

# Suicidal thoughts and behaviour among South African adolescents living with HIV: can social support buffer the impact of stigma?

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## Introduction

Adolescents living with HIV (ALHIV) are a high-risk population for suicidal ideation and attempts. Worldwide, suicide accounts for an estimated 6% of all deaths among young people, representing the second leading cause of mortality among females and the third among males aged 10–24 years (McKinnon et al., 2016; Patton et al., 2009). Youth suicide is therefore a major global public health concern, especially in low and middle income countries (LMICs), which are home to around 90% of the world's youth and account for over 75% of global suicide deaths (McKinnon et al., 2016; UNFPA, 2014). It is estimated that approximately 15% of adolescents aged 13-15 in LMICs experience suicidal ideation (i.e. are thinking of killing themselves) (Page et al., 2013), which in turn is strongly related to prospective suicidal attempts (McKinnon et al., 2016).

These risks are particularly salient in countries and populations with high HIV prevalence, given elevated rates of suicidal ideation and attempts found among people living with HIV (Catalan et al., 2011). A meta-analysis of data from 32 LMICs found rates of suicidal ideation to be highest among adolescents in the African region, and HIV/AIDS was posited to be a contributing factor (McKinnon et al., 2016). However very little is known about suicidal thoughts and behaviours among ALHIV in Africa, including potential risk and protective factors (McKinnon et al., 2016). Moreover, evidence of suicide management and prevention programs for this population is scant (Catalan et al., 2011).

HIV-related stigma is a potential risk factor for poor mental health and suicide among ALHIV. Decades into the HIV epidemic and despite numerous reduction efforts, stigma persists in many HIV-affected populations, and continues to act as barrier to HIV treatment and care (Dow et al., 2016; Katz et al., 2013; Rueda et al., 2016). ALHIV in particular may experience exceptionally high levels of stigma and discrimination (HIV Leadership through Accountability Programme: GNP and NAPWA SA, 2012). Recent meta-analyses point to higher rates of depression, anxiety and emotional distress among people living with HIV who perceive more HIV-related stigma (Katz et al., 2013; Rueda et al., 2016); reviewed studies include longitudinal studies and randomised control trials. More specifically,

HIV-related stigma has been associated with worse mental health among HIV-positive and HIV-affected youth, also in longitudinal analyses (Boyes and Cluver 2013; Cluver and Orkin, 2009; Dow et al., 2016; Pantelic et al., 2017), and with suicidal ideation and attempts among adults living with HIV (Bitew et al., 2016; Gebremariam et al., 2017). Links between poor mental health and suicide are well established, including among adolescents (Wild et al., 2004). Adolescence is a high risk period for the development of mental health problems (Kessler et al., 2012) and there is evidence to suggest that ALHIV may be at elevated risk of mental health disorders (Scharko, 2006; Mellins and Malee, 2013; Willis et al., 2018). Moreover, several Southern African studies, including longitudinal analyses, have shown poor mental health to mediate the relationship between specific stressors, such as parental death and abuse, and suicidal thoughts and behaviours among adolescents (Cluver et al., 2015; Shilubane et al., 2014). However none of these studies have examined the potentially interruptible pathways between HIV-related stigma and suicidal thoughts and behaviour with ALHIV.

In contrast, social support may be an important protective mechanism for adolescent psychosocial health. Social support in relation to health has been described as supportive relationships that provide something that people need to stay healthy or adapt to stress (House et al., 1988). These relationships may provide various types of support, including emotional, informational and instrumental assistance: this functional content of social relationships has been more strongly and frequently associated with better mental health outcomes than structural dimensions of support (e.g. quantity and type of interpersonal relationships) (Cohen and Wills, 1985; Ryan and Willits, 2007). The most important 'sources' or providers of this support in an individual's informal support network are most commonly friends, family and significant others (Thoits, 2011), but sources may include other providers such as church and other community groups. Moreover, perceived social support – i.e. the perception of the availability and adequacy of support from one's network of family, friends and others – has been more strongly and consistently linked to mental health outcomes than retrospective measures of actual support received

(McDowell and Serovich, 2007; Thoits, 2011). This may be explained by the fact that perceived support is less likely to be confounded with the severity of stress and support needs over a particular time period, and instead more likely to derive from generalisations based on multiple and regular experiences of support (Thoits, 2011).

A large body of research links social support to better mental health and lower odds of suicide among people living with HIV or other chronic illness (Bitew et al., 2016; Rzeszutek, 2017; Umberson and Montez, 2010). Higher social support (especially from caregivers) has been found to be protective against mental health difficulties among ALHIV (Gentz et al., 2017) and for suicidal behaviours among youth in high-income countries; this includes evidence from longitudinal studies (McKinnon et al., 2016; Teismann et al., 2016). Social support can impact these psychological outcomes either by means of a direct effect, or by buffering the negative effects of specific stressors on these outcomes (Alloway and Bebbington, 1987; Casale et al., 2015; Gellert et al., 2018). While multiple studies show direct protective effects of social support on depression and suicide among people living with HIV (Bitew et al., 2016; Brandt, 2009; Gentz et al., 2017), the evidence for stress-buffering is mixed: some studies have found social support to moderate effects of HIV-related stressors, such as financial stress or HIV-illness, on mental health outcomes (Robbins et al., 2003; Wight et al., 2003), while others did not find stress-buffering effects for HIV-related stigma (Breet et al., 2014; Rueda et al., 2012). However none of these studies were conducted specifically with adolescent populations in LMICs.

It should also be noted that most empirical evidence on protective effects of social support for health and mortality has been based on “naturally occurring social relationships” (Holt-Lanstad et al., 2010). There have been many attempts to replicate or complement these positive effects through interventions, some of which have shown promise, and others that have proved less effective or simply not financially feasible in certain contexts (Ertel et al., 2010; Feaster et al., 2010; Holt-Lanstad et al., 2010). Prompted by broader evidence of the potential positive effects of social support on a range of health outcomes and behaviours

(Holt-Lanstad et al., 2010; Umberson and Montez, 2010), HIV support groups have been established across sub-Saharan Africa by government, health facilities and community-based organizations, to provide socio-emotional support to people living with HIV while they initiate and maintain treatment. While evidence on the effectiveness of these interventions is limited, recent cross-sectional and longitudinal research suggests that these HIV support groups – run by nurses or lay counsellors in government facilities providing treatment for patients living with HIV – may have a positive impact on adherence to medication and overall health of adults and adolescents living with HIV (Cluver et al., 2016; Wouters et al., 2009). Support group interventions have also been found to improve mental health and psychosocial functioning among youth living in families affected by HIV (Smith Fawzi et al., 2012; Wu and Li, 2013). But there is no evidence of whether and how HIV support groups may affect the mental health of ALHIV.

This paper investigates potential direct and stress-buffering effects of social support resources on depression and suicidal ideation and attempts, among ALHIV in resource-scarce South African communities. Specifically, this study investigates the potential protective effects of two dimensions of social support against depression and suicidal tendencies: perceived availability of social support (commonly provided through ‘naturally occurring’ social networks and relationships (Holt-Lanstad et al., 2010)), and support groups linked to clinics (an example of a support ‘intervention’ provided by public health facilities).

We hypothesised that: i) stigma would be associated with higher suicidal thoughts and behaviour, directly and/or mediated by increased depression; ii) support resources, specifically perceived social support availability and HIV support group participation, would be directly associated with less depression and suicidal thoughts and behaviour; and iii) that these support resources would buffer the effects of stigma on depression and suicidal thoughts and behaviour.

## **Methods**

### *Sampling and data collection*

Data were collected in 2014-2015 from 1053 adolescents 10-19 initiated on HIV treatment within a high HIV-prevalence resource-limited health district in South Africa's Eastern Cape province. The study was developed in collaboration with the South African Departments of Health and Basic Education, UNICEF, PEPFAR-USAID, and regional and local NGOS. All public healthcare facilities providing HIV treatment to 5 or more ALHIV in the district were selected for inclusion (n=53). ALHIV who had initiated HIV treatment were identified through clinic patient records (n = 1176) and traced back to their communities (n=180), to ensure inclusion of those not engaged in care. Adolescents were recruited and interviewed at the clinics or in their communities (in their homes, schools or other locations they identified as safe). The large majority (n=1053; 90%) of eligible adolescents were interviewed; 4% of adolescents or their caregivers refused participation; around 1% were unable to participate because of severe cognitive delay, and the remaining 5% were not traceable. The pre-piloted questionnaire was developed in English, and items were translated and back translated independently. One-on-one tablet-assisted 60-90 minute interviews were conducted with the adolescents in the language of their choice (for the large majority in Xhosa), by researchers trained in working with vulnerable adolescents. Data were linked to questionnaire serial numbers instead of participant names, to ensure anonymity. Incentives were not provided, but participants were given certificates, refreshments, and a toiletry pack, regardless of whether they completed the interview. Voluntary informed consent was obtained from caregivers and adolescents. For cases of reported recent abuse, rape, suicidal attempt or other risk of significant harm, referrals were made to child protection and health services (n = 66, 6.2%).

Ethical clearance for this study was provided by Oxford University (SSD/CUREC2/12-21), the University of Cape Town (CSSR 2013/4), the South African National Departments of Health, Basic Education and Social

Development, and the Eastern Cape Departments of Health, Basic Education and Social Development.

### *Measures*

#### *Outcome variable: suicidal thoughts and behaviour*

Suicidal thoughts and behaviour were measured using the Mini International Psychiatric Interview for Children and Adolescents Suicidality and Self-harm subscale (Sheehan et al., 2004). The scale contains 4 questions on suicidal ideation (i.e. whether the adolescent had wished he/she were dead or thought about killing or hurting him/herself in the previous month) and one on suicidal attempt (i.e. whether the adolescent had tried to kill him/herself in the previous month); response options are binary (*1:yes; 0:no*). The MINI-Kid has been extensively validated, and shows strong internal consistency and test-retest reliability (Lecrubier et al., 1997). For this sample  $\alpha = .88$ .

#### *Independent variable: stigma*

Stigma was measured using the 10-item ALHIV stigma scale (ALHIV-SS); this consists of items measuring internalized stigma (5 items), anticipated stigma (2 items) and enacted HIV stigma (3 items). Response options are: *0:never; 1:sometimes; 2:most of the time*. The scale has been cross-culturally adapted from a stigma scale previously used with HIV-positive adolescents in the US (Wright et al., 2007), through cognitive interviews with South African adolescents, and validated within the present study (Pantelic et al., 2018).  $\alpha = .66$  in this sample.

#### *Mediator: depression*

Severity (*0: never; 1: many times; 2: all the time*) of depressive symptoms was measured using the Children's Depression Inventory (CDI 10-item short form) (Kovacs, 1992). The CDI is a widely used and well-validated measure with strong psychometric properties. It has been used with various other South African populations, including AIDS-affected children (Cluver et al., 2015; Suliman, 2002).  $\alpha = .64$  in this sample.

*Moderators: perceived social support availability and HIV support group participation*

Perceived social support availability was measured using 7 items from the Medical Outcome Study Social Support Survey/MOS-SS (Sherbourne and Stewart, 1991), an instrument that measures functional support. 3 items measured instrumental support (e.g. support with preparing meals or being accompanied to a doctor) and 4 items measured emotional/informational support (e.g. advice or assistance in dealing with personal problems). This scale has been widely used in the developing world, including with HIV-affected populations in South Africa (Casale et al., 2015). It demonstrated good reliability of  $\alpha=.85$  for this sample. For support group participation, adolescents were asked how often they attended an HIV support group at their clinic (weekly, monthly, yearly, once in a while, no attendance). Given the low frequency of any support group attendance overall (18%) this variable was dichotomized to: *1: attendance; 0: no attendance*.

*Socio-demographic and HIV control variables*

Covariates included in these analyses are: age, gender, urban versus rural location, socio-economic status, whether the child's primary caregiver is a biological parent, and mode of HIV infection. Relative socio-economic status (SES) was measured through a composite scale comprising the top eight socially-perceived necessities for children ( $\alpha= .72$ ) as identified by the Centre for South African Social Policy (Wright, 2008), and endorsed by over 80% of the South African population in the nationally-representative South African Social Attitudes Survey 2006 (Pillay et al., 2007); these include items such as 'enough clothes to keep you warm and dry' and '3 meals a day'. The existence of a primary caregiver and his/her relationship to the adolescent was identified using items from the National Survey of HIV and Risk Behaviour amongst young South Africans (RHRU, 2005). Mode of HIV infection was included as an additional control variable given recent evidence of worse mental health among youth with behaviourally acquired HIV (Lewis et al., 2015). It was assessed based on cohorts of children and adolescents living with HIV in Southern Africa



(Slogrove et al., 2017). Vertical infection refers to acquiring HIV through birth or breastfeeding and horizontal infection refers to acquiring HIV later on in life, mainly through sexual intercourse in this context. Adolescents were coded as vertically-infected if they had started treatment before age 10, with allocations verified using a predictive algorithm of literature-informed factors (e.g. orphanhood as a predictor of vertical infection and sexual abuse as a predictor of horizontal infection).

### *Data analyses*

The analyses were conducted in three stages. First, partial correlations were run in SPSS to identify significant associations between all key variables in the hypotheses to be tested, after controlling for socio-demographic covariates: stigma, perceived social support availability, support group participation, depression and suicidal thoughts and behaviour. The second step consisted of running the moderated mediation model, using the PROCESS plug-in for SPSS (Model 76, Hayes, 2013). This analysis was used to test all three hypotheses indicated above, i.e. for: direct effects of stigma on suicidal thoughts and behaviour and indirect effects mediated by depressive symptoms; direct associations between the support resources and depression and suicidal thoughts and behaviour; and moderation effects of the two support variables on the direct and indirect relationships between stigma and suicidal thoughts and behaviour. All continuous variables were standardized and the analysis controlled for socio-demographic covariates. Bootstrapping, a non-parametric sampling procedure, was used to simultaneously test for direct and indirect effects of the mediator (Preacher and Hayes, 2008); for 1000 bootstrap samples, results are statistically significant where 95% confidence intervals do not overlap zero. The third and final step consisted of illustrating and probing significant interactions using simple slopes tests, in order to further test the moderation effects (Aiken and West, 1991; Dawson, 2018).

## Results

### *Descriptive statistics*

Sample characteristics and descriptive statistics for the variables of interest are summarized in Table 1. The average age of included adolescents was 14 and 78% were living in urban areas. The large majority (75%) had acquired HIV through vertical infection. 43.5% reported having experienced some level of stigma and just under half of the sample (46%) were experiencing one or more symptom(s) of depression. 8% (84 adolescents) reported some level of suicidal thoughts over the previous month and approximately half (4%) of these participants indicated that they had tried to kill themselves during that period. Around 18% of participants attended a support group at their clinic.

**Table 1**

Descriptive statistics and frequencies (n= 1053)

<i>Socio-demographic covariates</i>	
Male (n, %)	476 (45)
Urban location (n, %)	823 (78)
Horizontally acquired HIV (n, %)	267 (25)
Caregiver is biological parent (n, %)	474 (45)
Age (mean, SD)	13.82 (2.84)
Socio-economic status (mean, SD)	1.61 (1.80)
<i>Main IV</i>	
Stigma (mean, SD)	1.14 (1.75)
<i>Mediator</i>	
Depression (mean, SD)	1.26 (1.98)
<i>Moderators</i>	
Perceived social support (mean, SD)	12.92 (2.17)
Support group attendance (n, %)	188 (18)
<i>Outcome variable</i>	
Suicidal thoughts and behaviour (mean, SD)	1.19 (0.78)

### *Partial correlations*

Table 2 shows partial correlations for key variables for the analyses, after controlling for covariates. Partial correlations between stigma, depression, perceived social support and suicidal thoughts and behaviour are in the expected direction and small to moderate in size ( $p < .001$  for all associations). Support group attendance, instead, is not significantly correlated with any of the other key variables. In particular, the lack of a significant association between the MOS social support scale and participation in a support group, and the small effect size of the association ( $B = -0.027$ ), indicate that these variables are distinct constructs likely measuring different functional dimensions of support.

**Table 2**

Partial correlations between stigma, support resources, depression and suicidal thoughts and behaviour

	Stigma	Perceived social support	Depression	Suicidal thoughts and behaviour
Stigma	—			
Perceived social support	-0.185***	—		
Depression	0.308***	-0.259***	—	
Suicidal thoughts and behaviour	0.300***	-0.119***	0.348***	—
Support group attendance	0.022	-0.027	-0.036	-0.020

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ .

*Note: all correlations controlled for age, gender, location, socio-economic status, mode of infection and whether caregiver is biological parent*

### *Moderated mediation analysis*

#### *Direct and indirect effects of stigma on suicidal thoughts and behaviour*

Tables 3-5 and Figure 1 display the results of the moderated mediation analysis. Higher HIV-related stigma is directly associated with higher depressive symptoms ( $B=0.295$ ;  $p<.001$ ) and higher suicidal thoughts and behaviour ( $B=0.185$ ;  $p<.001$ ) in this sample. Depression is also associated with higher suicidal thoughts and behaviour scores ( $B=0.164$ ;  $p<.001$ ). There are both significant direct effects of stigma on suicidal thoughts and behaviour and indirect effects via depression, dependent on the values of the moderator variables. This indicates the presence of moderated mediation, as discussed below and in Table 5.

*Direct associations between the support variables, depression and suicidal thoughts and behaviour*

Regression results also show that higher perceived social support is directly and significantly associated with less depression ( $B=-0.182$ ;  $p<.001$ ), while being part of a support group is not. Neither of the two support resources is directly associated with suicidal thoughts and behaviour.

*Moderating effects of perceived social support and HIV support group attendance*

Conditional direct and indirect effects of stigma on suicidal thoughts and behaviour, at high and low levels of the respective moderators, are presented in Table 5. At low levels of perceived social support, there is a significant indirect relationship between stigma and suicidal thoughts and behaviour – mediated by depression - irrespective of whether or not adolescents participate in a support group (confidence intervals do not cross zero). This relationship remains significant for adolescents with high social support, who are not participating in a support group. However, in the presence of both support resources - high perceived social support and support group participation - the association is not significant (CIs [95%]:  $-0.018 - 0.049$ ). The presence of moderation is reinforced by the significant interactions in the regression analyses: both the stigma x social support scale ( $B=-0.077$ ;  $p<.001$ ) and stigma x support group ( $-0.23$ ;  $p<.01$ ) interactions are significant predictors of depression, and the depression x support group interaction is significant for suicidal thoughts and behaviour ( $B=-$

0.074;  $p < .001$ ) (see Figure 1). Instead, with regard to conditional direct effects, the direct relationship between stigma and suicidal thoughts and behaviour is significant only for adolescents who are not part of a support group, regardless of whether their perceived level of social support availability is high or low ( $p < .001$  in both these cases). For adolescents who are part of a support group, this direct relationship is not significant. Evidence of support group moderation is reinforced by the significance of the stigma x support group interaction in predicting suicidal thoughts and behaviour ( $B = -0.112$ ;  $p < .05$ ). The stigma x social support scale interaction is not significant.

*[Insert Figure 1]*

**Table 3**

Results of PROCESS Model 76 multivariate regression predicting depression

	B (unstandardized coefficient)	LLCI	ULCI
<i>Socio-demographic covariates</i>			
Age	0.068	-0.004	0.139
Male	-0.002	-0.115	0.112
Urban location	0.090	-0.048	0.228
Worse SES	0.063*	0.006	0.120
Horizontal infection	0.096	-0.065	0.257
Caregiver biological parent	-0.071	-0.185	0.043
<i>Stressor/IV</i>			
Stigma	0.295***	0.228	0.361
<i>Moderators</i>			
Perceived social support	-0.182***	-0.242	-0.121
Support group attendance	-0.113	-0.258	0.033
<i>Interactions</i>			
Stigma x Perceived social support	-0.077***	-0.121	-0.034
Stigma x Support group	-0.230**	-0.370	0.090
Model summary: $R = 0.453$ ; $R\text{-sq} = 0.206$ ; $F = 23.244$			

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$

**Table 4**

Results of PROCESS Model 76 multivariate regression predicting suicidal thoughts and behaviour

	B (unstandardized coefficient)	LLCI	ULCI
<i>Socio-demographic covariates</i>			
Age	0.031	-0.024	0.085
Male	-0.068	-0.154	0.018
Urban location	-0.031	-0.136	0.074
Worse SES	-0.002	-0.045	0.042
Horizontal infection	0.066	-0.056	0.189
Caregiver biological parent	-0.054	-0.141	0.032
<i>Stressor/IV</i>			
Stigma	0.185***	0.132	0.238
<i>Mediator</i>			
Depression	0.164***	0.109	0.220
<i>Moderators</i>			
Perceived social support	0.025	-0.022	0.072
Support group attendance	-0.017	-0.127	0.094
<i>Interactions</i>			
Stigma x Perceived social support	-0.002	-0.040	0.036
Stigma x Support group	-0.112*	-0.222	-0.002
Depression x Perceived social support	-0.074***	-0.106	-0.042
Depression x Support group	-0.000	-0.119	0.119

Model summary:  $R = 0.476$ ;  $R\text{-sq} = 0.226$ ;  $F = 20.555$

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$

**Table 5**

Conditional indirect and direct effects of stigma on suicidal thoughts and behaviour

**Conditional indirect effect(s) of stigma on suicidal thoughts and behaviour at values of the moderator(s);****Mediator: depression scale**

Perceived Social Support	Support Group Attendance	Effect	Boot SE	BootLLCI	BootULCI
Low	No	.0875	.0266	.0433	.1502
Low	Yes	.0330	.0244	.0007	.1067
High	No	.0326	.0166	.0047	.0710
High	Yes	.0033	.0149	-.0184	.0486

**Conditional direct effect(s) of stigma on suicidal thoughts and behaviour at values of the moderator(s)**

Perceived Social Support	Support Group Attendance	Effect	SE	LLCI	ULCI
Low	No	.1864	.0303	.1269	.2459
Low	Yes	.0746	.0513	-.0262	.1754
High	No	.1839	.0302	.1248	.2431
High	Yes	.0721	.0526	-.0311	.1754

*Interaction plots and slope tests*

The plots and slope tests for each of the four significant interaction terms, included in Supplementary Figures 1-4, reinforce evidence of moderation effects. Slope gradients are significant for all significant interactions tested, and gradients are higher at lower levels of support resources (i.e. at lower levels of perceived social support or in the absence of support group participation).

## Discussion

### *Prevalence of suicidal thoughts and behaviour*

Our data indicate that 1 in approximately 12 ALHIV had thought about killing him/herself in the preceding month, and about half of these adolescents had attempted to do so. These rates are in line with findings of previous Southern African studies conducted with HIV-affected adolescents or HIV-positive adults attending clinics (7-8% for suicidal ideation and just over 3% for suicidal attempts (Cluver et al., 2015; Rukundo et al., 2016)). They are, however, lower than aggregate rates reported for people living with HIV globally or youth in South Africa and other LMICs (between 15 and 27%) (Catalan et al., 2011; Page et al., 2013; The South African Depression and Anxiety Group, 2016) and are likely to be considerably higher if past-year or any lifetime experiences are taken into consideration.

### *Associations between stigma and suicidal thoughts and behaviour*

We hypothesised that stigma would be associated with higher suicidal thoughts and behaviour in this population of ALHIV, directly and/or mediated by increased depression. Almost half of the adolescents in this sample (44%) have experienced or perceived some level of HIV-related stigma, evidence of how pervasive this phenomenon still is. This study reinforces stigma as a risk factor for psychological distress and suicide among ALHIV: it identified both direct associations with suicide, in line with previous studies conducted with people living with HIV (Bitew et al., 2016; Gebremariam et al., 2017), as well as indirect effects mediated by depression.

### *Direct associations between support resources, depression and suicidal thoughts and behaviour*



We hypothesised that support resources, specifically perceived social support availability and HIV support group participation, would be directly associated with less depression and less suicidal thoughts and behaviour. However, only perceived support availability appears to have a general mental health effect (Thoits, 2011) in this sample, in that it is directly associated with less depression among ALHIV whether or not these adolescents are experiencing stigma. This is not the case for support group participation, which is not significantly associated with depression. Moreover, neither perceived social support availability nor group participation are directly associated with suicidal thoughts and behaviour in multivariate analyses.

### *Stress-buffering effects of support resources*

Lastly, we hypothesised that these support resources would buffer the effects of stigma on depression and suicidal thoughts and behaviour. Findings do indeed point to stress-buffering protective effects of social support (Alloway and Bebbington, 1987) on the psychological outcomes of these HIV-positive adolescents. Both support resources investigated in these analyses appear to be moderating the negative effects of stigma on suicidal thoughts and behaviour. In particular, the combination of higher perceived social support and belonging to a support group appears to be particularly important to buffer the indirect effect of stigma, mediated by depression: it would in fact seem that (only) in the presence of both support resources, the mediated relationship between stigma and suicidal tendencies is not significant. Moreover, these individual support resources seem to be operating slightly differently to produce this stress-buffering effect: both perceived social support and support group participation are moderating the relationship between stigma and depression, but only perceived social support is moderating the effects of depression on suicidal thoughts and behaviour. Instead, with regard to direct effects of stigma, support group participation is what appears to make the difference: stigma did not have a significant effect on suicidal thoughts and behaviour for adolescents who attended a support group, regardless of their level of perceived social support. It is unclear how the observed direct effect of stigma in this model is operating, and

may indicate the presence of other mediating mechanisms, for example psychological variables such as self-efficacy, self-esteem and hope (Casale et al., 2013; Thoits, 2011). Future research should explore these potential mechanisms, as well as possible moderating effects of support interventions on these pathways.

### *Limitations*

This study has a number of limitations. It is subject to the risks of reporting bias and inaccuracies linked to self-reported data – although there are no known alternatives to reporting for factors such as experienced stigma and suicidal thoughts and behaviour. In addition, the data is cross-sectional and, despite theoretical assumptions around causality guiding these analyses, in some cases associations could be bi-directional: for example, poor mental health may negatively affect perceived stigma, prior suicidal attempts may increase stigma, and, in certain circumstances, participation or non-participation in a support group could potentially lead to stigma. In this regard future analyses with longitudinal data, and mixed methods research, could provide further useful insights. Also, given the complexity of these analyses and the focus on social resources, we chose to use an aggregate stigma variable rather than disaggregate by its individual sub-constructs. However, recent literature has highlighted the potential usefulness of exploring core psychosocial HIV-stigma mechanisms – namely internalized stigma, enacted stigma and anticipated stigma - distinctly (Earnshaw and Chaudoir, 2009; Pantelic et al., 2017), to obtain a more nuanced understanding of how HIV-related stigmas may be affecting health-seeking behaviours (Earnshaw et al., 2013; Turan et al., 2017). It may be useful for future research to unpack the relationship between different stigma mechanisms and mental health outcomes for ALHIV.

### *Implications for future research and interventions*

Despite the above-indicated limitations, this paper contributes to a key gap in the literature. These are the first known analyses to explore the moderating

effects of social support resources on the direct and indirect relationship between stigma and suicidal ideation and attempts, among ALHIV in a low-income setting. Findings reinforce the potential of social support as an important protective general mental health and stress-buffering resource for ALHIV. They also suggest that the distinct roles of specific support resources – representing different sources and/or types of support - are important to consider in understanding these overall effects. Perceived support availability and support group participation in this sample appear to be conceptually distinct in terms of their functional dimension (House and Khan, 1985) and support providers. It is likely that the types of instrumental and emotional support measured by the perceived support construct in this study (e.g. support with health care, practical help or general problem-solving) are being provided by individuals within the adolescent's informal family and community network, and not by support group facilitators or members. Clinic-based HIV support groups are instead likely to be providing predominantly informational and emotional support related to HIV treatment and the adolescent's experience of living with HIV, distinct from the support deriving from other naturally occurring relationships. Further enquiry would however be needed to determine the content and functioning of clinic support groups versus adolescents' other sources of support. It would also be useful for future research to help further our understanding of the effects and pathways through which these different support types and mechanisms may be operating simultaneously (House et al., 1988) - and possibly synergistically - to improve health behaviours and outcomes in this specific adolescent population.

Our findings also have several implications for interventions. First, they suggest that it is important to intervene as early as possible to strengthen support resources among ALHIV who are experiencing stigma and poor mental health, in order to mitigate further risks of deteriorating mental health and suicidal attempts. Support groups show potential as a component of effective mental health and suicide prevention interventions; they are also relatively low-cost initiatives with potentially high acceptability and sustainability in the medium-long term, since they draw from existing African community models (Verhoef, 2001). Moreover, while this paper focuses on depression and suicide, support

groups may have several further beneficial effects in other domains, for example on social functioning, coping skills, psychological resilience, health service uptake and treatment adherence (Wouters et al., 2009; Wu and Li, 2013). These should be considered when assessing the potential costs and benefits of scaling up similar initiatives with public health resources.

It is noteworthy, however, that, despite potential benefits of support group participation, less than 20% of ALHIV in this sample reported attending any form of clinic support group. Reasons may include a lack of support group availability at certain health facilities, time constraints, distance and travel cost to the meeting location, concerns linked to privacy or disclosure, or groups poorly aligned to needs specific to ALHIV (Adejumo et al., 2015). It would be useful to gain a better understanding of why participation in these groups is so low among ALHIV, and how to increase uptake and effectiveness through content and modalities that are desirable to adolescents. It is key that adolescents be involved in the development of these initiatives, since effective adult support interventions may not necessarily work for adolescents (Grimsrud et al., 2016).

Findings also suggest that attempting to prevent suicidal thoughts and behaviour through social support with ALHIV already experiencing depression may be more difficult, and likely require a greater focus on interventions that strengthen existing family and community support networks. These types of initiatives may also have the additional benefit of improving mental health more broadly through 'general health' protective effects (Thoits, 2011). However, structural interventions aiming to alter individuals' existing social networks and environments have shown mixed results and are often costly (Feaster et al., 2010), suggesting that we need to find alternative and preferably community-based solutions in settings with scarce (human and other) resources for health.

Lastly, results of these analyses show that our ability to protect ALHIV from negative psychosocial effects of HIV-related stressors is likely to be greater in the presence of multiple support resources. Adolescents in this sample that both perceived high social support and participated in support groups appeared to be

more resilient than their peers. This suggests that there is value in working to strengthen multiple support resources available to ALHIV. While further research would be needed to determine long-term effects, our findings present an example of a support intervention that can be protective for adolescent psychosocial health, in a way that may be both distinct and complementary to the support deriving from naturally occurring relationships (Holt-Lanstad et al., 2010). These findings are noteworthy, given the challenges often faced by interventionists attempting to replicate positive effects of support deriving from ‘informal’ social relationships (Ertel et al., 2010; Holt-Lanstad et al., 2010). They point to the potential value of clinic-community collaborations and are particularly pertinent for low resource settings where public specialised psychiatric services are unfortunately scarce or non-existent.

Adolescents living with HIV in low and middle income countries should be a priority population group for the prevention of mental health disorders and suicide. Even where poor mental health and suicidal ideation do not result in suicidal attempts, they can lead to poor quality of life, high risk behaviours and lower retention in HIV treatment and care, resulting in higher HIV transmission and AIDS-related mortality (Lowenthal et al., 2014; Mutumba et al., 2015). These challenges are likely to intensify over the next decade, especially in the sub-Saharan African region, where adolescent populations - and specifically adolescents living with HIV and dependent on life-long care and treatment - continue to grow (Lowenthal et al., 2014). Better understanding risk and protective factors for psychosocial health, and developing more effective interventions to protect these adolescents’ health, will be critical to their survival and realisation of full life’s potential.

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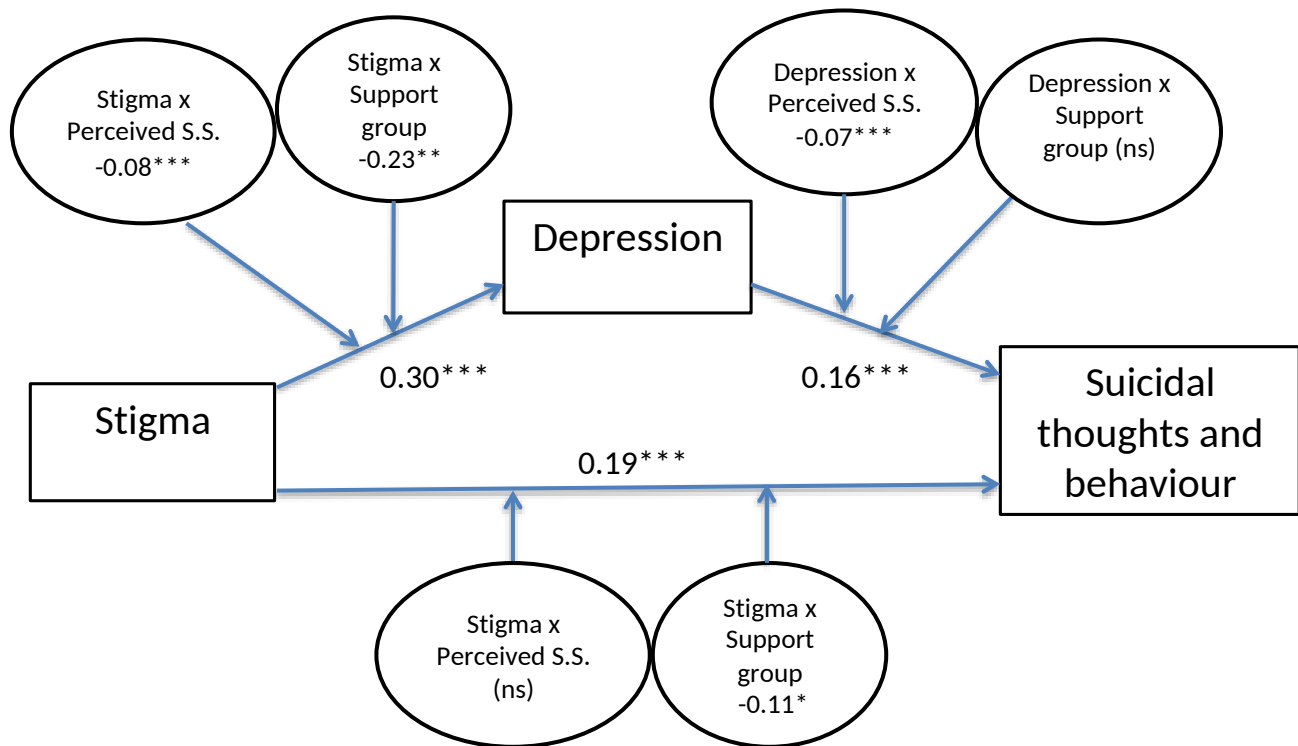
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Figure 1: Results of moderated mediation analysis  
(n=1053)



\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$

*Footnote for Figure 1*

Figure 1 displays unstandardized coefficients and significance levels for individual associations and interaction terms, generated from the moderated mediation analysis. The oval shapes contain results of interaction terms or moderators tested. The conditional direct and indirect pathway effects of stigma on suicidal thoughts and behaviour at different values of the moderators are displayed in Table 5. Lower (LLCI) and upper (ULCI) confidence intervals that do not cross zero denote significant effects at the specific indicated values of the moderators.



### **Competing interests**

The authors understand and comply with the Journal's Conflict of Interest Policy.  
All the authors declare that they have no conflicts of interest.

The authors: Marisa Casale, Mark Boyes, Marija Pantelic, Elona Toska, Lucie Cluver



## AUTHOR STATEMENT

### Authors' contributions

As first author, MC took the lead in conceptualizing and writing the paper and conducted the statistical analysis with the support of MB. LC and ET had key roles in designing the research study and managing the research data. MP and MB contributed to the research design and to the choice of measurement tools. LC, ET, MC and MP were involved in the management of the field research. All authors contributed to and have approved the final manuscript.

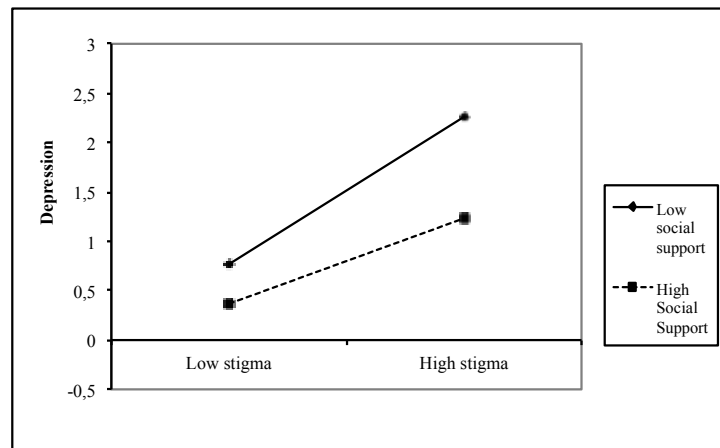
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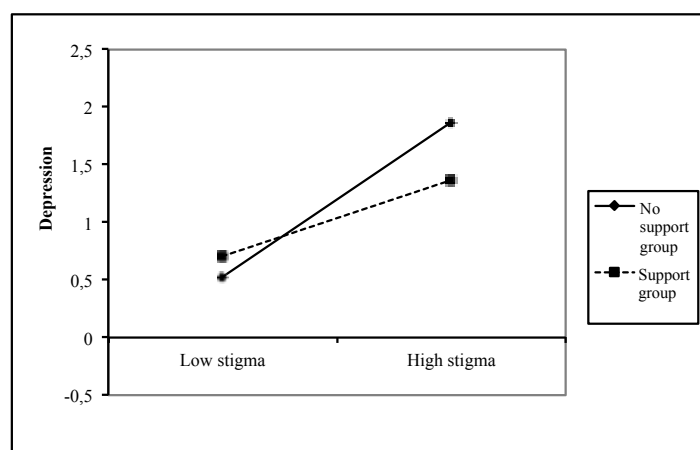
**Supplementary file:** Plots and results of slope tests for each significant interaction term

**Figure S1: Plot of the interaction of stigma x perceived social support on depression**



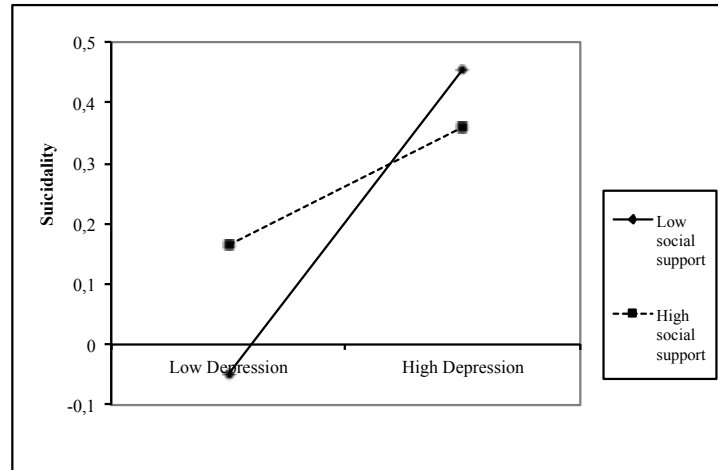
Gradient of slope for Low social support: **0,741** Gradient of slope for High Social Support: **0,429**  
t-value of slope for Low social support: **10,479** t-value of slope for High Social Support: **4,522**  
p-value of slope for Low social support: **0,000** p-value of slope for High Social Support: **0,000**

**Figure S2: Plot of the interaction of stigma x support group on depression**



Gradient of slope for No support group: **0,678** Gradient of slope for Support group: **0,329**  
t-value of slope for No support group: **7,845** t-value of slope for Support group: **3,987**  
p-value of slope for No support group: **0,000** p-value of slope for Support group: **0,000**

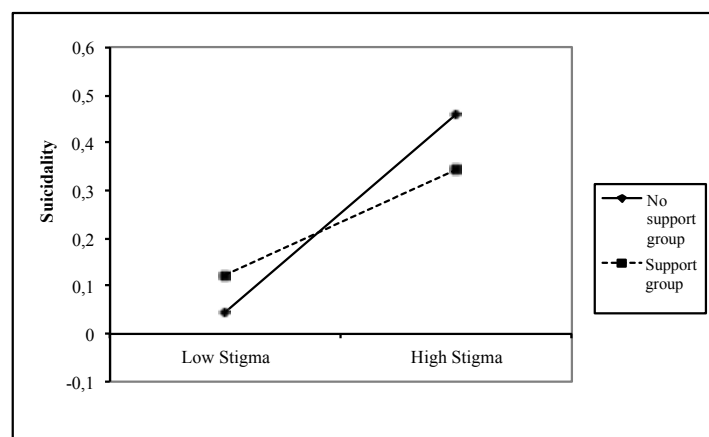
Figure S3: plot of the interaction of depression x perceived social support on suicidal thoughts and behaviour



Gradient of slope for Low social support: **0,251**  
t-value of slope for Low social support: **7,937**  
p-value of slope for Low social support: **0,000**

Gradient of slope for High Social Support: **0,097**  
t-value of slope for High Social Support: **3,067**  
p-value of slope for High Social Support: **0,002**

Figure S4: Plot of the interaction of stigma x support group on suicidal thoughts and behaviour



Gradient of slope for No Support Group: **0,207**  
t-value of slope for No Support Group: **5,290**  
p-value of slope for No Support Group: **0,000**

Gradient of slope for Support Group: **0,109**  
t-value of slope for Support Group: **3,801**  
p-value of slope for Support Group: **0,000**