' self-reported health status – measured by the *EUROQoL Visual Analogue Scale* – and *antiretroviral treatment duration*. Finally, several articles have reported a significant impact of two psychosocial variables – HIV-related stigma and different coping styles – on depression in HIV patients on ART. The stigma scale was generated from eight items in the questionnaire, asking respondents about the extent to which they agreed or disagreed with perceptions that they or others had regarding HIV and AIDS. Two dimensions of stigma were measured: *external stigma* (5 items), reflecting the negative social identity ascribed to PLWHA by other people, and *internalized stigma* (3 items), which occurs when external stigma is internalized by the patient resulting in negative self-image, feelings of shame or guilt, and other manifestations of felt stigma (39). Both types of stigma were operationalized using an adaptation of Berger's HIV stigma scale presented by Wright et al. (40). Three coping behaviors were measured: *positive*, *avoidant* and *social support seeking coping styles*. Respondents were asked to describe how they were currently dealing with living with HIV and AIDS by answering 'yes' or 'no' to sixteen statements. The statements were taken from a study conducted in the United States. This study reported three sub-scales identifying 'positive', 'avoidant' and 'seeking social support' as be

three main coping mechanisms of people with AIDS (41). Both the stigma and coping scales were previously successfully applied in studies on the mental health of HIV patients on ART in South Africa (19).

The current study aims to expand on current literature by including a range of *family-level variables* in the analyses – and thus apply Wouters’ (2012) Individual-Family-Community framework for HIV research to depression (34). We however first need to clearly define what constitutes a family in our research context, the Free State province of South Africa. The FEATS questionnaire contained an open-ended question, which referred to the usage of the word family in the family-functioning scale employed in this study (the FACI-8 scale – see below): “Please describe what is ‘family?’”. We analyzed the responses to this open-ended question to see whether the respondent’s understanding of the concept ‘family’ corresponds to the concept used by the researchers who developed the questionnaire. Answers of respondents touched upon different aspects. First, *ties and relations* (e.g. “a mother, father who are staying in the same house with their children”) and *living conditions* (e.g. “a group of people living together under the same roof”) are a key attributes of respondents’ conceptualization of a family. Second, *interpersonal relations and responsibilities* have been indicated as being an important characteristic of the family, such as open communication (e.g. “communicating with one another and always supporting each other”) and shared responsibilities (e.g. “members of the same household sharing responsibilities”). Third, respondents indicated that *emotional associations* are also an important aspect of what constitutes a family (e.g. “when members of the family are unite, devoted, respecting one another and are loving and kind to one another”). Fourth, families have been attributed certain *functions*, such as problem solving (“discussing problems and feeling good about decisions and respecting one another”); sharing food (e.g. “people who share food and live under one roof”); giving support (e.g. “the members of a household who share advise and problems”); and care for one another (e.g. when people living together take care of each other”).

This conceptualization of a family as group of (related) individuals who live under the same roof and share responsibilities, emotional bonds and functions is in line with Xhosa participants’ definitions of

and associations with family in research of Smith (2006) (42). This definition of a family is closely related to the concept of a household as defined by Niehof (2011) and Randall et al. (2011) (43, 44). Indeed, respondents in the FEATS data used “family” and “household” interchangeably – which is in line with Niehof’s experience when working in South Africa as well: “the concepts of family and home emerge in the analysis as well, but are seen as partly overlapping with the concept of household and subsumed under it” (43). It is thus important to bear this definition of a family in mind when interpreting the outcomes of our analyses.

Theoretically, one of the enduring research topics of family sociology and psychology is why some families respond positively or constructively to challenges, while others fail to cope well under similar circumstances (45). Theoretically, the Resiliency Model of Family Stress, Adjustment and Adaptation focuses on the significance of the family’s relational processes – levels of *family functioning* – in explaining individual and family-level differences in responding to adversity (46). According to this framework, families create specific, recurring styles of functioning, which express the quality of the interactions among the family members. The resulting patterns have predictive power in explaining which families and individuals will adapt negatively and positively to health-related challenges (47). In the current study, the Family Attachment and Changeability Index 8 (FACI-8), developed by McCubbin, Thompson and Elver (1996), was used to measure *family functioning* at the follow-up interviews – FACI-8 was not included in the baseline interview. According to the above-mentioned Resiliency Model, the outcomes of all family dynamics result in a certain degree of adaptation and functioning in the family. The culturally and ethnically sensitive FACI-8 is a 16-item scale designed especially to measure levels of family functioning, using two subscales to assess Attachment and Changeability (47). The Attachment subscale consists of eight items (e.g. “In our family, everyone goes his/her own way” and “We have difficulty thinking of things to do as a family”). The subscale was designed to ascertain the strength of the family members’ attachment to each other. The Changeability subscale consists of eight items that determine the relative flexibility of family members in their relationships with each other (e.g. “Our family tries new ways of dealing with

problems” and “Each family member has input in major family decisions”). In accordance with the literature, confirmatory factor analysis was used to extract two first-order factors (representing Attachment and Changeability). These factors were subsequently analysed in order to extract a single second-order factor measuring *the latent construct Family Functioning (FACI-8)*. The FACI-8 scale was previously successfully employed in another study by Wouters et al. (2014) on the impact of family functioning on treatment outcomes (48). The detailed description of the characteristics of the scale can be found in this publication.

In order to assess the true effect of family functioning on ART outcomes, two additional family-related confounders, being single: represented by a dichotomous variable '*partner status*', which indicated whether the respondent had a partner (0) or was single (1); and *household size*, a continuous variable measuring the total number of persons living in the household, were included in the regression analysis. Finally, we also included a measure of the family's socio-economic position, namely the *real per capita monthly household income* (standardized) as increasing evidence demonstrates that there is a strong link between household level income and individual health, especially in vulnerable patient groups (49, 50).

Finally, the literature has also demonstrated the significant association between *community-based (peer) (adherence) support* and the occurrence of depressive symptoms in HIV patients on ART (25, 27, 51). First of all, we included a variable representing the peer adherence support intervention of the trial. Peer adherence support comprised bi-weekly visits by a trained *community-based peer adherence supporter* who at recruitment had been on ART for at least 12 months. Recruited peer adherence supporters were provided with five days of theoretical and practical training on antiretroviral treatment and adherence support. Peer adherence supporters were paid a monthly stipend of ZAR 800 and were required to pay two visits each week to eight ART patients over a period of 18 months. The peer adherence supporters performed a wide range of adherence counselling tasks. Their activities included asking the patients about their primary complaints, talking to them about these complaints, improving their knowledge about HIV/AIDS/ART, referring them to the

facility if needed, motivating them to adhere to treatment, performing a weekly pill-count to assess adherence and, if needed, providing counselling in order to address possible barriers to medication compliance. In addition to the peer adherence support intervention data, data on two other community-based support initiatives were collected. Firstly, we asked respondents how often they used the services of *a community-based lay health worker*. Secondly, we asked the respondents how often they participated in *an HIV/AIDS support group*.

Depression was measured by using the Hospital Anxiety and Depression Scale (HADS). The HADS was originally developed to detect depression and anxiety states among patients in non-psychiatric hospital clinics (52-55). The original instrument consists of 14 items, each rated on a four-point Likert-scale indicating absence, possible presence (two categories) or probable presence of mental health problems. The questionnaire was translated from English to Sesotho independently by two researchers working at the CHSR&D, whose mother tongue was Sesotho, and these translations were checked by the Sesotho-speaking interviewers during training to check the acceptability and clarity of the items and the scale as a whole. The final translated instrument reflected the consensus on the wording, clarity and cultural equivalence of the individual items. A recent study, performed on the baseline data of the current study supported the use of the HADS as a valid and reliable means to screen for both anxiety (HADS-A) and depression (HADS-D) in HIV/AIDS patients enrolled in a public-sector ART program in a resource-limited context (56). The current study only employs the depression subscale (HADS-D) to assess the levels of depressive symptoms in the patient population.

Data analysis

Structural equation modeling (SEM) was used to assess the impact of individual-level, family-level and community-level determinants of depression in HIV patients on ART at two time points. SEM is a combination of factor and multiple regression analysis. First, the measurement model specifies the relationships between the observed indicators (i.e. the items of the HADS and FACI-8 scales) and the latent variables. Second, the structural model specifies the relationships among the latent variables and between the latent variables and the other manifest variables (e.g. age, sex, etc.). The cross-

lagged structural model will be tested using stepwise multiple linear regression analyses. The cross-lagged model contains three types of regression paths. A first type connects like variables over time and thus represents within-variable regression paths (stability paths). By including regression paths between the same variable measured in different survey waves, we can estimate its relative stability across time. Secondly, the model contains the standard regression paths from individual, family and community-level variables on depression at each Wave. Finally, we included cross-lagged effects (between Wave 1 and 2) of all time-variant predictors on depression to test the impact over time. The fit of the models will be evaluated based on Hu and Bentler's cutoff criteria (57), in which two of the following three criteria must be met for a satisfactory global model fit to be attained: comparative fit index (CFI) ≥ 0.95 , root mean square error of approximation (RMSEA) ≤ 0.06 , and standardized root mean square residual (SRMR) ≤ 0.08 . To assess the net gain of adding a layer of the socio-ecological model, we will start by including the individual determinants of depression (Model 1), and then add the family-level (Model 2) and community-level blocks (Model 3) of variables. Standardised beta coefficients are provided for purposes of comparing the relative importance of the independent variables. All data analysis was performed with the statistical software package MPlus version 5.

RESULTS

Sample description

Table I shows the individual-level and family-level characteristics our sample of 435 antiretroviral treatment patients. It also describes the (availability and) use of community-based (peer) (adherence) support initiatives.

TABLE I

Measurement model

Although SEM represents the hybrid of factor analysis and path analysis, a two-step approach is recommended. Separate assessments of the measurement and the structural model prevent the good fit of the one model compensating for (and potentially masking) the poor fit of the other. The final measurement model showed acceptable practical fit indices (RMSEA < 0.05, SRMR < 0.08). Using the χ^2 difference test adapted for MLR estimation (58), we found that all latent factors (attachment, changeability and depression) to be fully metric invariant over time (Satorra–Bentler scaled χ^2 difference test TRd: 17,180, $p = 0.374$). Consequently, all factor loadings were set equally across the two rounds (59). Furthermore, the measurement error associated with a wave 1 latent factors item correlated with the measurement errors associated with the corresponding wave 2 item (60). The outcomes of the confirmatory factor analysis support the use of the depression subscale (HADS-D) at both Waves. However, three items (items 8, 10 and 14) did not sufficiently load onto the latent factor measuring depression. The final depression scale thus consisted of four items: all factor loadings were significant and ranged from 0.446 to 0.619. In accordance with the literature, our data also support the proposed two-factor structure of the FACI-8 scale, representing attachment and changeability, at both time points. All factor loadings were significant and ranged from 0.468 to 0.759. However, the two subscales were strongly correlated (0.646 at Wave 1 and 0.705 at Wave 2). A model comprising a second-order factor measuring overall family functioning did not fit the data as MPlus reported that the latent variable covariance matrix (ψ) was not positive definite due to a correlation greater than one between two latent variables (i.e. family functioning at wave 2 and

attachment at wave 2). Given the high correlation between the two subscales (attachment and changeability) and the subsequent risk for collinearity, we will perform two separate analyses: one testing the impact of attachment on depression and one testing the impact of changeability on depression, each time including a wide range of individual-level, family-level and community-level independent variables. Stepwise multiple linear regression analyses will be used to examine the net gain of adding a layer of the socio-ecological model to the regression model explaining depression levels in our sample of HIV patient on ART.

Structural models

Attachment

All models presented in Table II fitted the data well (RMSEA < 0.05, SRMR < 0.08). The stepwise regression analyses demonstrate that several individual-level variables significantly impact the HADS-D factor in our sample of HIV patients. Respondents' educational level was significantly and negatively correlated with depression at Wave 1. External stigma was positively correlated with the HADS-D factor at Wave 1, while internalized feelings of stigma were significantly associated with depression at Wave 2. An avoidant coping style was only significantly correlated with the HADS-D factor at Wave 2. Seeking social support coping was negatively associated with the occurrence of depressive symptoms at this time point. At the family-level, attachment was significantly and negatively correlated with the HADS-D factor at both time points: patients residing in a close-knit family report lower levels of depressive symptoms. Finally, the community-level predictors did not produce any significant cross-sectional or cross-lagged results.

TABLE II

Changeability

The three models displayed in Table III showed acceptable practical fit indices (RMSEA < 0.05, SRMR < 0.08). The stepwise regression analyses incorporating the impact of family changeability on depression produced similar but slightly different outcomes. The education of the patient was significantly associated with depression in all three models – but only at wave 1 – with lower

educated patients displaying significantly higher HADS-D factor scores. Health status at Wave 1 was significantly associated with depression at Wave 2 in models 1 and 2. Again, the avoidant coping style was associated with an increased risk of depression at Wave 2, while patients displaying seeking social support coping were less likely to suffer from depressive symptoms at this time point. Victims of external stigmatizing attitudes were significantly more likely to suffer from depressive symptoms at Wave 1. Respondents that internalized these stigmatizing attitudes had significantly higher HADS-D factor scores at Wave 2: an increase of one standard deviation in internalized stigma resulted in a 0.19 standard deviation ($P < 0.05$) increase in depressive symptoms at Wave 2. When looking at the family-related variables, changeability produced a cross-lagged effect on depression: patients residing in more flexible families at wave 1 displayed significantly lower HADS-D factor scores at Wave 2. This is an indicator of the differential longer term consequences of life changes across different family types. Again, none of the community-level variables was significantly associated with our depression measure.

TABLE III

DISCUSSION

The aim of the current study is to comprehensively and longitudinally study the predictors of depressive symptoms in HIV patients on ART in a high HIV-prevalence, resource-limited setting. By not only studying the most relevant individual-level and community-level predictors, but also explicitly incorporating the family-level, the study employs a comprehensive socio-ecological approach.

Firstly, the study revealed a range of individual-level correlates of depressive symptoms in HIV patients on ART. The study results showed that depressive symptoms were negatively correlated with the educational level achieved by the respondents. This outcome supports previous findings by Adewuya et al. (2008) and Kaharuza et al. (2006) in Nigeria and Uganda that demonstrate that lower education is associated with an increased risk of psychological health problems (61, 62). In contrast to many studies, our findings did not show a consistent pattern of gender differences in depressive symptoms in our population (11, 20, 22). In accordance with Yeji et al. (2014), the avoidant coping style was significantly associated with depression, demonstrating that denial and behavioral disengagement increases the likelihood of depression. The outcomes moreover showed that the social support seeking coping strategy can be a protective factor against depressive symptoms. This is in line with the psycho-social literature that predicts that patients who rely more on an active, approach coping strategy instead of a passive, avoidance strategy adapt better to life stressors and experience less mental health problems (63, 64). Stigma emerged as one of the strongest predictors of depressive symptoms in our population: external stigma was significantly correlated with symptoms of depression at Wave 1. Over time, however, these stigmatizing attitudes and behaviors can become internalized. Our findings demonstrated that over time, at Wave 2, this felt stigma became a strong correlate of depression among our sample of PLWHA on ART. These findings are in accordance with those reported by Simbayi et al. (2007).

Secondly, and proceeding from the Resiliency Model of Family Stress, Adjustment and Adaptation (46), we explored whether differing levels of family functioning were correlated with the occurrence

of depressive symptoms in our population of PLWHA. Family attachment emerged as the *only* factor that continuously impacted depression as it was significantly correlated with depression at both time points. These results suggest that a strong bond between the different members of a family can be an essential protective factor against depressive feelings in this vulnerable population. The second dimension of family functioning, changeability was the only factor that produced a cross-lagged effect on depression. A family's ability to positively react to contextual changes seems to produce a long-term impact on the mental health of a member with HIV. Conversely, rigid family dynamics that are not able to adapt to the challenges faced are an environment in which mental health problems cannot be recognized and addressed in a timely fashion. This is the first study to incorporate this crucial dimension of family functioning into a longitudinal analysis of mental health problems in a sample of PLWHA on ART in a high HIV-prevalence setting. Previous research on the relationship between family functioning have been limited to studies executed in Thailand, India and the USA (35-37) with all of these studies stressing the importance of family relationships and dynamics for the mental health of HIV-infected members.

Finally, on the community level, the peer adherence support intervention did not produce a significant impact on the mental health of the patients. It should be noted that this intervention was designed to impact patients' adherence levels and subsequent treatment outcomes and not patients' mental health. Uptake to the services of community-based lay health worker did not impact on respondents' mental health, nor did attending a treatment support group. Again, this could be due to the treatment-related focus of these support services as well as, for community health workers and HIV support groups, the relatively low level of access to such support in the study population.

The strengths of this study include its theoretical foundation in family sociology and the availability of information on a wide range of individual, family and community factors as part of a large-scale, longitudinal study on ART experienced PLWHA in a high HIV-prevalence, resource-limited setting. To the best of our knowledge, ours is the first study to comprehensively study the impact of all these factors on the levels of depression in this vulnerable population. Our study is nevertheless subject to

several limitations. First of all, respondents were drawn only from those HIV infected individuals who had gained access to the public sector antiretroviral treatment program and had successfully completed drug-readiness training. Patients suffering from depression may be less likely to seek care, complete drug readiness, and initiate treatment. They are thus under-represented in this study and one can thus only compare our findings with other patient groups who have accessed ART. Secondly, our study employed a large dataset containing information on a wide range of relevant aspects of life with HIV in South Africa. However, this strategy did not allow us an in-depth investigation of all these individual aspects. In order to truly disentangle the complex interrelationships between all aspects of family life in a challenging context and the mental health of family members living with HIV, one would need to add a layer of in-depth qualitative investigation to the current more superficial quantitative study. More research is thus needed to study how and why family dynamics impact the mental health of PLWHA. Thirdly, the empirical analysis, and thus also our measurement of depression, was based on self-reported information. Although according to some authors “the HADS appears to represent the best currently available self-report to reliably and validly assess anxiety and depression in HIV infected patients” (65), it has not yet been validated among HIV infected patients initiating ART in South Africa. Finally, it should be stressed that the HADS depression subscale is a questionnaire that performs well in screening for the dimensions of depression in various patient groups. However, the final and definitive diagnosis can only rest on the process of clinical examination (55). This information was not available in the current study. Finally, the analysis only includes data from the two follow-up survey rounds as the questions on family functioning was not included in the baseline survey, which would have provided an even richer data set to investigate these questions, particularly in regards to the longitudinal component of the analysis.

This analysis has both theoretical and practical implications. From a theoretical point of view, the immediate and long-term impact of family functioning on depression draws attention to the role of family dynamics in the mental health of PLWHA on ART. In addition to patient-level and community-based factors, future research activities should also incorporate the role of the family context, as the

familial context in which ART clients resides seems to be interconnected with his/her health outcomes. Future studies should thus employ a socio-ecological perspective, incorporating family theories, such as the *Resiliency Model of Family Stress, Adjustment and Adaptation*, to supplement more conventional approaches to mental health. In addition, future research on this topic should comprise both large-scale multilevel studies investigating the strength of the relationships between individual, family and community level determinants of mental health as well as in-depth qualitative efforts investigating how and why family relationships impact the mental health of PLWHA on ART. From the perspectives of practical policy and management, our cross-lagged findings that patients residing in poorly functioning families are more vulnerable to depression than patients living in a more harmonious family context, urge policy makers to target these vulnerable patients groups in their efforts to fight mental health problems. In a context of limited resources for health, significant gaps in the delivery of mental health services remain, despite recent progress in the decentralization of mental health care provision (24). In the face of limited specialist resources, task-shifting to less-specialized cadres is often propagated. The current study findings offer an entry point for lay health workers and family counselors to significantly contribute to the prevention and treatment of depression in a vulnerable group, i.e. PLWHA residing in ill-functioning families. Additional research is however needed to confirm our findings as well as provide the necessary scientific evidence to inform future family intervention to prevent and treat depressive symptoms in PLWHA.

TABLES

Table 1. Individual-level and family level characteristics and community-based support (n = 435)

	Wave 1	Wave 2
Age (mean ± SD)	38.9 ± 9.5	
Sex		
Male	22.6	
Female	77.4	
Education		
No formal education	3.1	
Primary education	26.9	
Some secondary education	46.9	
Grade 12 / matriculation	20.0	
Tertiary education	3.1	
Peer adherence intervention		
Yes	53.9	
No	46.1	
Treatment duration (mean ± SD)	504.3 ± 86.8	
Health status (EQ-VAS)	82.5 ± 17.3	82.1 ± 16.5
Positive coping (mean ± SD)	4.9 ± 0.4	4.9 ± 0.4
Avoidant coping (mean ± SD)	4.1 ± 1.6	3.8 ± 1.5
Social support seeking coping (mean ± SD)	1.5 ± 0.7	1.7 ± 0.6
External stigma (mean ± SD)	11.3 ± 2.9	11.5 ± 2.8
Internal stigma (mean ± SD)	4.5 ± 1.9	4.4 ± 1.8
Per capita household income (ZAR, mean ± SD)	587.4 ± 628.1	807.7 ± 646.5
Household size (mean ± SD)	3.1 ± 1.9	3.1 ± 1.9
Family functioning (FACI-8)		
Extreme	16.9	7.5
Moderate	21.2	18.5
Midrange	35.4	32.0
Balanced	26.4	41.9
Lay health worker		
Yes	22.4	14.5
No	77.6	85.5
Support group		
Yes	7.3	7.1
No	92.7	92.9

Table II. Impact of individual-level, family-level (including attachment), and community-level variables on depression: standardized regression coefficients (minus relative stability paths) and model summary.

	Depression (HADS-D factor)					
	Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2
Individual						
Age	0.115	-0.044	0.133	-0.050	0.122	0.005
Sex	0.014	-0.078	0.011	-0.070	0.014	-0.086
Education	-0.159*	-0.111	-0.176*	-0.089	-0.165*	-0.067
Treatment duration	-0.021	-0.038	-0.015	-0.044	-0.004	-0.034
Health status Wave 1	-0.010	-0.164*	-0.039	-0.138	-0.031	-0.113
Health Status Wave 2		0.094		0.057		0.043
Positive coping Wave 1	-0.043	-0.072	-0.016	-0.066	-0.016	-0.069
Positive coping Wave 2		0.095		0.085		0.096
Avoidant coping Wave 1	0.045	0.076	0.009	0.086	0.017	0.069
Avoidant coping Wave 2		0.224**		0.237**		0.273***
Social support seeking coping Wave 1	0.042	-0.063	0.048	-0.101	0.058	-0.076
Social support seeking coping Wave 2		-0.235**		-0.239***		-0.211**
External stigma Wave 1	0.207**	0.135	0.198**	0.130	0.209**	0.138
External stigma Wave 2		0.141		0.110		0.109
Internal stigma Wave 1	0.087	-0.060	0.096	-0.076	0.071	-0.081
Internal stigma Wave 2		0.208*		0.213*		0.184*
Family						
Per capita household income Wave 1			-0.039	0.046	-0.046	0.063
Per capital household income Wave 2				-0.024		-0.026
Household size Wave 1			-0.057	0.098	-0.064	0.151
Household size Wave 2				-0.059		-0.115
Attachment Wave 1			-0.174*	0.048	-0.162*	0.051
Attachment Wave 2				-0.202*		-0.192*
Community						
Support group Wave 1					-0.053	-0.039
Support group Wave 2						0.126
Lay health worker Wave 1					-0.086	-0.012
Lay health worker Wave 2						-0.092
Peer adherence support intervention					0.039	0.025
Variance explained (R²)						
Depression Wave 1		0.138**		0.174**		0.172**
Depression Wave 2		0.270***		0.306***		0.315***

*p < 0.05; ** p < 0.01; *** p < 0.001

Table III. Impact of individual-level, family-level (including changeability), and community-level variables on depression: standardized regression coefficients (minus relative stability paths) and model summary.

	Depression (HADS-D factor)					
	Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2
Individual						
Age	0.115	-0.044	0.132	-0.047	0.117	0.007
Sex	0.014	-0.078	0.002	-0.073	0.007	-0.086
Education	-0.159*	-0.111	-0.171*	-0.114	-0.161*	-0.094
Treatment duration	-0.021	-0.038	-0.026	-0.046	-0.017	-0.032
Health status Wave 1	-0.010	-0.164*	-0.021	-0.146*	-0.016	-0.122
Health Status Wave 2		0.094		0.084		0.068
Positive coping Wave 1	-0.043	-0.072	-0.018	-0.084	-0.017	-0.088
Positive coping Wave 2		0.095		0.092		0.101
Avoidant coping Wave 1	0.045	0.076	0.007	0.091	0.015	0.075
Avoidant coping Wave 2		0.224**		0.231**		0.264**
Social support seeking coping Wave 1	0.042	-0.063	0.050	-0.077	0.060	-0.060
Social support seeking coping Wave 2		-0.235**		-0.231***		-0.206**
External stigma Wave 1	0.207**	0.135	0.204**	0.131	0.213**	0.136
External stigma Wave 2		0.141		0.129		0.129
Internal stigma Wave 1	0.087	-0.060	0.110	-0.074	0.084	-0.076
Internal stigma Wave 2		0.208*		0.216*		0.188*
Family						
Per capita household income Wave 1			-0.024	0.059	-0.036	0.080
Per capital household income Wave 2				-0.040		-0.044
Household size Wave 1			-0.019	0.039	-0.030	0.096
Household size Wave 2				-0.020		-0.077
Changeability Wave 1			-0.049	-0.161*	-0.041	-0.151*
Changeability Wave 2				-0.014		0.003
Community						
Support group Wave 1					-0.061	-0.019
Support group Wave 2						0.124
Lay health worker Wave 1					-0.089	-0.001
Lay health worker Wave 2						-0.098
Peer adherence support intervention					0.027	0.023
Variance explained (R²)						
Depression Wave 1		0.138**		0.147**		0.147**
Depression Wave 2		0.270***		0.300***		0.308***

*p < 0.05; ** p < 0.01; *** p < 0.001

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