



Depression, social support, and stigma as predictors of quality of life over time: results from an Asha-based HIV/AIDS intervention in India

Dana Rose Garfin^a, Sanghyuk S. Shin^a, Maria L. Ekstrand^b, Kartik Yadav^a, Catherine L. Carpenter^c, Sanjeev Sinha^d and Adeline M. Nyamathi^a

^aSue & Bill Gross School of Nursing, University of California, Irvine, CA, USA; ^bUCSF School of Medicine, San Francisco, CA, USA; ^cUCLA Center for Human Nutrition, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA; ^dDepartment of Medicine, All India Institute of Medical Sciences, New Delhi, India

ABSTRACT

Quality of life (QOL) is associated with better outcomes in HIV/AIDS populations. We explored predictors of improved QOL over time in 600 Women Living with HIV/AIDS (WLH/A) in India [mean age = 34.31, $SD = 6.97$], enrolled in a nurse-led-Asha (Accredited Social Health Activist) intervention. Trained local interviewers ascertained self-report data at baseline and six-month follow-up (post-intervention). Latent Class Analysis (LCA) identified constellations of responses on psychosocial indicators (depression, social support, internalized stigma and stigma fears); their relationship with QOL over time was examined. We identified three classes: Class 1) Highest Social Resources/Lowest Depression; Class 2) Some Social Resources/Highest Depression; and Class 3) Lowest Social Resources/Higher Depression. At baseline, Class 3 reported the lowest QOL ($M = 0.25$, $SD = 0.26$); Class 1 reported the highest ($M = 0.37$, $SD = 0.33$). Class 2's QOL did not differ from Class 3's QOL, likely due to the potent effects of high depression. At six-month follow-up, all groups reported improved QOL; class membership no longer predicted variability (contrast between Class 2 and 1 = -0.05 , 95% CI = -0.14 , 0.04 ; contrast between Class 3 and 1 = 0.01 , 95% CI = -0.03 , 0.05 ; contrast between Class 3 and 2 = 0.07 , 95% CI = -0.02 , 0.16). Psychosocial indicators are important predictors of QOL; an Asha-supported approach may have broad applicability to improve QOL in WLH/A in India.

ARTICLE HISTORY

Received 4 April 2018
Accepted 20 December 2018

KEYWORDS

AIDS; HIV; quality of life; stigma; depression; social support; Latent Class Analysis

Introduction

Quality of life (QOL) has been associated with better health and potentially longer survival times in HIV/AIDS populations (Bucciardini et al., 2014). QOL measures functioning and adaptation on physical, social, emotional and cognitive domains, can be a proxy measure of HIV/AIDS-related disease progression and impairment (Erlandson et al., 2014), and correlates with clinically-relevant HIV/AIDS-related physiological markers and symptomatology (Bucciardini et al., 2014; Mwesigire, Martin, Seeley, & Katamba, 2015; Nyamathi et al., 2017). Targeting QOL may help HIV-treatment adherence and improve the effectiveness of HIV/AIDS-related interventions (Mwesigire et al., 2015).

Identifying profiles of Women Living with HIV/AIDS (WLH/A) in need of assistance and examining potential individual-level differences in response to treatment could inform targeted efforts to improve QOL. Latent Class Analysis (LCA) identifies subgroups, characterized by patterns of risk factors (i.e., tailoring variables) potentially related to differential responses to treatment (Lanza

& Rhoades, 2013). Adaptive interventions can then implement varying decision rules regarding intervention type and dose according to key individual-level characteristics (Collins, Murphy, & Bierman, 2004).

Predictors of subgroup membership: depression, social support, and stigma

Responses to psychosocial indicators may help identify subgroup membership for WLH/A related to treatment-response and QOL over time. Potential QOL-relevant tailoring variables include depression, social support, and stigma (Rueda et al., 2016). Cross-sectional work has described social support as a mediator of depression (Hou et al., 2014) and vice versa (Jia et al., 2004; Simoni, Frick, Lockhart, & Liebovitz, 2002). Previous research has linked internalized stigma and depression in HIV populations in Southern India (Chan et al., 2017; Steward et al., 2011). Moreover, also in HIV-positive individuals in India, depression and stigma were highly correlated and depression predicted lower QOL (Charles et al., 2012).

Depression is common in HIV-infected individuals (Campos, Guimarães, & Remien, 2010) and is positively associated with lower QOL (Hou et al., 2014), ART non-adherence (Dworkin, Douglas, Sabitha Rani, & Chakraborty, 2016) and lower gains during ART interventions (Cook et al., 2007). In a sample of highly-compliant-HIV-positive individuals, depression was negatively associated with QOL in all domains assessed (Jia et al., 2004). Improvements in depression have been linked with improved QOL (Bengtson et al., 2015).

Prior research indicated social support as an independent predictor of QOL in HIV/AIDS populations (Hou et al., 2014; Oetzel et al., 2014), with both direct and indirect effects (Oetzel et al., 2014). Multiple mechanisms may underlie these relationships. Social support may impact QOL and related outcomes through enhanced coping (Xiao, Li, Qiao, Zhou, & Shen, 2018), improved health behavior choices, increased emotional well-being, and reduction of physiological stress responses (Hostinar, Sullivan, & Gunnar, 2014). Social support has also been linked to higher ART adherence (Simoni et al., 2002) and CD4 cell count (Persson, Ostergren, Hanson, Lindgren, & Naucler, 2002).

Stigma is also negatively correlated with QOL (Nyamathi et al., 2017). It has been documented as a barrier to receiving care, both due to delays in health-care seeking (Steward, Bharat, Ramakrishna, Heylen, & Ekstrand, 2013) and denial of proper care from providers (Kiriazova et al., 2017). Internalized stigma is related to health care avoidance (Dos Santos, Kruger, Mellors, Wolvaardt, & van der Ryst, 2014) and delays in seeking treatment after testing HIV positive (Steward et al., 2013). Stigma fears are associated with impaired healthcare access, adherence, social interaction and social support (Carr & Gramling, 2004). Given increasing life expectancy for individuals on effective ART (Trickey et al., 2017), initiating and maintaining early ART treatment is critical to increasing survival and QOL.

Interventions targeting QOL for WLH/A

WLH/A in developing nations, including India, face critical challenges to receiving adequate care (Srivastava et al., 2017) that may be detrimental to QOL such as patriarchal cultural values leading to abuse and trauma (Panchanadeswaran & Koverola, 2005) and limited knowledge regarding HIV transmission and care (Pallikadavath, Garda, Apte, Freedman, & Stones, 2005). The multi-faceted-health-care provision that integrates task-shifting approaches using community health workers (CHW) to augment orthodox care may help address such challenges (Nyamathi et al., 2016). Task-shifting utilizes existing community structures and

transfers tasks from highly-trained professionals to CHW with less or no prior healthcare training (Joshi et al., 2014). CHWs can increase intervention scalability and feasibility (Nyamathi, Hanson, et al., 2012) and benefit communities with shortages of highly-trained medical professionals (Joshi et al., 2014).

Our team's Asha (Accredited Social Work Activist) WLH/A intervention in India implemented a CHW model that accounted for WLH/A's unique challenges. Asha are community members and offer culturally-sensitive and relatable, cost-effective care; they provide logistical, medical, and social support (Nyamathi et al., 2016), and work to reduce the impact of stigma. They help medical professionals transfer and reinforce health information, providing an important bridge between WLH/A and the HIV/AIDS-treatment-community (Nyamathi et al., 2016).

The present analyses examined whether psychosocial variables measured at baseline could help classify subgroups of WLH/A enrolled in an Asha-supported intervention and whether subgroup membership predicted QOL at baseline, change over time, and at 6-month follow-up.

Method

Baseline and 6-month follow-up data were collected from 600 WLH/A in Southern India enrolled in a larger nurse-led-Asha-support randomized control trial (RCT). The RCT implemented a factorial design: (1) Standard education (Asha-support-attention-control); (2) Enhanced-nutrition education; (3) Enhanced-nutrition supplements; and (4) Combined nutrition education and supplements. (All groups integrated Asha support). Ethics approval was obtained in the US and India.

Women lived in rural Andhra Pradesh near one of four high-HIV-prevalence sites. Each site had one Community Health Center and 1–2 Primary Care Centers (PHCs) women were recruited from. Geographic randomization (four regions randomized into one of four arms) was implemented to minimize group cross-over effects. Inclusion criteria included WLH/A who were: (a) aged 18–50; (b) receiving ART for ≥ 3 months, validated by an ART card given by the district hospital to all ART patients; (c) demonstrating CD4 levels ≥ 100 cells/mm³; and (d) living with a child aged 3–8.

Flyers were posted in the PHCs; interested women privately met with research staff, received study information, provided written-informed consent (signature/thumbprint) and completed a 2-minute-eligibility screener. Eligible participants completed a second written-informed (signature/thumbprint) consent.

Baseline data collection was staggered over two years (May 2014–November 2016), enrolling 100 women at a time (25 per condition) in six rounds. Follow-up data were collected six months after baseline. Data were collected via face-to-face interviews in a private location, recorded via the secure-tablet application hosted by UCLA on Google and Microsoft cloud servers. Individual files were kept onsite in locked cabinets; responses were deidentified to ensure confidentiality. Additional variables were collected; only those pertinent to present analyses are presented herein.

Asha selection training

Asha were lay village women, selected and trained by the Principal Investigators (PIs) and Project Director (PD). Asha eligibility included: age 20–50; education \geq 8th grade; interest in caring for WLH/A; history of community service; and residence in similar villages (and similar caste membership) as the WLH/A.

Asha training included education about study protocol, needs of WLH/A, basic HIV/AIDS disease progression, the importance of ART adherence, strategies to assist WLH/A in coping with their illness, and maintaining participant confidentiality. Four Asha, employed full-time, were assigned to each program and trained per program design. Quarterly quality-assurance assessments occurred.

Asha-support program

The Asha-support program was derived from focus-group sessions with community members prior to the commencement of study procedures for cultural relevance and to address specific challenges of WLH/A in India. A minimum of six group sessions (three modules with two sessions each; see Table 1) were delivered by experts in a large room at the research site. (Intervention groups that received nutrition education participated in two additional models.) Asha-support augmented and reinforced group-session content and provided additional support regarding ART adherence and self-care. Ashas attended all group sessions with participants, visited women 1:1 weekly, monitored barriers to and recording of ART adherence, accompanied women to medical visits, and provided additional assistance.

Measures

Depression. A modified Center for Epidemiologic Depression Scale (CES-D), short version (Radloff, 1977) was used. The CES-D has been established as a reliable and valid measure in India and elsewhere

(Nyamathi et al., 2011). It was dichotomized at ≥ 10 according to standard guidelines, given $\alpha = .52$ (Zhang et al., 2012).

Social support. The 18-item MOS Social Support Scale (Sherbourne & Stewart, 1991), previously used in India (Suhadev, Nyamathi, Swaminathan, Suresh, & Venkatesan, 2009), assesses support (e.g., emotional/informational, affectionate, tangible) availability (1 = none of the time, 5 = all of the time). Social support was low: ($M = 1.08$, $SD = 0.22$, $\alpha = .93$); 60.67% ($n = 364$) reported social support an average of “none of the time”. Responses were dichotomized (0 = no social support; 1 = any social support).

Stigma fears. Developed for persons living with HIV/AIDS (Ekstrand, 2017), with versions previously used in India (Heylen, Panicker, Chandy, Steward, & Ekstrand, 2015) this measure consists of five subscales (family, friends, healthcare workers, community, work) pertaining to fear of being stigmatized. Fear of divorce was not included as over half (60%) of the sample was not married. Several work-related items were eliminated: factor analyses revealed a lack of relevance for our sample (e.g., losing promotion, work relocation). Alpha = .80 for remaining items. Responses were dichotomized into high/low at the median (0 = low stigma fear; $n = 279$, 46.50%; 1 = high stigma fear, $n = 321$, 53.50%).

Internalized stigma. This 10-item measure previously used in India assessed the extent respondents believed that, as HIV-infected people they deserved stigmatization (Ekstrand, Bharat, Ramakrishna, & Heylen, 2012;

Table 1. Outline of group-based modules.

<i>Keeping healthy</i> Module 1A and 1B:	<ol style="list-style-type: none"> 1. Getting support; talking to my Asha and my doctor/nurse; learning about HIV/AIDS 2. Learning about and taking ART; recognizing an OI; healthy eating 3. Keeping with healthy routines 4. Deciding with whom to share health problems
<i>Caregiving</i> Module 2A and 2B:	<ol style="list-style-type: none"> 1. Breastfeeding safely or learning to sterilize the formula 2. Promoting care-giving for family while caring for my own mental and physical well-being 3. Engaging in life skills education 4. Staying in sync with my children; identifying their needs
<i>Staying upbeat</i> Module 3A and 3B:	<ol style="list-style-type: none"> 1. Finding the joys in life; creating a social network for myself 2. Dealing well with problems; keeping positive relations with family 3. Taking active steps to improve my life every day 4. Getting psychological assistance
<i>Healthy eating for self and family</i> Module 4A and 4B: (Program 2 & 4 only)	<ol style="list-style-type: none"> 1. Learning about low-cost foods that are nutritious 2. Where to purchase foods 3. Learning how to monitor my food intake 4. Considering ways to eat healthy 5. Participating in cooking classes

Steward et al., 2011); $\alpha = .76$. Responses were dichotomized high/low at the median (0 = low internalized stigma; $n = 298$, 49.67%; 1 = high internalized stigma; $n = 302$, 50.33%).

Quality of life (QOL). The 10-item short form Quality of Life Enjoyment and Satisfaction Questionnaire (Endicott, Nee, Harrison, & Blumenthal, 1993), has been internationally validated (Ritsner, Kurs, Kostizky, Ponzovsky, & Modai, 2002) and previously implemented in India (Heylen et al., 2015). Items were reverse coded for improved interpretation (higher values = greater QOL). Reliability was good at baseline ($\alpha = .80$) and follow-up ($\alpha = .86$).

Covariates. Demographics (education, marital status, and income); % ART adherence (Giordano, Guzman, Clark, Charlebois, & Bangsberg, 2004); opportunistic infections (eight common included TB, febrile illness, candida, diarrhea); and food insecurity (The Household Food Insecurity Access Scale; Coates, Swindale, & Bilinsky, 2007) were assessed at baseline. Intervention group membership was included as a potential predictor of baseline QOL.

Analytic strategy

A two-step approach (Roy & Raver, 2014; Savage & Birch, 2016) was implemented. First, guided by theory and exploratory analyses, latent classes were identified using standard model fit guidelines (i.e., Akaike information criteria [AIC] and Bayesian information criteria [BIC]). LCA identifies subgroups of individuals sharing common patterns among a set of variables and helps identify the optimal number of classes to describe a given population (Lanza & Cooper, 2016). Individuals are assigned to a class based on their probability of belonging to that class given their data on the observed variables that help define the latent classes. Social support, depression, internalized stigma, and stigma fears were evaluated as predictors of latent class membership.

Since the four indicator variables were initially continuous measures, a series of latent profile analyses (LPA) were conducted using a Gaussian distribution, then compared to results of the LCA, which utilized dichotomized versions of the variables in a logit distribution. (LCA and LPA are conceptually identical). Potential iterations were set at 100.

Each observation has a predicted class that can be identified based on the calculation of their predicted posterior class probability. These are *predicted probabilities* and responses may vary within classes. These probabilities define the latent classes and, after selection, are stored to be used as an independent variable for subsequent analyses.

Table 2. Percent and probabilities of endorsing depression, internalized stigma, social support, and stigma fears at baseline.

Latent group membership ^a	Entire sample											
	Class 1: Lower depression/higher support/lower internalized stigma fears				Class 2: High depression/low support/lower internalized stigma/lower stigma fears				Class 3: High depression/low support/high internalized stigma/high stigma fears			
	Dichotomized score		Continuous score		Dichotomized score		Continuous score		Dichotomized score		Continuous score	
N	%	M	SD	N	%	M	SD	n	%	M	SD	
Depression	147	24.50	9.18	3.08	36	14.46	8.51	2.88	81	25.23	9.21	2.82
Social support	236	39.33	1.08	0.22	127	51.00	1.13	0.33	109	33.96	1.04	0.07
Internalized stigma	302	50.33	2.30	0.25	103	41.37	2.26	0.34	199	61.99	2.34	0.14
Stigma fears	321	53.50	2.81	0.26	0	0	2.63	0.29	321	100	2.97	0.04
	N = 600				n = 249 41.40%		n = 30 5%		n = 321 53.50%			

^aBased on maximum posterior probabilities. Dichotomized scores represent % high.

Table 3. Means, standard deviations, and differences between groups of quality of life at baseline and six months.

	Quality of life Baseline M(SD)	Quality of life Six-months M(SD)	Change in Quality of life M(SD)
Class 1: Highest Social Resources/Lowest Depression	0.37 (0.33)	2.93(0.16)	2.56(0.40)
Class 2: Some Social Resource/Highest Depression	0.27(0.20)	2.89(0.25)	2.62(0.35)
Class 3: Lower Social Resources/High Depression	0.25(0.26)	2.93(0.16)	2.68(0.35)
ANOVA test of between group differences	$F(2, 597) = 12.81, p < .001$	$F(2, 597) = 1.04, p = 0.355$	$F(2, 597) = 8.34 p < .001$

Variables that predicted QOL at baseline were examined in bivariate regressions; those significant were included in longitudinal multivariate models. Next, a repeated measures approach was implemented using STATA's mixed command to examine whether membership in latent class was associated with QOL over time. Independent variables included LCA class membership, time, LCA class X time interaction, and covariates that were statistically significant (as tested by OLS regressions) at baseline.

Results

Description of the sample

The average age was 34.3 (range 19–50, $SD = 6.97$). The majority were widowed ($n = 308$; 51.33%); 39.67% ($n = 238$) were married, and 9% ($n = 54$) were divorced. On average they had 1.86 children ($SD = 0.80$, range 1–6).

Latent class identification

A three-class solution using dichotomized predictors best characterized the sample at baseline. Models had difficulty converging using continuous predictors in the LPA and had poorer model fit compared to LCA models. Moreover, the various profile groups in the Gaussian distribution had extreme proportions across classes (e.g.,

98% in certain classes compared to 1% or 2% in others), likely due to relative homogeneity between individuals for key observed variables (e.g., extremely low social support at baseline).

The best model fit suggested a three class solution using an LCA. BIC and AIC were lower with the three class solution (BIC = 3171; AIC = 3109) compared to the four (BIC = 3200; AIC = 3177) or five (BIC = 3205; AIC = 3177) class solutions. Thus three latent classes were identified: (1) Lower depression/ higher support / lower stigma fears (Highest Social Resources/Lowest Depression); (2) Highest depression/low support/lower internalized stigma/lower stigma fears (Some Social Resources/Highest Depression) (3) High depression/ lower social support/higher stigma (Lowest Social Resources/High Depression). See Table 2 for percentages and probabilities. At follow-up, the sample as a whole exhibited lower depression ($M = 0.05$, $SD = 0.32$), internalized stigma, ($M = 0.004$, $SD = 0.03$), and stigma fears ($M = 0.01$, $SD = 0.13$) and improved social support ($M = 4.96$, $SD = 0.09$) compared to baseline (for paired t -tests comparing baseline to follow-up scores all p -values $< .001$).

Quality of life over time

Table 3 presents mean QOL by class membership at baseline and follow-up. Table 4 presents results of

Table 4. Results of repeated measures analyses of predicted class and quality of life between baseline and 6-month follow-up^a.

	B	SE	Z	<i>p</i> -value	95% CI	
<i>Predicted class^b</i>						
1: Highest Social Resources/Lowest Depression (reference group)						
2: Some Social Resources/Highest Depression	−0.12	0.05	−2.55	.011	−0.21	−0.03
3: Lowest Social Resources/High Depression	−0.11	0.02	−5.52	<.001	−0.15	−0.07
Time	2.56	0.02	121.38	<.001	2.51	2.60
<i>Predicted class^b X time^c</i>						
1: Highest Social Resources/Lowest Depression X baseline (reference group)						
2: Some Social Resources/Highest Depression X 6-month follow-up	0.06	0.06	1.00	.318	−0.06	0.19
3: Lowest Social Resources/High Depression X 6-month follow-up	0.13	0.03	4.56	<.001	0.07	0.18
Constant	0.49	0.05	9.42	<.001	0.39	0.60
<i>Random effects parameters</i>						
	<i>Estimate</i>	<i>SE</i>	<i>95% CI</i>			
Subject: constant	4.27e-20	3.67e-20	7.93e-21, 2.30e-19			
Residual	0.06	0.002	0.05, 0.06			

^aAnalyses control for monthly household income in Rupees, % ART adherence, food insecurity at baseline and intervention group; test of independence between predicted class and intervention group were significant, $\chi^2(6) = 34.41, p < .001$.

^b1 = Low depression/high social support/low stigma fears; 2 = High depression/low social support/low internalized stigma/low stigma fears; 3 = High depression/low social support/high internalized stigma/high stigma fears.

^cBaseline = reference group for time.

Table 5. Test of contrasts between baseline and 6 month follow-up by latent class on quality of life.

	Contrast	SE	z	p	95% CI	
<i>Time@ predicted class^a</i>						
(6 m vs baseline) 1 (Highest Social Resources/Lowest Depression)	2.56	0.02	121.38	<.001	2.51	2.60
(6 m vs baseline) 2 (Some Social Resources/ Highest Depression)	2.62	0.06	43.19	<.001	2.50	2.74
(6 m vs baseline) 3 (Lowest Social Resources/High Depression)	2.68	0.02	144.71	<.001	2.65	2.72

^a1 = Low depression/high social support/low stigma fears; 2 = High depression/low social support/low internalized stigma/low stigma fears; 3 = High depression/low social support/ high internalized stigma/high stigma fears.

repeated-measures analyses of QOL from baseline to 6-month follow up. The following covariates predicted QOL at baseline and were included in repeated-measures analyses: monthly household income in Rupees ($b = -0.0002$; 95% CI, $-0.0002, -0.0001$; $p < .001$), % ART adherence ($b = 0.002$; 95% CI, $0.00004, 0.004$; $p = .045$), food insecurity ($b = -0.13$; 95% CI, $-0.19, -0.07$; $p < .001$), and intervention group membership. Compared to Group 1 (attention control), Group 2 ($b = 0.07$, 95% CI, $0.01, 0.14$, $p = .029$) and Group 4 ($b = 0.07$, 95% CI, $0.01, 0.14$, $p = .029$) reported higher QOL. The interaction between class membership and time was significant: a change in QOL over time was the highest for the lowest resource group. Table 5 presents contrasts tests of change in QOL for each class from baseline to follow-up: all groups exhibited statistically significant gains in QOL from baseline to 6-month follow-up. Table 6 presents the test of marginal contrasts (i.e., tests of simple effects): QOL scores between some groups were statistically different at baseline although not at six-month follow-up.

Discussion

All participants received Asha-supported intervention and experienced significant improvements in QOL across three latent classes that differentiated QOL at baseline. At baseline, members of Class 1, who had the highest psychosocial resources (lower stigma, higher social support, lowest depression) reported higher baseline QOL relative to other groups, in line with prior research (Charles et al., 2012; Xiao, Li, Qiao, Zhou, & Shen, 2017); members of Class 2 and 3 (both with relatively higher depression) were not significantly different from each other. At six month follow-up, all groups improved QOL. Latent class membership no longer explained variability in QOL although Class 3 improved

Table 6. Tests of contrasts between latent classes on quality of life at baseline and six months.

	Contrast	SE	Z	p-value	95% CI	
<i>Predicted class^a@ time</i>						
(2 vs 1) baseline	-0.12	0.05	-2.55	.011	-0.21	-0.03
(2 vs 1) 6mo	-0.05	0.05	-1.15	.252	-0.14	0.04
(3 vs 1) baseline	-0.11	0.02	-5.52	<.001	-0.15	-0.07
(3 vs 1) 6 mo	0.01	0.02	0.70	.483	-0.03	0.05
(3 vs 2) baseline	0.003	0.05	0.06	.949	-0.09	0.09
(3 vs 2) 6 mo	0.07	0.05	1.47	.141	-0.02	0.16

^a1 = Highest Social Resources/Lowest Depression (low depression/high social support/low stigma fears); 2 = Some Social Resources/Highest Depression (high depression/low social support/low internalized stigma/low stigma fears); 3 = Lowest Social Resources/Higher Depression (high depression/low social support/high internalized stigma/high stigma fears).

the most, likely due to lowest baseline scores. This suggests a compressive intervention that concurrently targets psychological, social, behavioral, and physiological needs may help WLH/A overcome baseline vulnerabilities, improving QOL and overall health for many.

For the majority of our sample, baseline-risk markers hung together in an expected manner (i.e., lower psychosocial resources with higher depression) (Hou et al., 2014). Indeed, Class 1 and Class 3 comprised 95% of our sample. Recent structural equation modeling similarly demonstrated relationships between lower social support, higher stigma, poor mental health, and lower QOL in a vulnerable HIV/AIDS sample (Mitchell et al., 2017), with lower QOL negatively correlated with viral suppression (Mitchell et al., 2017), emphasizing QOL as an important target for comprehensive HIV/AIDS care. Yet findings simultaneously emphasize the important relationship between depression and QOL. Class 2 members reported lower stigma compared to other groups but were more similar to Class 3 in terms of QOL scores than to Class 1. This emphasizes the critical link between depression, social support and QOL for WLH/A in India (Deshmukh, Borkar, & Deshmukh, 2017); a potent relationship was evident despite the availability of some social resources. Although most HIV/AIDS-related research finds positive linear relationships between high depression and both low social support (Charles et al., 2012; Kalomo, 2017) and high stigma (Kalomo, 2017), for a minority of WLH/A in India, these interrelationships may be more complex, with depression and low social support detrimental to QOL despite availability of some psychosocial resources. Notwithstanding efforts of their community to intervene (evidenced by lower stigma), for highly depressed individuals, more structured support-based intervention may be necessary.

Results demonstrate the broad benefit of using lay CHWs to augment standard medical care: all classes improved QOL from baseline to follow-up. Previous

work has demonstrated the effectiveness of the nurse-led Asha-based approach in WLH/A on improving outcomes including stigma (Nyamathi et al., 2013), adherence (Nyamathi, Hanson, et al., 2012), and depression (Nyamathi, Salem, et al., 2012), which likely improve via reciprocal, interrelated mechanisms. Recent work in Southern India using a CHW-administered psychological intervention for depression found it superior to treatment as usual for depression and secondary outcomes (Patel et al., 2017). The approach benefited the community long-term in terms of cost savings and improved resident health and functioning (Patel et al., 2017).

Limitations

Our study has several limitations. Groups reported extremely low social support and high stigma at baseline, creating potential floor and ceiling effects. Classes were not balanced: Class 2 (Highest Depression/Some Social Resources) comprised only 5% of the sample. Measures were self-reported and thus subject to bias. An attention-control was implemented for ethical reasons. Lastly, the unique characteristics of our sample may limit generalizability: future studies could explore these questions in other populations.

Conclusion

Constellations of scores on psychosocial indicators may elucidate variability in QOL in WLH/A in India. Depression, with or without additional psychosocial resources, may be a potent predictor of low QOL. Interventions combining focused education with Asha-support may expand existing structures within the community (Nyamathi, Hanson, et al., 2012), be beneficial for WLH/A with a range of psychosocial characteristics, help WLH/A overcome baseline vulnerabilities, and be appropriate for broad dissemination.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by National Institute of Allergy and Infectious Diseases [grant number K01AI118559]; National Institute of Mental Health [grant number R01MH098728].

References

Bengtson, A. M., Pence, B. W., O'Donnell, J., Thielman, N., Heine, A., Zinski, A., ... Gaynes, B. (2015). Improvements in depression and changes in quality of life among HIV-

- infected adults. *AIDS Care*, 27, 47–53. doi:10.1080/09540121.2014.946386
- Bucciardini, R., Pugliese, K., Weimer, L., Digregorio, M., Fragola, V., Mancini, M., ... Florida, M. (2014). Relationship between health-related quality of life measures and high HIV viral load in HIV-infected triple-class-experienced patients. *HIV Clinical Trials*, 15, 176–183. doi:10.1310/hct1504-176
- Campos, L. N., Guimarães, M. D. C., & Remien, R. H. (2010). Anxiety and depression symptoms as risk factors for non-adherence to antiretroviral therapy in Brazil. *AIDS and Behavior*, 14(2), 289–299. doi:10.1007/s10461-008-9435-8
- Carr, R. L., & Gramling, L. F. (2004). Stigma: A health barrier for women with HIV/AIDS. *Journal of the Association of Nurses in AIDS Care*, 15(5), 30–39.
- Chan, B. T., Pradeep, A., Prasad, L., Murugesan, V., Chandrasekaran, E., Kumarasamy, N., ... Tsai, A. C. (2017). Association between internalized stigma and depression among HIV-positive persons entering into care in Southern India. *Journal of Global Health*, 7. doi:10.7189/jogh.07.020403
- Charles, B., Jeyaseelan, L., Pandian, A. K., Sam, A. E., Thenmozhi, M., & Jayaseelan, V. (2012). Association between stigma, depression and quality of life of people living with HIV/AIDS (PLHA) in South India – A community based cross sectional study. *BMC Public Health*, 12, 463. doi:10.1186/1471-2458-12-463
- Coates, J., Swindale, A., & Bilinsky, P. (2007). *Household Food Insecurity Access Scale (HFIAS) for measurement of household food access: Indicator Guide (v.3)*. Washington, DC: United States Agency for International Development.
- Collins, L. M., Murphy, S. A., & Bierman, K. L. (2004). A conceptual framework for adaptive preventive interventions. *Prevention Science*, 5(3), 185–196.
- Cook, J. A., Grey, D. D., Burke-Miller, J. K., Cohen, M. H., Vlahov, D., Kapadia, F., ... Levine, A. M. (2007). Illicit drug use, depression, and their association with highly active antiretroviral therapy in HIV-positive women. *Drug and Alcohol Dependence*, 89(1), 74–81. doi:10.1016/j.drugalcdep.2006.12.002
- Deshmukh, N., Borkar, A., & Deshmukh, J. (2017). Depression and its associated factors among people living with HIV/AIDS: Can it affect their quality of life? *Journal of Family Medicine and Primary Care*, 6, 549. doi:10.4103/2249-4863.222016
- Dos Santos, M. M., Kruger, P., Mellors, S. E., Wolvaardt, G., & van der Ryst, E. (2014). An exploratory survey measuring stigma and discrimination experienced by people living with HIV/AIDS in South Africa: The people living with HIV stigma index. *BMB Public Health*, 14, 80. doi:10.1186/1471-2458-14-80
- Dworkin, M. S., Douglas, G. W., Sabitha Rani, G. P., & Chakraborty, A. (2016). Adherence to highly active antiretroviral therapy in Hyderabad, India: Barriers, facilitators and identification of target groups. *International Journal of STD & AIDS*, 27(3), 186–195. doi:10.1177/0956462415578545
- Ekstrand, M. (2017). *No path to 90-90-90 without addressing stigma*. Presentation given at AIDS Impact, Nov. 14, 2017, Cape Town, South Africa.
- Ekstrand, M. L., Bharat, S., Ramakrishna, J., & Heylen, E. (2012). Blame, symbolic stigma and HIV misconceptions

- are associated with support for coercive measures in urban India. *AIDS and Behavior*, 16, 700–710. doi:10.1007/s10461-011-9888-z
- Endicott, J., Nee, J., Harrison, W., & Blumenthal, R. (1993). Quality of life enjoyment and satisfaction questionnaire: A new measure. *Psychopharmacology Bulletin*, 29(2), 321–326. doi:10.1111/j.1365-2850.2011.01735.x
- Erlanson, K. M., Allshouse, A. A., Jankowski, C. M., Mawhinney, S., Kohrt, W. M., & Campbell, T. B. (2014). Relationship of physical function and quality of life among persons aging with HIV infection. *AIDS (London, England)*, 28(13), 1939–1943.
- Giordano, T. P., Guzman, D., Clark, R., Charlebois, E. D., & Bangsberg, D. R. (2004). Measuring adherence to antiretroviral therapy in a diverse population using a visual analogue scale. *HIV Clinical Trials*, 5, 74–79.
- Heylen, E., Panicker, S. T., Chandu, S., Steward, W. T., & Ekstrand, M. L. (2015). Food insecurity and its relation to psychological well-being among South Indian people living with HIV. *AIDS and Behavior*, 19(8), 1548–1558. doi:10.1007/s10461-014-0966-x
- Hostinar, C. E., Sullivan, R. M., & Gunnar, M. R. (2014). Psychobiological mechanisms underlying the social buffering of the hypothalamic-pituitary-adrenocortical axis: A review of animal models and human studies across development. *Psychological Bulletin*, 140(1), 256–282. doi:10.1037/a0032671
- Hou, W.-L., Chen, C.-E., Liu, H.-Y., Lai, Y.-Y., Lee, H.-C., Lee, N.-Y., ... Ko, N.-Y. (2014). Mediating effects of social support on depression and quality of life among patients with HIV infection in Taiwan. *AIDS Care*, 26(8), 996–1003. doi:10.1080/09540121.2013.873764
- Jia, H., Uphold, C. R., Wu, S., Reid, K., Findley, K., & Duncan, P. W. (2004). Health related quality of life among men with HIV infection: Effects of social support, coping, and depression. *AIDS Patient Care and STDs*, 18, 594–603. doi:10.1089/apc.2004.18.594
- Joshi, R., Alim, M., Kengne, A. P., Jan, S., Maulik, P. K., Peiris, D., & Patel, A. A. (2014). Task shifting for non-communicable disease management in low and middle income countries - A systematic review. *PLoS ONE*, 9(8), e103754. doi:10.1371/journal.pone.0103754
- Kalomo, E. N. (2017). Associations between HIV-related stigma, self-esteem, social support, and depressive symptoms in Namibia. *Ageing and Mental Health*, 21(1), 1–7. doi:10.1080/13607863.2017.1387763
- Kiriazova, T., Lunze, K., Raj, A., Bushara, N., Blokhina, E., Krupitsky, E., ... Gifford, A. L. (2017). “It is easier for me to shoot up”: stigma, abandonment, and why HIV-positive drug users in Russia fail to link to HIV care. *AIDS Care*, 29, 559–563. doi:10.1080/09540121.2016.1259451
- Lanza, S., & Rhoades, B. (2013). Latent class analysis: An alternative perspective on subgroup analysis in prevention and treatment. *Prevention Science*, 14, 157–168.
- Lanza, S. T., & Cooper, B. R. (2016). Latent class analysis for developmental research. *Child Development Perspectives*, 10, 59–64. doi:10.1111/cdep.12163
- Mitchell, M. M., Nguyen, T. Q., Isenberg, S. R., Maragh-Bass, A. C., Keruly, J., & Knowlton, A. R. (2017). Psychosocial and service use correlates of health-related quality of life among a vulnerable population living with HIV/AIDS. *AIDS and Behavior*, 21, 1580–1587. doi:10.1007/s10461-016-1589-1
- Mwesigire, D. M., Martin, F., Seeley, J., & Katamba, A. (2015). Relationship between CD4 count and quality of life over time among HIV patients in Uganda: A cohort study. *Health and Quality of Life Outcomes*, 13, 144. doi:10.1186/s12955-015-0332-3
- Nyamathi, A., Ekstrand, M., Salem, B. E., Sinha, S., Ganguly, K. K., & Leake, B. (2013). Impact of Asha intervention on stigma among rural Indian women with AIDS. *Western Journal of Nursing Research*, 35, 867–883. doi:10.1177/0193945913482050
- Nyamathi, A., Ekstrand, M., Srivastava, N., Carpenter, C. L., Salem, B. E., Al-Harrasi, S., ... Sinha, S. (2016). ASHA-life intervention perspectives voiced by rural Indian women living with AIDS. *Health Care for Women International*, 37, 412–425. doi:10.1080/07399332.2015.1066790
- Nyamathi, A., Hanson, A. Y., Salem, B. E., Sinha, S., Ganguly, K. K., Leake, B., ... Marfisee, M. (2012). Impact of a rural village women (Asha) intervention on adherence to antiretroviral therapy in southern India. *Nursing Research*, 61, 353–362. doi:10.1097/NNR.0b013e31825fe3ef
- Nyamathi, A., Heravian, A., Zolt-Gilburne, J., Sinha, S., Ganguly, K., Liu, E., ... Leake, B. (2011). Correlates of depression among rural women living with AIDS in Southern India. *Issues in Mental Health Nursing*, 32, 385–391. doi:10.3109/01612840.2011.577269
- Nyamathi, A., Salem, B. E., Meyer, V., Ganguly, K. K., Sinha, S., & Ramakrishnan, P. (2012). Impact of an ASHA intervention on depressive symptoms among rural women living with AIDS in India: Comparison of the ASHA-life and usual care program. *AIDS Education and Prevention*, 24(3), 280–293. doi:10.1521/aeap.2012.24.3.280
- Nyamathi, A. M., Ekstrand, M., Yadav, K., Ramakrishna, P., Heylen, E., Carpenter, C., ... Sinha, S. (2017). Quality of life among women living with HIV in rural India. *Journal of the Association of Nurses in AIDS Care*, 28(4), 575–586. doi:10.1016/j.jana.2017.03.004
- Oetzel, J., Wilcox, B., Archiopoli, A., Avila, M., Hell, C., Hill, R., & Muhammad, M. (2014). Social support and social undermining as explanatory factors for health-related quality of life in people living with HIV/AIDS. *Journal of Health Communication*, 19(6), 660–675. doi:10.1080/10810730.2013.837555
- Pallikadavath, S., Garda, L., Apte, H., Freedman, J., & Stones, R. W. (2005). HIV/AIDS in rural India: Context and health care needs. *Journal of Biosocial Science*, 37(5), 641–655. doi:10.1017/S0021932004006893
- Panchanadeswaran, S., & Koverola, C. (2005). The voices of battered women in India. *Violence Against Women*, 11(6), 736–758. doi:10.1177/1077801205276088
- Patel, V., Weobong, B., Weiss, H. A., Anand, A., Bhat, B., Katti, B., ... Fairburn, C. G. (2017). The Healthy Activity Program (HAP), a lay counsellor-delivered brief psychological treatment for severe depression, in primary care in India: A randomised controlled trial. *The Lancet*, 389(10065), 176–185. doi:10.1016/S0140-6736(16)31589-6
- Persson, L., Ostergren, P. O., Hanson, B. S., Lindgren, A., & Naucner, A. (2002). Social network, social support and the rate of decline of CD4 lymphocytes in asymptomatic HIV-positive homosexual men. *Scandinavian Journal of Public Health*, 30, 184–190. doi:10.1080/14034940210133870
- Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population.

- Applied Psychological Measurement*, 1, 385–401. doi:10.1177/014662167700100306
- Ritsner, M., Kurs, R., Kostizky, H., Ponizovsky, A., & Modai, I. (2002). Subjective quality of life in severely mentally ill patients: A comparison of two instruments. *Quality of Life Research*, 11, 553–561. doi:10.1023/A:1016323009671
- Roy, A. L., & Raver, C. C. (2014). Are all risks equal? Early experiences of poverty-related risk and children's functioning. *Journal of Family Psychology*, 28(3), 391–400. doi:10.1037/a0036683
- Rueda, S., Mitra, S., Chen, S., Gogolishvili, D., Globerman, J., Chambers, L., ... Rourke, S. B. (2016). Examining the associations between HIV-related stigma and health outcomes in people living with HIV/AIDS: A series of meta-analyses. *BMJ Open*, 6, e011453. doi:10.1136/bmjopen-2016-011453
- Savage, J., & Birch, L. L. (2016). Patterns of weight control strategies predict differences in women's 4-year weight gain. *Obesity*, 3(10), 973–982. doi:10.1038/oby.2009.265
- Sherbourne, C. D., & Stewart, A. L. (1991). The MOS social support survey. *Social Science and Medicine*, 32, 705–714.
- Simoni, J. M., Frick, P. A., Lockhart, D., & Liebovitz, D. (2002). Mediators of social support and antiretroviral adherence among an indigent population in New York City. *AIDS Patient Care and STDS*, 16, 431–439. doi:10.1089/108729102760330272
- Srivastava, N., Nyamathi, A. M., Sinha, S., Carpenter, C., Satyanarayana, V., Ramakrishnan, P., & Ekstrand, M. (2017). Women living with AIDS in rural Southern India: Perspectives on mental health and lay health care worker support. *Journal of HIV/AIDS and Social Services*, 16, 170–194. doi:10.1080/15381501.2016.1274703
- Steward, W. T., Bharat, S., Ramakrishna, J., Heylen, E., & Ekstrand, M. L. (2013). Stigma is associated with delays in seeking care among HIV-infected people in India. *Journal of the International Association of Providers of AIDS Care (JIAPAC)*, 12, 103–109. doi:10.1177/1545109711432315
- Steward, W. T., Chandy, S., Singh, G., Panicker, S. T., Thomas, A., Heylen, E., & Ekstrand, M. L. (2011). Depression is not an inevitable outcome of disclosure avoidance: HIV stigma and mental health in cohort of HIV infected individuals from Southern India. *Psychology, Health and Medicine*, 16, 74–85. doi:10.1080/13548506.2010.521568
- Suhadev, M., Nyamathi, A. M., Swaminathan, S., Suresh, A., & Venkatesan, P. (2009). Factors associated with willingness to participate in HIV vaccine trials among high-risk populations in South India. *AIDS Research and Human Retroviruses*, 25(2), 217–224.
- Trickey, A., May, M. T., Vehreschild, J.J., Obel, N., Gill, M. J., Crane, H. M., ... Zangerle, R. (2017). Survival of HIV-positive patients starting antiretroviral therapy between 1996 and 2013: A collaborative analysis of cohort studies. *The Lancet HIV*, 4(8), e349–e356. doi:10.1016/S2352-3018(17)30066-8
- Xiao, Z., Li, X., Qiao, S., Zhou, Y., & Shen, Z. (2018). Coping, social support, stigma, and gender difference among people living with HIV in Guangxi, China. *Psychology, Health & Medicine*, 23, 18–29.
- Xiao, Z. W., Li, X., Qiao, S., Zhou, Y., & Shen, Z. (2017). Social support, depression and quality of life among people living with HIV in Guangxi, China. *AIDS Care*, 29(3), 319–325.
- Zhang, W., O'Brien, N., Forrest, J. I., Salters, K. A., Patterson, T. L., Montaner, J. S. G., ... Lima, V. D. (2012). Validating a shortened depression scale (10 item CES-D) among HIV-positive people in British Columbia, Canada. *PLoS ONE*, 7, 1–6. doi:10.1371/journal.pone.0040793