Jurnal Keperawatan Indonesia, 2019, 22 (2), 147–160
DOI: 10.7454/jki.v22i2.952
Received April 2019; Accepted June 2019

pISSN 1410-4490; eISSN 2354-9203

THE INFLUENCE OF SELF-EFFICACY ON THE RELATIONSHIP BETWEEN DEPRESSION AND HIV-RELATED STIGMA WITH ART ADHERENCE AMONG THE YOUTH IN MALAWI

Eric Umar[1*], Judith A. Levy[2], Geri Donenberg[2], Mary Ellen Mackesy-Amiti[2], Hening Pujasari[3], Robert C. Bailey[2]

1. College of Medicine, University of Malawi, Blantyre, Malawi
2. University of Illinois, Chicago, USA
3. Faculty of Nursing Universitas Indonesia, Depok 16424, Indonesia

**E-mail:* eumar@medcol.mw

Abstract

Depression and HIV-related stigma, among other factors, have been inversely linked independently with adherence to antiretroviral therapy (ART) among the youth. However, the processes through which the various factors influence this relationship is not fully known. Guided by Social Action Theory, we examined the interactive mechanisms through which depression, HIV-related stigma, and self-efficacy influenced ART adherence and whether or not these relationships are moderated by gender. A total of 450 HIV-positive youth (13–24 years) in Malawi receiving ART participated in this cross-sectional study. Moderated mediation analyses were conducted using Hayes' PROCESS macro 2.11 in SPSS. ART adherence was measured by pill count. Findings showed that self-efficacy mediated the effects of depression and stigma on ART adherence. The analyses also revealed that gender moderated both the direct and indirect influence of depression and stigma (via self-efficacy) on ART adherence. Furthermore, self-efficacy simultaneously mediated and moderated the relationship between stigma and ART adherence. The interactive mechanisms through which various factors influence ART nonadherence must be considered to design effective interventions. To reduce the impact of depression and stigma on ART adherence, medication self-efficacy should be bolstered while taking gender in consideration.

Keywords: adolescent, antiretroviral adherence, Malawi, moderated mediation, Social action theory, youth.

Abstrak

Pengaruh Efikasi Diri Terhadap Hubungan antara Depresi dan Stigma HIV dengan Kepatuhan Terapi ART pada Remaja di Malawi*. Depresi dan stigma HIV, di antara faktor-faktor lain, berhubungan terbalik secara independen dengan kepatuhan terapi antiretroviral (ART) pada remaja. Akan tetapi, dalam prosesnya faktor yang memengaruhi hubungan ini belum sepenuhnya diketahui. Berdasarkan Teori Perilaku Sosial, penelitian ini dilakukan bertujuan untuk mengkaji mekanisme interaktif depresi, stigma HIV, dan efikasi diri yang memengaruhi kepatuhan ART, dan untuk mengetahui apakah hubungan ini dimoderasi oleh gender atau tidak. Sebanyak 450 remaja dengan HIV-positif (13–24 tahun) di Malawi yang menerima ART ikut berpartisipasi dalam penelitian potong lintang ini. Analisis mediasi moderated dilakukan dengan menggunakan Hayes 'PROCESS macro 2.11 pada SPSS. Kepatuhan ART diukur menggunakan jumlah pil. Hasil penelitian menunjukkan bahwa efikasi diri memediasi efek depresi dan stigma pada kepatuhan ART. Hasil analisis juga mengungkapkan bahwa jenis kelamin memoderasi pengaruh langsung dan tidak langsung dari depresi dan stigma (melalui efikasi diri) terhadap kepatuhan ART. Lebih lanjut,efikasi diri secara bersamaan mediasi dan moderasi hubungan antara stigma dan kepatuhan ART. Mekanisme interaktif dengan berbagai faktor yang memengaruhi ketidakpatuhan ART harus dipertimbangkan untuk merancang intervensi yang efektif. Untuk mengurangi dampak depresi dan stigma terhadap kepatuhan ART, efikasi diri pengobatan harus didukung saat mempertimbangkan jenis kelamin.*

Kata kunci*: kepatuhan antiretroviral, Malawi, mediasi tingkat menengah, Teori Perilaku Sosial, remaja.*

Introduction

Advances in antiretroviral therapy (ART) have transformed HIV into a chronic condition for those with access and adherence to treatment (Hawkins, et al., 2016). Although AIDS-related mortality has gradually declined in other age groups, emerging evidence indicates that it is increasing among adolescents and young people worldwide (Bekker, Johnson, Wallace, & Hosek, 2015). These trends have been linked to poor ART adherence among adolescents and young people. Studies show that numerous factors influence adolescents' adherence to ART (Kim, Gerver, Fidler, & Ward, 2014; Taddeo, Egedy, & Frappier, 2008). An understanding of the mechanisms through which these factors affect ART adherence among adolescents and young people in specific contexts is needed to develop and implement effective interventions (Hudelson & Cluver, 2015).

Approximately 80% of adolescents living with HIV are in sub-Saharan Africa (SSA) (UNICEF, 2016). Malawi is one of the countries in the region with an HIV prevalence rate of 10.8% and is ranked 9th in the world. Young people in Malawi bear a higher burden of HIV compared with other age groups. In 2015, they accounted for 50% of new HIV infections with an estimated 3.6% of young women and 2.5% of young men (age 15–24 years) living with HIV (Avert, 2016).

With high levels of new HIV infection among young people combined with the successful scale up of pediatric HIV care, the population of adolescents living with HIV is likely to increase. This emerging group of young people living with HIV must adhere to their treatment regimens to ensure a better quality of life and prevent onward HIV transmission as they navigate adolescence. Unfortunately, studies show that adolescents and young people comprise the lowest adherent age group relative to other age groups (Cluver, et al., 2016).

Among other factors, research indicates a strong association between depression and HIV-related stigma with suboptimal ART adherence among adolescents and young people living with HIV. Self-efficacy also has been linked with optimal ART adherence (Kekwaletswe, Jordaan, Nkosi, & Morojele, 2016). Research on youth revealed an association between ART adherence and factors such as demographic characteristics including age and education, family context, peer support, and treatment side effects (Taddeo, et al., 2008).

The prevalence of depression among people living with HIV is estimated to be double that of the general population; adolescents and young people living with the virus are especially vulnerable (Kim, et al., 2015). For example, a Malawi study found that nearly 19% of adolescents (12–18 years) living with HIV in the country are depressed and depression is independently associated with a few years of schooling and being bullied for taking medication (Kim, et al., 2015). Other factors associated with depression among adolescents and young people include experiences of death in the family, not having disclosed or sharing a positive HIV status with someone, and severe immunosuppression (Dow, et al., 2016; Kim, et al., 2015).

High levels of stigma were reported among people living with HIV in the few studies conducted in Malawi (Kamen, et al., 2016). A number 22% prevalence of anticipated stigma was found among Malawians who were offered home-based HIV testing (MacPherson, et al., 2011). A multi-country study in SSA that included Malawi found that HIV stigma among people living with HIV and their nurse health providers varies from 6.6% to 13.4% (Holzemer, et al., 2009). Other studies in SSA that included Malawi found a relationship between HIV stigma and missed doses of ART (Dlamini, et al., 2009). Stigma limits adolescents' HIV disclosure to friends and even fa-

mily who may be a source of support for them in taking their medication (Aderomilehin, Hanciles-Amu, & Ozoya, 2016). It also raises youth's fears of being discovered to be HIV-positive, a worry that can prevent them from taking their medication in the presence of people unaware of their status. Despite its importance, no study has examined the association between HIV-related stigma and ART adherence within the Malawian context (Aderomilehin, et al., 2016). Furthermore, no known study has examined the interplay of these variables in influencing ART adherence among adolescents and young people.

High levels of ART adherence are necessary for adolescents to benefit individually from ART, as well as for public health benefits to be realized. Although ART adherence interventions are known to be more effective if they consider the complexity of mechanisms through which various factors intersect to influence ART adherence, most adherence studies in SSA have focused on single variables (Hudelson & Cluver, 2015). In addition, few studies focused globally on the interactive mechanisms through which various factors influence ART adherence or have examined mediational effects of self-efficacy on the relationship between depression and stigma with adherence (Hudelson & Cluver, 2015; Wagner, et al., 2016). Meanwhile, studies on the possible influence of gender on adolescent ART adherence have yielded contradictory findings regarding its effects (Ioannides, et al., 2017).

In contrast to previous research in SSA, we went beyond examining direct associations of various factors with ART adherence. Instead, we sought to examine the potential mechanisms through which stigma and depression impact youth's adherence to ART and whether or not the mediational effects of self-efficacy are contingent on one or more factors. The study utilized social action theory (SAT) as a guiding framework to test moderated mediation models of self-efficacy and gender on the relationship between HIV-related stigma and depression with ART adherence (Ewart, 1991). SAT posits that health protective behavior, which is ART adherence in this study, results from three interactive domains: the environmental context, which includes sociodemographic variables including gender; responses to internal affective states, such as depression and HIV stigma; and the self-regulation capacities of the individual, such as defined by self-efficacy (Bekker, et al., 2011; Hawkins, et al., 2016; Johnson, et al., 2003; Kim, et al., 2014; Taddeo, et al., 2008).

On the basis of SAT, a self-regulatory factor (self-efficacy) is hypothesized to mediate the relations between the environmental contextual factors (depression and stigma) with action state factors (ART adherence). This mediational effect is expected to depend on gender. Stigma is also expected to moderate its indirect effect on ART adherence via self-efficacy.

Specifically, the study analyzed the following hypotheses:

Hypothesis 1: Self-efficacy mediates the relationship between depression and ART adherence;
Hypothesis 2: Self-efficacy mediates the relationship between stigma and ART adherence;
Hypothesis 3: Gender moderates the direct and the mediational effects of self-efficacy on the relationship between depression and ART adherence;
Hypothesis 4: Gender moderates the direct and the mediational effects of self-efficacy on the relationship between stigma and ART adherence;
Hypothesis 5: Self-efficacy simultaneously mediates and moderates the relationship between stigma and ART adherence.

Methods

This study was conducted in six district hospitals in southern Malawi, a region of the country with an HIV prevalence rate that is twice that of northern and central Malawi (Avert, 2015). The study was approved for the protection of research subjects by the Institutional Review Boards of the University of Illinois at Chicago and the University of Malawi's College of Medicine Research and Ethics Committee.

Subjects for this study were adolescents and young people (13–24 years) living with HIV in Southern Malawi. A total of 450 adolescents and young people were involved in face-to-face structured interviews, lasting between 50 min and 1 hour. Potential subjects were all young people (13–24 years of age) who had ever registered to start ART at one of the six clinics. Criteria for screening and enrollment included 1) being an HIV-positive male or female between 13 and 24 years of age, 2) being aware of their HIV-positive status, and 3) having been registered to be on ART for at least the past 6 months. All potential subjects who contacted the researchers and met the enrollment criteria participated in the study.

Subjects between 18 and 24 years of age provided voluntary informed consent, whereas those ages 13–17 years provided informed assent along with approval by a parent or guardian. In appreciation of their time in being interviewed, participants were reimbursed for transport expenses and given a snack before the interviews.

Data were collected by two research assistants and the senior investigator who administered a questionnaire to the youth. The questionnaire contained demographic questions and measures for various key factors. Visual prompt cards were used to facilitate responses for questions that required respondents to provide Likert responses. The questionnaire, consent, and assent forms were translated and back-translated between English and Chichewa or Yao. Interviews were conducted in either language based on the respondent's preference.

Demographics and clinical characteristics were obtained by asking the participants to self-report their age, gender, how long they had known they were HIV-positive, and their highest level of education. Patient records were used to determine when they had been diagnosed and how long they had been on ART. Apart from gender, all demographic variables were measured as continuous values. ART adherence was assessed using pill count percentages abstracted from the youth's electronic medical records (EMRs) as these have been found reliable in determining ART adherence (Wu, et al., 2014). The EMR calculates ART adherence rates based on the number of unused pills in the container that the youth brought back when refilling their medication. Given that the last recorded adherence rate occurred within 30 days of data collection, the abstracted score reflects a 30-day window period. HIV-related stigma was assessed using the HIV/AIDS Stigma Instrument–PLWA (HASI-P). This measure was developed in five sub-Saharan African countries including Malawi and it has been used in several studies in the region (Sorsdahl, Mall, Stein, & Joska, 2011; Uys, et al., 2009).

The measure consists of six subscales: verbal abuse (8 items), negative self-perception (5 items), health care neglect (7 items), social isolation (5 items), fear of contagion (6 items), and workplace stigma (2 items) (Holzemer, et al., 2007). The negative self-perception subscale measures internalized stigma, while the remaining five subscales measure enacted stigma. Internalized stigma refers to an individual's unpleasant beliefs toward themselves after incorporating negative views from others, whereas enacted stigma refers to an individual's real experience from external discrimination after disclosure of their HIV-positive status (Zhang, et al., 2016). In the current study, the two workplace items were adapted to suit ado-

lescents, most of whom were unemployed. For example, the item "My employer denied me opportunities" was revised to say, "My teacher/team/group leader denied me opportunities." The items for the HASI-P were scored from 0-never; 1-once or twice; 2-several times; and three-most of the time. In the current study, Cronbach's alpha was 0.93. Depressive symptoms were assessed using the Self-Reporting Questionnaire (SRQ 20). The SRQ is a brief measure of psychiatric symptomatology, designed by WHO to be used cross-culturally as a measure for screening common mental disorders. The measure consists of 20 questions with "yes" or "no" answers. The SRQ was previously validated in Malawi and has been used with women in several studies (Stewart, Umar, Tomenson, & Creed, 2013). The raw SRQ score is the total of "yes" items out of the 20. In the current study, Cronbach's alpha was 0.83. ART adherence self-efficacy was measured by the Adherence Self-Efficacy Scale, which is a 12-item scale used to measure patient confidence in carrying out important treatment-associated behaviors related to perseverance and integration of treatment into one's life (Johnson, et al., 2007). Responses range from 1 (*cannot do it*) to 10 (*certain can do it*), with a high score indicating great self-efficacy. The ASE demonstrated robust internal consistency (rhos> 0.90) and 3 (*r*s> 0.70) and 15 months (*r*s> 0.40) test–retest reliability (Johnson, et al., 2007). This scale was translated-back-translated by two bilingual people because it had never been validated in Malawi. In this study, Cronbach's alpha was 0.81.

Descriptive statistics were calculated to describe the sample characteristics (Table 1). Correlational analyses determined if study variables were significantly associated with ART, the study's dependent variable (Table 2). To investigate the proposed hypotheses, mediated regression analyses followed by moderated mediation analyses were carried out using Hayes' PROCESS macro 2.11 for SPSS version 22 (Hayes, 2013).

Mediation analysis tested the effects of HIV-related stigma and depression as independent variables on ART adherence, with self-efficacy as a mediator variable by applying PROCESS model 4 with 5000 bootstraps and 95% confidence level. The age, gender, educational level, and period of knowing that they were HIV-positive were entered as covariates to control for their influence. Bootstrapping in PROCESS provides lower and upper level confidence intervals (LLCIs and ULCIs). The effect is considered significant if the range of these limits does not straddle zero (Hayes, 2013). Given a significant mediation effect, we then tested a moderated mediation model to examine if the simple mediation models held given the level of independent variables (depression and/or stigma), or gender. Moderated mediation allows researchers to assess both how and when an indirect effect of an independent variable on a dependent occurs (Blashill & Vander Wal, 2010).

Moderated mediation analyses were conducted using PROCESS models 15 and 74. PROCESS combines mediation and moderation through the construction and estimation of *conditional process models.* It allows the direct and/or indirect effects of independent variable *X* on a dependent variable *Y* through one or more mediators (*M*) to be moderated. When there is moderation of the effect of *X* on *M*, effect of *M* on *Y*, or both, estimation of the inference (conditional indirect effect) of *X* provides insight into the contingent nature of the dependent variable's effect on the dependent variable through the mediator(s), depending on the moderator (Hayes, 2013).

The current analysis used PROCESS model 15 to test two moderated mediation models. The first model entered depression as the independent variable, with self-efficacy as the mediator and gender as a moderator. The second model considered stigma as an independent variable, with self-efficacy as the mediator and gender as the moderator. The moderator (gen-

der) was tested for both direct and indirect effects in the two models. A third model, using PROCESS model 74, considered stigma as the independent variable and moderator, while self-efficacy acted as the mediator variable.

Moderated mediation explains both how and when a given effect occurs. Moderated mediation effects may occur in multiple ways (Preacher, Rucker, & Hayes, 2007). In this analysis, two ways were proposed. First, a separate variable (gender) would moderate the mediated effect of HIV-related stigma and depression, with ART adherence as the direct effect. Second, an independent variable (HIV-related stigma) would function as a moderator of the pathway from the mediator to the dependent variable (ART adherence). All continuous variables were mean centered. Gender was coded 1= male and 2= female.

Results

Table 1 reports the demographic characteristics of the participants. Nearly two-thirds (59.8%) were female, and most were primary school educated (64.2%). Table 2 presents inter-correlations of variables of interest. Stigma and depression were both significantly and negatively correlated with ART adherence (r= -0.240, p< 0.001 and r= -0.155, p< 0.001 respectively). Self-efficacy was significantly and positively correlated with ART adherence (r= 0.222, p< 0.001).

Table 1. Characteristics of The Sample (N = 450)

Variable	Mean	SD	*N*	%
ART adherence	86.30	(17.75)		
Depression	4.93	(4.10)		
HIV-related stigma	5.86	(11.12)		
Age in years	16.72	(2.99)		
Years on ART	5.73	(2.99)		
Years aware of HIV-positive status	4.82	(3.15)		
Gender				
Male			181	(40.2)
Female			269	(59.8)
Education level				
Primary school			289	(64.2)
Secondary school			152	(33.8)
College education			9	(2.0)

Table 2. Correlations among Study Variables

	Adherence	Self-efficacy	Depression	Stigma	Age	Years Status
Adherence	1					
Self-Efficacy	.222**	1				
Depression	-.155**	-.274**	1			
Stigma	-.240**	-.231**	.406**	1		
Age	.117*	-.005	.090	.112*	1	
Years Status[a]	.111*	.100*	-.005	-.067	.259**	1

[a] *Years Status* Years youth has known his or her HIV-positive status
**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Table 3. Coefficients and Confidence Intervals for Depression, Self-Efficacy, Gender, and Art Adherence in The Moderated Mediation Model

Source [a]	Coeff.	SE	t	*p*	LLCI	ULCI
Depression to Self-efficacy	-0.094	0.017	-5.397	<0.001	-0.128	-0.721
Self-efficacy to Adherence	1.9478	0.606	3.216	0.001	0.758	3.138
Depression to Adherence (controlling for S-E)	-0.437	0.223	-1.953	0.051	-0.876	0.003
Gender	0.169	1.534	0.110	0.912	-2.846	3.186
Self-efficacy x gender	-3.302	1.212	-2.725	0.006	-5.683	-0.921
Depression x gender	-0.395	0.430	-0.919	0.358	-1.240	0.450

Conditional direct effect of depression on adherence at values of the moderator (male/female)

Mediator	Moderator	Coeff.	SE	t	BootLLCI	BootULCI
Self-efficacy	Male	-0.200	0.3189	-0.6203	-0.827	0.427
Self-efficacy	Female	-0.058	0.2992	-1.9901	-1.183	-0.007

Conditional indirect effect of depression on adherence at values of moderator (male/female)

Mediator	Moderator	Coeff.	BootSE	BootLLCI	BootULCI
Self-efficacy	Male	-0.368	0.1102	-0.620	-0.189
Self-efficacy	Female	-0.058	0.0743	-0.219	0.074

Index of moderated mediation

Mediator	Index	SE (Boot)	BootLLCI	BootULCI
Self-efficacy	0.3101	0.1310	0.092	0.606

Dep: depression, SE: standard error, S-E: self-efficacy
[a] Controlling for age, educational status, period known to be HIV-positive

Subsequently, we examined the mediation effect of self-efficacy on the relation between depresion and ART adherence (Hypothesis 1). The results revealed a significant partial mediation effect (Sobel test for indirect effect, Z= -2.92, *P*= 0.0035). We also examined the mediation effect of self-efficacy on the relation between stigma and ART adherence (Hypothesis 2). These results also revealed a significant partial mediation effect (Sobel test for indirect effect, Z= -2.13, *P*= 0.0327).

After establishing the mediational effects of self-efficacy on the relations between depression and stigma with ART adherence, we examined moderated mediation models involving depression and HIV-related stigma as independent variables, self-efficacy as both mediator and moderator, and gender as moderator (Hypothesis 2).

Hypothesis 3 posited that gender would mediate both the direct and the mediational effect of self-efficacy on the relationship between depression and ART adherence. Table 3 shows the results. For indirect effects, the analysis revealed that depression predicted self-efficacy (*B*= -0.09, t= -5.39, *P*< 0.001), with high scores of depression predicting low levels of self-efficacy. The interaction term in the analysis, self-efficacy x gender, significantly predicted ART adherence beyond the independent main effects of self-efficacy and gender (*B*= -3.30, t= -2.73, *P*= 0.0067). The analysis tested the indirect conditional effects at two levels (male, female), and the results depicted self-efficacy serving as a mediator in the relationship between depression and ART adherence for males (*B*= -.36, BootLLCI= -0.61, BootLLCI= -0.17) only but not females (*B*= -.05, BootLLCI= -0.21, BootLLCI= 0.07). The boot-

Table 4. Coefficients and Confidence Intervals for Stigma, Self-Efficacy, Gender, and Art Adherence in The Mediation Model

Source	Coeff.	SE	t	*p*	LLCI	ULCI
Stigma to Self-efficacy	-0.031	0.011	-2.83	0.0048	-0.053	-0.009
Self-efficacy to Adh	1.828	0.577	3.16	0.0017	0.693	2.964
Stigma to Adh (controlling for self-efficacy)	-0.332	0.104	-3.18	0.0016	-0.537	-0.127
Gender	-0.119	1.547	-0.077	0.9385	-3.161	2.922
Self-efficacy x gender	-2.559	1.177	-2.16	0.0302	-4.873	-0.246
Stigma x gender	0.022	0.219	0.10	0.9196	-0.409	0.454

Conditional direct effect of stigma on adherence at values of the moderator (male/female)

Moderator	Coeff.	SE	t	*p*	BootLLCI	BootULCI
Male	-0.342	0.041	-1.895	0.0588	-0.697	0.0128
Female	-0.320	0.026	-2.564	0.0107	-0.565	-0.074

Conditional indirect effect of stigma on adherence at values of the moderator (male/female)

Mediator	Moderator	Coeff.	Boot SE	Boot LLCI	BootULCI
Self-efficacy	Male	-0.105	0.041	-0.213	-0.042
Self-efficacy	Female	-0.025	0.026	-0.094	0.014

Index of moderated mediation

Mediator	Index	SE (Boot)	BootLLCI	BootULCI
Self-efficacy	0.079	0.043	0.017	0.198

Adh: adherence, SE: standard error
[a] Controlling for age, educational status, period known HIV-positive

Table 5. Coefficients and Confidence Intervals for Stigma, Self-Efficacy, Stigma, and Art Adherence in The Moderated Mediation Model

Source[a]	Coeff.	SE	T	*p*	LLCI	ULCC
Stigma to self-efficacy	-0.030	0.011	-2.78	0.0057	-0.053	-0.009
Self-efficacy to adherence	1.616	0.577	2.80	0.0053	0.482	2.749
Stigma to adherence	-0.317	0.091	-3.46	0.0006	-0.497	-0.137
Self-efficacy X stigma	0.107	0.037	2.88	0.0042	0.034	0.179

Conditional direct effect of stigma on ART adherence at values of self-efficacy

Self-efficacy	Effect	SE (Boot)	t	*p*	BootLLCI	BootULCI
Low	-.457	0.089	-5.157	<0.001	-0.632	-0.283
Medium	-.297	0.077	-3.868	0.0001	-0.448	-0.146
High	-.136	0.102	-1.338	0.1815	-0.336	0.064

Index of moderated mediation

Mediator	Index	SE (Boot)	BootLLCI	BootULCI
Self-efficacy	-0.003	0.002	-0.007	-0.001

SE standard error
[a] Controlling for age, educational status, period known HIV-positive

strapped (n= 5,000) 95% confidence intervals (CIs) for males did not straddle zero, signifying a significant effect. However, the CIs for females were zero, depicting non-significant effects. For the direct effect of stigma on ART adherence, the analysis tested the moderating effect (conditional direct effect) between depression and ART adherence at different levels (male vs. female). The results revealed that gender moderated the relation with females (*B*= -0.59, BootLLCI= -1.18, BootLLCI= -0.01) only but not males (*B*= -0.20, BootLLCI= -0.82, BootLLCI= 0.42). The bootstrapped (n= 5000) 95% CIs for females did not straddle zero, portraying a significant effect. By contrast, the CIs for males were zero, depicting a non-significant effect. All covariate effects were not statistically significant in terms of age (*B*= 0.46, *p*= 0.08), education (*B*= 1.33, *p*= 0.40), and time known HIV status (*B*= 0.20, *p*= 0.41).

Hypothesis 4 posited that gender would moderate both the direct and the mediational effects of self-efficacy on the relationship between stigma and ART adherence. Table 4 shows the results. First, focusing on the indirect effects, the analysis showed that stigma predicted self-efficacy (*B*= -0.03, t= -2.83, *P*= 0.0048), indicating that high scores of stigma predicted low levels of self-efficacy. The interaction term in the analysis, self-efficacy x gender, depicted that it significantly predicted ART adherence beyond the main effects of self-efficacy and gender, independently (*B*= -2.56, t= -2.17, *P*= 0.0302).

The analysis tested the indirect conditional analysis at the two levels (male vs. female). The results showed that self-efficacy served as a mediator in the relationship between stigma and ART adherence for males (*B*= -0.10, Boot-LLCI= -0.21, BootLLCI= -0.04) only but not females (*B*= -0.03, Boot-LLCI= -0.09, Boot-LLCI= 0.01). The 95% bootstrapped (n= 5000) CIs for males did not straddle zero, representing significant effects, whereas the CIs for females contained zero, depicting non-significant. Second, focusing on the direct effect of stigma on ART adherence, the ana-lysis tested the conditional direct effect bet-ween stigma and ART adherence at different levels (male vs. female). The results revealed that gender moderated the relation, with females (*B*= -0.32, BootLLCI= -0.56, BootLLCI= -0.07) only but not males (*B*= -0.34, BootLLCI= -0.69, BootLLCI= 0.01). The 95% bootstrapped (n= 5000) confidence intervals for females did not straddle zero, representing a significant effect. By contrast, the CIs for males were zero, depicting non-significant effects. For the covariates, age was statistically significant (*B*= 0.58, *p*= 0.03), whereas education (*B*= 1.24, *p*= 0.41) and time known HIV-positive status (*B*= 0.09, *p*= 0.69) were not significant.

Hypothesis 5 postulated that the mediator (self-efficacy) would act as a moderator in the relationship between stigma and ART adherence. Table 5 shows that stigma predicted self-effi-cacy with higher stigma scores predicting lower self-efficacy (*B*= -0.03, t= -2.78, *P*= 0.005). To determine whether or not self-efficacy mediates the relationship between stigma and ART adherence, the interaction term, stigma x self-efficacy, was assessed to see if it independently predicted ART adherence beyond the main effects of stigma and self-efficacy. The results revealed that the interaction predicted ART adherence over and above the effects of stigma and self-efficacy (*B*= 0.11, t = 2.88, *P*= 0.004).

We also tested, as per Hayes' PROCESS model 74 guideline, whether self-efficacy simultaneously moderates the direct relationship between stigma and ART adherence. Self-efficacy emerged as a significant moderator of the direct relationship between stigma and ART adherence. Using PROCESS model 1, we generated conditional direct effects (Table 5). The coefficient for the interaction term (stigma x self-efficacy) is statistically different from zero (b= 0.111, *p*= 0049).

Discussion

This study is possibly the first to examine the role of self-efficacy and gender in the relationships between depression and HIV-related stigma with ART adherence among adolescents and young people. The findings reveal a com-plex interplay among various factors in influ-encing ART adherence. On the basis of SAT, we examined whether or not self-efficacy functions as a mediating mechanism in the relationship between depression and HIV-related stigma with ART adherence. The findings showed that self-efficacy mediates the relations between depression and stigma with ART adherence. Moderated mediation analysis revealed that gender moderated both the direct and indirect effects of depression and stigma on ART adherence where the mediational effects of self-efficacy were significant for males but not females. Moreover, gender moderated the direct effects of depression and stigma on ART adherence among females but not males. Stigma also moderated the indirect effects of stigma on ART adherence via self-efficacy. These findings highlight a unique association of factors previously understood only in their direct association with ART adherence among youth.

Drawing on SAT, this study uniquely contributes to the literature on ART medication adherence among adolescents by presenting self-efficacy's complex association with various factors in influencing adherence in the context of stigma. The simultaneous role of self-efficacy as both a mediator and moderator in influencing ART adherence highlights the importance of designing adherence interventions based on strengthening self-efficacy. This study is among the first to examine the mediational influence of self-efficacy on the relationship between depression and stigma with ART adherence among youth particularly in SSA. The current findings are consistent with previous studies among adult samples that found that self-efficacy mediates the relationship between depression and stigma with ART adherence (Cha, Erlen, Kim, Sereika, & Caruthers, 2008; Archiopoli, et al., 2016; Seghatol-Eslami, 2017). Depression and stigma appear to influence ART adherence through their effect on youth's self-efficacy with respect to medication. Consequently, self-efficacy may be diminished by symptoms of depression such as hopelessness, poor concentration, fatigue, and anhedonia (Wagner, et al., 2016). Similarly, stigmatized youth may internalize negative beliefs held in the community and develop self-defacing internal representations of themselves that result in demoralization, emotional distress, and diminished self-efficacy (Katz, et al., 2013). In turn, diminished self-efficacy negatively influences ART medication adherence.

The current study provides strong evidence for gender differences in how depression and stigma influence ART adherence both direct and indirectly. In the relationships between depression and stigma with ART adherence, the effects were mediated by self-efficacy among males but not females. Social cognitive theory (SCT) contends that the decision-making that underlies self-efficacy differs by gender (Chavez, Beltran, Guerrero, Enriquez, & Reyes, 2014). From this perspective, gender differences in medication self-efficacy result from cultural expectations and a gendered socialization process that accords males and females differing tasks and activities. In applying SCT to the findings from our study, unlike males, females in Malawi are introduced to tasks associated with medication early in life as they are more often at home and also tasked with gendered activities that include caring for their siblings. These experiences possibly prepare them for better medicating themselves as well. Given such gender differences, interventions to increase ART adherence among adolescents must consider gender when assessing and strategizing to improve medication self-efficacy. This task includes acknowledging the unique gendered, contextual realities within which male versus female adolescents undertake self-medication. Interventional efforts that bolster adolescents' confidence to take their medica-

tions under different challenging conditions also are needed.

The moderated mediation models tested and presented in this paper are based on cross-sectional data. For this reason, causality cannot be established. For example, depression and stigma may work together to reduce ART adherence, but the opposite could also be true. Better ART adherence produces a lesser likelihood of depression and stigma.

Although the sample was randomly drawn from ART registers at a hospital in each of the six districts, it does not represent a random sample for each district. For example, the study sample does not include youth who registered and received ART in district clinics not included in the study's sampling frame. Nonetheless, by using a large sample and range of district hospitals in the southern region (6 out of 13), the sample likely comes close to representing the HIV epidemic among youth in southern Malawi and those accessing ART in public hospitals in the country's southern region. In terms of sample representation, for ethical reasons, the health workers per district compiled randomly selected potential subjects and contacted them independent of the study's research team. No information exists on how many potential subjects were approached and declined.

Most instruments used in this study were adapted or validated in Malawi with adults but not with the country's young people living with HIV. Rigorous translation-back-translation was used to help ensure the instruments' validity, although this method does not fully guarantee construct equivalence.

Conclusion

Understanding the interplay of various factors in influencing ART adherence is crucial to the development of viable interventions. To reduce the effects of depression and stigma on ART adherence, medication self-efficacy must be bolstered while taking gender in consideration. Further research may unravel additional reasons behind gender's influence (INR, AW, PN).

References

Aderomilehin, O., Hanciles-Amu, A., & Ozoya, O. O. (2016). Perspectives and practice of HIV disclosure to children and adolescents by health-care providers and caregivers in sub-Saharan Africa: a systematic review. *Frontiers in Public Health, 4*, 166. doi: 10.3389/fpubh.2016.00166.

Archiopoli, A., Ginossar, T., Wilcox, B., Avila, M., Hill, R., & Oetzel, J. (2016). Factors of interpersonal communication and behavioral health on medication self-efficacy and medication adherence. *AIDS Care, 28*(12), 1607-1614. doi: 10.1080/09540121.2016.1192577.

Avert. (2015). *HIV and AIDS in Malawi*. Retrieved from http://www.avert.org/professionals/hiv-around-world/sub-saharan-africa/malawi.

Avert. (2016). *AIDS and HIV in Malawi*. Retrieved from http://www.avert.org/professionals/hiv-around-world/sub-saharan-africa/malawi.

Blashill, A.J., & Vander Wal, J.S. (2010). The role of body image dissatisfaction and depression on HAART adherence in HIV positive men: tests of mediation models. *AIDS and Behavior, 14* (2), 280–288. doi: 10.1007/s10461-009-9630-2.

Bekker, L.G., Johnson, L., Wallace, M., & Hosek, S. (2015). Building our youth for the future. Journal of the *International AIDS Society, 18*, 20027. doi: 10.7448/IAS.18.2.20027.

Cha, E., Erlen, J.A., Kim, K.H., Sereika, S.M., & Caruthers, D. (2008). Mediating roles of medication–taking self-efficacy and depressive symptoms on self-reported medication adherence in persons with HIV: A questionnaire survey. *International Journal of Nursing Studies, 45* (8), 1175–1184.

Chavez, J.F.A., Beltran, F.M., Guerrero, A.C., Enriquez, M.Z., & Reyes, J.J. (2014). A gender study on college students' academic self-efficacy. *Science Journal of Education, 2*(6), 180–184.

Cluver, L.D., Toska, E., Orkin, F.M., Meinck, F., Hodes, R., Yakubovich, A.R., & Sherr, L. (2016). Achieving equity in HIV-treatment outcomes: can social protection improve adolescent ART-adherence in South Africa? *AIDS Care. 28* (S2), 73–82. doi: 10.1080/ 09540121.2016.1179008.

Dlamini, P.S., Wantland, D., Makoae, L.N., Chirwa, M., Kohi, T.W., Greeff, M., ... & Holzemer, W.L. (2009). HIV stigma and missed medications in HIV-positive people in five African countries. *AIDS Patient Care STDS, 23* (5), 377–87. doi: 10.1089/apc. 2008.0164.

Dow, D.E., Turner, E.L., Shayo, A.M., Mmbaga, B., Cunningham, C.K., & O'Donnell, K. (2016). Evaluating mental health difficulties and associated outcomes among HIV-positive adolescents in Tanzania. *AIDS Care. 28* (7), 825–33. doi: 10.1080/09540 121.2016. 1139043.

Ewart, C.K. (1991). Social action theory for a public health psychology. *American Psychologist, 46* (9), 931–46. http://dx.doi. org/10.1037/0003-066X.46. 9.931.

Hayes, A.F. (2013). *Methodology in the social sciences. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, US: Guilford Press.

Hawkins, A., Evangeli, M., Sturgeon, K., Le Prevost, M., Judd, A., & AALPHI Steering Committee. (2016). Episodic medication adherence in adolescents and young adults with perinatally acquired HIV: A within-participants approach. *AIDS Care, 28*(S1), 68–75. doi: 10.1080/09540121.2016.11462 10.

Holzemer, W.L., Uys, L.R., Chirwa, M.L., Greeff, M., Makoae, L.N., Kohi, T.W., ... & Wantland, D. (2007). Validation of the HIV/AIDS Stigma Instrument—PLWA (HASI-P). *AIDS Care, 19*(8), 1002-1012. doi: 10.1080/09540120701245999.

Holzemer, W.L., Makoae, L.N., Greeff, M., Dlamini, P.S., Kohi, T.W., Chirwa, M.L., ... & Uys, L.R. (2009). Measuring HIV stigma for PLHAs and nurses over time in five African countries. *SAHARA-J: Journal of Social Aspects of HIV/AIDS, 6* (2), 76–82.

Hudelson, C., & Cluver, L. (2015). Factors associated with adherence to antiretroviral therapy among adolescents living with HIV/AIDS in low- and middle-income countries: a systematic review. *AIDS Care. 27* (7), 805–16. doi: 10.1080/09540121. 2015. 1011073.

Ioannides, K.L., Chapman, J., Marukutira, T., Tshume, O., Anabwani, G., Gross, R., & Lowenthal, E. D. (2017). Patterns of HIV treatment adherence do not differ between male and female adolescents in Botswana. *AIDS and Behavior, 21*(2), 410–414. doi: 10.1007/s10461-016-1530-7.

Johnson, M.O., Catz, S.L., Remien, R.H., Rotheram-Borus, M.J., Morin, S.F., Charlebois, E., ... & Chesney, M.A. (2003). Theory-guided, empirically supported avenues for intervention on HIV medication nonadherence: Findings from the Healthy Living Project. *AIDS Patient care and STDS, 17* (12), 645–656. doi: 10.1089/10872910377 1928708.

Johnson, M.O., Neilands, T.B., Dilworth, S.E., Morin, S.F., Remien, R.H., & Chesney, M.A. (2007). The role of self-efficacy in HIV treatment adherence: validation of the HIV Treatment Adherence Self-Efficacy Scale (HIV-ASES). *Journal of behavioral medicine, 30* (5), 359–370. doi: 10.1007/s10 865-007-9118-3.

Kamen, C., Arganbright, J., Kienitz, E., Weller, M., Khaylis, A., Shenkman, T., ... & Gore-Felton, C. (2015). HIV-related stigma: implications for symptoms of anxiety and depression among Malawian women. *African Journal of AIDS Research, 14* (1),

67–73. doi: 10.2989/16085906.2015. 1016987.

Katz, I.T., Ryu, A.E., Onuegbu, A.G., Psaros, C., Weiser, S.D., Bangsberg, D.R., & Tsai, A.C. (2013). Impact of HIV-related stigma on treatment adherence: systematic review and meta-synthesis. *Journal of the International AIDS Society, 16* (3S2), 18640. doi: 10.7448/IAS.16.3.18640.

Kekwaletswe, C.T., Jordaan, E., Nkosi, S., & Morojele, N.K. (2017). Social support and the mediating roles of alcohol use and adherence self-efficacy on antiretroviral therapy (ART) adherence among ART recipients in Gauteng, South Africa. *AIDS and Behavior, 21* (7), 1846–1856. doi: 10.1007/s10461-016-1595-3.

Kim, M.H., Mazenga, A.C., Devandra, A., Ahmed, S., Kazembe, P.N., Yu, X., ... & Sharp, C. (2014). Prevalence of depression and validation of the Beck Depression Inventory- II and the Children's Depression Inventory- Short amongst HIV- positive adolescents in Malawi. *Journal of the International AIDS Society, 17* (1), 18965. doi: 10.7448/IAS.17. 1.18965.

Kim, M.H., Mazenga, A.C., Yu, X., Devandra, A., Nguyen, C., Ahmed, S., ... & Sharp, C. (2015). Factors associated with depression among adolescents living with HIV in Malawi. *BMC psychiatry, 15* (1), 264. doi: 10.1186/s12888-015-0649-9.

Kim, S.H., Gerver, S.M., Fidler, S., & Ward, H. (2014). Adherence to antiretroviral therapy in adolescents living with HIV: systematic review and meta-analysis. *AIDS (London, England), 28* (13), 1945. doi: 10.1097/QAD. 0000000000000316.

MacPherson, P., Webb, E.L., Choko, A.T., Desmond, N., Chavula, K., Mavedzenge, S. N., ... & Corbett, E.L. (2011). Stigmatising attitudes among people offered home-based HIV testing and counselling in Blantyre, Malawi: construction and analysis of a stigma scale. *PLoS One, 6* (10), e26814. doi: 10.1371/journal.pone.0026814.

Preacher, K.J., Rucker, D.D., & Hayes, A.F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral research, 42* (1), 185–227. doi: 10.1080/00273170701341316.

Seghatol-Eslami, V.C., Dark, H., Raper, J.L., Mugavero, M.J., Turan, J.M., & Turan, B. (2017). Interpersonal and intrapersonal factors as parallel independent mediators in the association between internalized HIV stigma and ART adherence. *Journal of Acquired Immune Deficiency Syndromes (1999), 74* (1), e18. doi: 10.1097/QAI. 0000000000001177.

Sorsdahl, K.R., Mall, S., Stein, D.J., & Joska, J.A. (2011). The prevalence and predictors of stigma amongst people living with HIV/AIDS in the Western Province. *AIDS Care, 23* (6), 680–685. doi: 10.1080/ 09540121.2010.525621.

Stewart, R. C., Umar, E., Tomenson, B., & Creed, F. (2013). Validation of screening tools for antenatal depression in Malawi—A comparison of the Edinburgh Postnatal Depression Scale and Self Reporting Questionnaire. *Journal of affective disorders, 150* (3), 1041–1047. doi: 10.1016/j.jad.2013. 05.036.

Taddeo, D., Egedy, M., & Frappier, J.Y. (2008). Adherence to treatment in adolescents. *Paediatr Child Health, 13* (1), 19–24. doi: 10.1016/j.jad.2013.05.036.

UNICEF. (2016). The AIDS epidemic continues to take a staggering toll, especially in sub-Saharan Africa. Retrieved from https://data. unicef.org/topic/hivaids/global-regional-trends/#.

Uys, L., Chirwa, M., Kohi, T., Greeff, M., Naidoo, J., Makoae, L., ... & Holzemer, W.L. (2009). Evaluation of a health setting-based stigma intervention in five African countries. *AIDS patient care and STDs, 23*(12), 1059–1066. doi 10.1089/apc.2009.0085.

Wagner, G.J., Ghosh-Dastidar, B., Robinson, E., Ngo, V.K., Glick, P., Mukasa, B., ... & Akena, D. (2017). Effects of depression alleviation on ART adherence and HIV clinic attendance in Uganda, and the mediating roles of self-efficacy and motivation. *AIDS and Behavior, 21* (6), 1655–1664. doi: 10.1007/s10461-016-1500-0.

Wu, P., A Johnson, B., B Nachega, J., Wu, B., E Ordonez, C., Q Hare, A., ... & C Marconi, V. (2014). The combination of pill count and self-reported adherence is a strong predictor of first-line ART failure for adults in South Africa. *Current HIV Research, 12* (5), 366–375.

Zhang, C., Li, X., Liu, Y., Qiao, S., Zhang, L., Zhou, Y., ... & Chen, Y. (2016). Stigma against people living with HIV/AIDS in China: does the route of infection matter?. *PLoS One, 11* (3), e0151078. doi: 10.1371/journal.pone. 0151078.