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Examining the Relationship Between Psychosocial Factors with Knowledge of HIV-Positive Status and Antiretroviral Therapy Exposure Among Adolescent Girls and Young Women Living with HIV in South Africa

Janan J. Dietrich[1,2], **Kim Jonas**[1,3], **Mireille Cheyip**[4], **Tracy McClinton Appollis**[1,3], **Oluwatobi Ariyo**[5], **Roxanne Beauclair**[6], **Carl Lombard**[7,8], **Glenda E. Gray**[9], **Catherine Mathews**[1,3]

[1]Health Systems Research Unit, South African Medical Research Council, Bellville, South Africa

[2]Perinatal HIV Research Unit (PHRU), School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

[3]Adolescent Health Research Unit, Division of Child and Adolescent Psychiatry, Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa

[4]Division of Global Health Protection, Center for Global Health, Centers for Disease Control and Prevention, Pretoria, South Africa

[5]Harvard University, Boston, MA, USA

[6]The South African Department of Science and Technology/National Research Foundation (DST-NRF) Centre of Excellence in Epidemiological Modelling and Analysis (SACEMA), Stellenbosch University, Stellenbosch, South Africa

[7]Biostatistics Unit, South African Medical Research Council, Bellville, South Africa

[8]Division of Epidemiology and Biostatistics, Department of Global Health, University of Stellenbosch, Bellville, South Africa

[9]Office of the President, South African Medical Research Council, Bellville, South Africa

Abstract

✉ Janan J. Dietrich, dietrichj@phru.co.za.

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Conflict of interest No conflict of interest to declare.

Code Availability Not applicable.

Ethical Approval Study procedures were approved by the South African Medical Research Council Research Ethics Committee (EC036-11/2016). The study was also reviewed in accordance with the Centers for Disease Control and Prevention (CDC) human research protection procedures and was determined to be research, but CDC investigators did not interact with human subjects or have access to identifiable data or specimens for research purposes.

Consent to Participate Informed consent was obtained from all participants aged ≥ 18 years. For adolescent girls and young women aged < 18 years, assent and parent/guardian/foster/caregiver consent were obtained. Participants were reimbursed with a voucher worth ZAR75 (~ US$5).

Consent for Publication I have received consent to publish the study results. No individual data or images are provided. All data are anonymised.

Adolescent girls and young women (AGYW) living with HIV have poor antiretroviral therapy (ART) outcomes. We examined the relationship between psychosocial factors with knowledge of HIV-positive status and antiretroviral therapy exposure among AGYW living with HIV in South Africa. Participants 15–24 years responded to a survey including socio-demographics, psychosocial factors, and HIV testing. Blood was collected to determine HIV status and ART exposure. Multivariable analyses were conducted using R. Of 568 participants with HIV, 356 had knowledge of their HIV-positive status. Social support from family [aOR 1.14 (95% CI 1.04–1.24)] or from a special person [aOR 1.12 (95% CI 1.02–1.23)] was associated with knowledge of HIV-positive status. Resilience [aOR 1.05 (95% CI 1.01–1.08)] was the only psychosocial factor associated with a higher odds of ART exposure. Social support and resilience may increase knowledge of HIV-positive status and ART exposure among South African AGYW.

Keywords

HIV; Antiretroviral therapy (ART); Adolescent girls and young women (AGYW); Africa

Introduction

HIV is the fourth leading cause of death among adolescents in Africa [1, 2]. In South Africa, adolescent girls and young women (AGYW) aged 15–24 years remain disproportionately affected by human immunodeficiency virus (HIV) with prevalence rates of 5.8% and 15.7% among those aged 15–19 years and 20–24 years, respectively, and an incidence rate almost three times higher than young men [3]. South Africa currently has the largest global antiretroviral therapy (ART) programme, and HIV can be a manageable chronic condition [4, 5]. However among AGYW living with HIV, AIDS-related mortality rates are increasing [6]. In a 2020 study of South African AGYW, less than half living with HIV had knowledge of their HIV-positive status [7]. In 2018, approximately 50% of AGYW living with HIV and receiving ART in South Africa had viral suppression [7], which is far from the Joint United Nations Programme on HIV/AIDS (UNAIDS) viral suppression target of 90% [8]. Overall, ART adherence seems to be poor in adolescents compared to adults [9–11] in South Africa and in other resource-poor countries [12–14].

Structural and economic factors contribute to the poor HIV care coverage among young people. Limited access to food, transportation costs, and political instability have been negatively correlated with ART adherence [15]. Psychosocial factors—that is, modifiable strength-based factors [16]—also affect ART adherence. For example, limited caregiver supervision and lack of strong support networks were negatively associated with ART adherence, whereas resilience factors such as healthy adaptive skills and positive future expectations were positively correlated with adherence in a sample of South African adults living with HIV [16]. Instead of using a scale to measure resilience, previous studies used different concepts of resilience [17]. In some instances, resilience has been characterised as the absence of mental health challenges [17, 18]. In a previous study among South African adults receiving ART, the role of resilience, measured as social support and coping strategies, was predictive of viral suppression [19].

To address ART exposure among AGYW, a gender-responsive approach is recommended [20]. Therefore, it will be necessary to analyze how different psychosocial risk and protective factors influence ART exposure in AGYW. Qualitative evidence illustrates how psychosocial factors, such as mental health, discrimination, and internalised stigma, hinder treatment adherence among adolescents living with HIV [20–23].

AGYW living with HIV can have adverse psychosocial risks. Therefore, our analyses were guided by theories of syndemics which posit collective risk or co-occurring epidemics [24–26]. Previous research in South African youth have established an association between HIV risk and psychosocial factors [24, 27]. A qualitative study among South African AGYW showed the interconnectedness and bidirectional relationship between HIV risk and adverse mental health outcomes [28]. Co-occurring psychosocial factors are regarded as important syndemic factors which could contribute to ART outcomes for youth. We hypothesised that psychosocial factors (wellbeing, resilience, social support, gender equity, and internalised stigma) would be associated with ART exposure among AGYW living with HIV. For the present paper, we examined the relationship between psychosocial factors (wellbeing, resilience, social support, gender equity, and internalised stigma) with knowledge of HIV-positive status and antiretroviral therapy exposure among AGYW living with HIV in South Africa. Since HIV care can be a barrier to ART exposure we also describe facilitators and barriers of clinic access [25].

Methods

Study Design

This study was part of the HERStory study, an evaluation of a donor-funded [23] large-scale combination HIV prevention intervention for AGYW aged 10–24 years in South Africa; one of the interventions that aimed to achieve the UNAIDS 90–90-90. The targets are for 90% of HIV-positive individuals to know their status; of these, 90% to be receiving ART; and of these, 90% to have viral suppression) and to end the global HIV epidemic by 2030 [29]. The primary objective of the HERStorystudy was to determine the intervention impact on HIV incidence over a 2-year period [29]. The first survey (used for the present paper) was planned to be conducted in six of the ten districts in which the combination HIV intervention was implemented.

Participant Sampling

For the larger HERStory study, a cross-sectional household study was conducted from 2017 to 2018 in six South African districts: City of Cape Town (Western Cape), Ehlanzeni (Mpumalanga), O.R. Tambo (Eastern Cape), Tshwane (Gauteng), King Cetshwayo (KwaZulu-Natal), and Zululand (KwaZulu-Natal) [7]. The sample size was designed to be proportionate to the size or number of AGYW in the sub-district areas or wards for the Global Fund interventions. Within districts, sampling was restricted to areas selected a priori for implementation of the combination intervention [30]. In each district, the non-governmental organisation or government organisation delivering the intervention was tasked to outline the sub-areas in which they would be implementing the intervention. These areas were then mapped onto the available census small areas layer (SAL) sampling

areas that covered the targeted areas. A sampling frame was compiled for each district based on the 2011 census SALs. Thereafter, a systematic random sample of 35% of the available households within each sampled SAL was selected for the required sample size of participants. All AGYW aged 15–24 years in sampled households were invited to participate, thus there were no sampling at this level.

The HIV prevalence was 12.4% (n = 568) among 4399 AGYW participating in the HERStory study [20]. In a recent paper published on the HIV Care Cascades for the HERStory study, we found that only 26 (4.5%) of the 568 AGYW testing positive for HIV had a recent infection—most were older infections [7]. Of the 26 with a recent HIV infection 2 had knowledge of their HIV-positive status. Therefore, data analyses for the present paper were restricted to those with a HIV-positive status and knowledge of their HIV-positive, including the 2 with recent infection.

Procedures

Trained female fieldworkers obtained written informed consent from participants privately in their homes before collecting blood samples. Thereafter, fieldworkers read each survey question aloud and entered participant responses on a computer tablet using the Mobenzi Researcher online survey software [31]. Sensitive questions about HIV and sexuality were completed by participants and entered privately on the computer tablet. A social worker was available in each district for healthcare and social support.

Main Outcomes

Our two primary outcomes are knowledge of HIV-positive status and ART exposure based on the a priori hypothesis that almost all of the participants with knowledge of their HIV-positive status would be exposed to ART.

Knowledge of HIV-Positive Status

Participants were considered to have knowledge of their HIV-positive status if they responded yes to knowing their HIV-positive status, to ever testing for HIV, and if they responded yes to having an HIV-positive result from their most recent HIV test. Additionally, AGYW living with HIV were assumed to have knowledge of their HIV-positive status through a laboratory confirmed positive test and if ART metabolites were detected in their blood.

ART Exposure

Dried blood spot samples were tested for ART exposure via high-performance liquid chromatography and tandem mass spectrometry (Agilent HPLC-Module 1260 Infinity; Mass spectrometer ABSciex 6.5+). The assay was a validated qualitative detection of Nevirapine, Emtricitabine, Lamuvidine, Abacavir, and Tenofovir (the lower limit of detection was 25 ng/ml/0.025 μg/ml); Efavirenz, and Lopinavir (the lower limit of detection was 100 ng/ml/0.1 μg/ml). Known standards were analysed with every batch of samples to ensure reproducibility and adequate quality assurance. In this paper, the participant was considered to have ART exposure if any metabolite was detected in their blood [32].

Main Exposure

The psychosocial measures included wellbeing, resilience, social support, gender equity, and internalised stigma. To measure wellbeing we used the eight-item Flourishing Wellbeing Scale. This scale measures self-perceived success [33] and has a seven-point Likert scale with responses ranging from “strongly disagree” to “strongly agree”. Scores ranged from 8 to 56. The Cronbach’s alpha score for this sample is 0.78.

Psychological resilience was measured with the 10-item Connor–Davidson Resilience Scale a 10-item scale [34, 35]. For this tool psychological resilience is defined as “how well one is equipped to bounce back after stressful events, tragedy, or trauma”. The scale has a five-point Likert scale and responses range from “not at all true” to “true all the time”. Total scores range from 10 to 50. High scores indicate greater resilience. The Cronbach alpha score for this sample is 0.83.

We used the 12-item Multidimensional Scale of Perceived Social Support to measure perceived support from family, peers/friends, and a special person/significant other [36]. Responses range from “very strongly agree” to “very strongly disagree,” scored 1–7. Mean scores 1–2.9 are considered low support, 3–5 moderate support, and 5.1–7 high support [37]. The Cronbach’s alpha scores for this sample are as follows: overall, 0.91; family scale, 0.85; peer scale, 0.88; special person scale, 0.83).

Gender equity was measured with an adapted version of the 23-item Gender Equitable Men’s Scale assessing sexual relationship and gender power (Cronbach’s alpha for this sample: 0.71) [38]. Scores range from 22 to 66, and high scores indicate high gender equity.

Internalised stigma was measured with the six-item Internalized AIDS-Related Stigma Scale [39]. Response options were “agree” or “disagree,” and scores ranged from 0 to 6. High scores indicate increased internalised stigma (Cronbach’s alpha for this sample: 0.88).

See Table 1 for additional variables [40].

Ethical Considerations

Study procedures were approved by the South African Medical Research Council Research Ethics Committee (EC036–11/2016). The study was also reviewed in accordance with the Centers for Disease Control and Prevention (CDC) human research protection procedures and was determined to be research, but CDC investigators did not interact with human subjects or have access to identifiable data or specimens for research purposes. Informed consent was obtained from all participants aged ≥ 18 years. For AGYW aged < 18 years, assent and parent/guardian/foster/caregiver consent were obtained. Participants were reimbursed with a voucher worth ZAR75 (~ US$5).

Data Analysis

All statistical analyses were survey-based and used the “survey” and “srvyr” packages in R, version 3.5.0 [41–43]. We specified small area layers as the primary sampling unit, districts as our strata, the number of small area layers in each district as the finite-population

correction, and sample weights. Therefore, the numbers may not add up exactly as the weighted dataset would have to be used for accurate calculations.

Participant characteristics were described using frequencies, percentages, and 95% confidence intervals (CIs). Bivariate associations were assessed between outcomes and socio-demographic, health and wellbeing, psychosocial, and sexual and reproductive health factors. We investigated significant differences in frequencies for knowledge of HIV-positive status and ART exposure. For categorical factors, Pearson chi-square tests were used, and for numeric variables, Wilcoxon rank-sum tests were used. Non-parametric tests such as the such as the Wilcoxon rank-sum test were used because the numeric variables (that is, psychosocial score variables) were not normally distributed. We described facilitators of and barriers to going to the clinic for HIV care among AGYW with knowledge of their HIV-positive status and with ART exposure (n = 299).

We used multivariable logistic regression models to examine associations between each of the psychosocial factors and our two primary outcomes. The first outcome is knowledge of HIV-positive status among all AGYW living with HIV (n = 568). The second outcome is ART exposure among all HIV-positive AGYW with knowledge of their HIV-positive status (n = 356). Analysis of ART exposure was only done on those with knowledge of their HIV+ status, as we would not expect those without knowledge of their HIV status to be on ART.

For the exposure variables, each psychosocial construct was added as the primary exposure in its own model, without the other constructs. The models were adjusted for known confounders, including age, highest grade achieved, and the length of time in the community. The models for wellbeing, resilience, and gender equity norms were adjusted for known confounders of rape or forced sex. Adjusted Odds Ratios (aOR) and 95% CIs are presented. For the Cronbach alpha scores, a cut-off of 0.70 was used.

Results

Sample Characteristics

Among 568 AGYW living with HIV, most were aged 20–24 years (69.1%), had secondary schooling (88.5%), and two-thirds (69.3%) had always lived in their community (Table 2). Among participants who ever had sex (n = 499), 67.2% reported ever being pregnant.

Among 358 (60.8%) participants who had knowledge of their HIV-positive status, two had missing ART status information and were removed from the analysis. Of the remaining participants (n = 356), 83.1% (n = 299) had ART metabolites detected in their blood and thus were considered to be using ART.

Bivariate Associations

Knowledge of HIV-Positive Status—Participants with knowledge of their HIV-positive status tended to be less educated (86.3% vs 92.0%; $p < 0.05$) and were less likely to have always lived in their community (66.2% vs 73.9%; $p < 0.005$), when compared to those without knowledge of their HIV status. Compared to those without knowledge of HIV status, participants with knowledge of their HIV-positive status had significantly higher rates

of: being hospitalized (50.1% vs 40.7%; $p \leq 0.005$), going a day and /night without food in the past month (23.3% vs 16.7%; $p < 0.05$), ever being pregnant (70.3% vs 62.3%, $p \leq 0.05$), and ever being forced to have sex or raped (13.8% vs 8.9%; $p < 0.05$) (Table 3).

ART Exposure—Among AGYW with knowledge of their HIV-positive status, those with no ART exposure tended to be less likely to have always lived in their community (60.6% vs 67.5%; $p < 0.05$) and have lower rates of going a day and night without food in the past month (15.4% vs 24.7%; $p < 0.05$) than those with without knowledge of their HIV-positive status. Compared with AGYW with no ART exposure, those with ART exposure tended to have fewer reports of ever being raped (11.9% vs 23.5%; $p < 0.05$) and tended to be less likely to have accessed male condoms in the past year (68.8% vs 79.8%; $p < 0.05$; Table 4).

Multivariable Regression Results

Table 5 shows the models reflecting the hypothesised relationships between psychosocial factors with knowledge of HIV-positive status as well as ART exposure. Social support from family [adjusted odds ratio (aOR), 1.14 (95% CI 1.04–1.24)] or a special person [aOR 1.12 (95% CI 1.02–1.23)] were significantly associated with knowledge of HIV-positive status. After adjusting for confounders, a 1-unit increase in support from peers decreased likelihood of knowing one's HIV-positive status [aOR 0.9 (95% CI 0.83–0.97). On the other hand, a 1-unit increase in support from a special person increased the odds of a participant knowing her HIV-positive status by 12%. Resilience [aOR 1.05 (95% CI 1.01–1.08)] was the only psychosocial factor significantly associated with ART exposure. For each unit increase in resilience, the odds of ART exposure increased by 5%. A surprising result is that experiencing internalised stigma did not result in not being on ART.

HIV Care

Main facilitators to clinic access were living close to a clinic (37.3%) and having transportation (28.3%; Fig. 1). Main barriers included long waiting queues (16.0%), long distance to travel (13.0%), and transportation problems (12.9%; Fig. 2).

Discussion

This is the first quantitative study to extensively investigate the relationship between multiple psychosocial factors with knowledge of HIV-positive status and ART exposure among AGYW living with HIV. Our study contributes to an understanding of ART exposure in AGYW living with HIV within the context of co-occurring syndemics with a specific focus on psychosocial variables. Our results show that interventions maximising psychosocial resources, such as, social support and resilience may enhance ART-based strategies among AGYW living with HIV.

Our data are in line with previous research, showing the relevance of syndemic factors, that is, environmental (social support) and internal (resilience) factors to promote biological outcomes (ART exposure) [44]. The results show that social support from a family member or a special person increased likelihood of knowledge of HIV-positive status among AGYW living with HIV. Our findings also show that psychological resilience substantially increased

the likelihood of ART exposure among AGYW living with HIV. Our results indicate the role of resilience in improving ART exposure for South African AGYW living with HIV. Taken together, these findings suggest that psychosocial factors can contribute to achieving the UNAIDS HIV targets in low-income and middle-income settings. These data contribute to a growing evidence of work about HIV treatment and ART outcomes among adolescents in general and specifically for AGYW.

Our findings support previous studies that found that social support networks were positively correlated with knowledge of HIV-positive status [13, 45]. These results indicate the subtle yet important need for AGYW living with HIV to have supportive relationships with family members and friends. Having strong social support networks likely decrease internalised stigma. Another important component in reaching the UNAIDS targets is ensuring that the population of adolescent girls and young women with HIV infection have awareness of their HIV-positive status. Our results show higher knowledge of HIV-positive status among AGYW than studies conducted in sub-Saharan Africa that included both young men and women [46].

Our study is one of a few to investigate five psychosocial factors. Previous studies including psychosocial factors indicate adverse outcomes with ART adherence in young people. In a 2019 study analysing the psychosocial predictors of quality of life in South African adolescents receiving ART [47], insomnia, anxiety, and depression were significant predictors of poor quality of life; other studies showed that these indicators were associated with decreased ART adherence [48]. Our study did not specifically measure anxiety and depression but overall psychological wellness. Furthermore, we found that internalised stigma was not significantly associated with knowledge of HIV-positive status or ART exposure, contradicting findings from other studies [49]. A study of women living with HIV in Indonesia found that those with high levels of internalised stigma were 2.27 times less likely to adhere to HIV treatment than those with low levels of internalised stigma. In a meta-analysis of 33 cross-sectional studies, 71% reported a correlation between internalised stigma and ART non-adherence.

Many variables with significant bivariate associations for knowledge of HIV-positive status and ART exposure were not significant in the multivariable models. However, assessing school-going AGYW living with HIV for food security and adverse sexual and reproductive health outcomes could help identify those who are particularly vulnerable and who may experience barriers to ART. These assessments could be prioritised in tailored psychosocial counseling and integrated into HIV care for AGYW living with HIV. Barriers to HIV care could be resolved through private pharmacy innovations, including, home deliveries, automated teller machine medication dispensers, medications prepared in advance, and automation of the process of collating patient medications [50–52].

Further research, incorporating quantitative and qualitative methods, is necessary to elucidate the mechanisms that increase resilience in AGYW living with HIV. Our results suggest the importance of caregiver-child interventions because adolescent girls likely rely on caregivers for support. An initial solution is to integrate tailored psychosocial counselling into HIV care services for adolescent girls and young women living with HIV.

Our study has several limitations. The data are cross-sectional, and temporal associations cannot be made. However, a strength of our study, is that we assessed multiple psychosocial factors, consisting of five psychosocial factors. Furthermore, we used a validated measure of resilience. Last, we were unable to stratify the analyses with knowledge of HIV-positive status further by recent HIV infection (e.g. in Table 3), because there were too few recent infections (n = 26) in this dataset. For the analyses that had ART exposure status as the outcome, we accommodated for this by restricting the analysis to only those with knowledge their HIV-positive status (n = 356).

Conclusions

Interventions maximizing social support and resilience may increase knowledge of HIV-positive status and ART exposure among young South African AGYW living with HIV.

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Data Availability

Data will be made available on request to Professor Catherine Mathews through email communication sent to catherine. mathews@mrc.ac.za.

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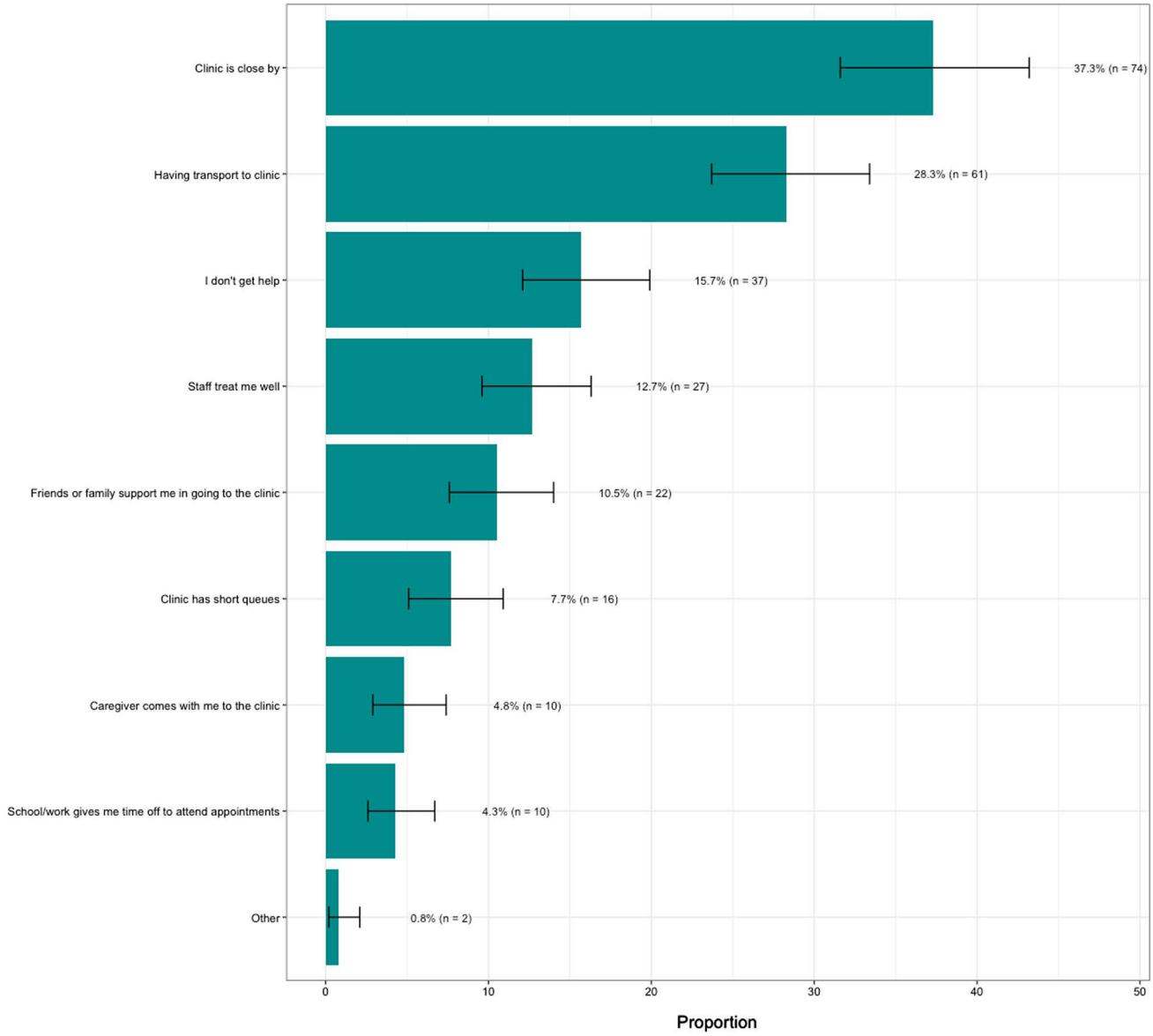

Fig. 1.

Facilitators (reasons that make it easier) for going to the clinic for HIV care in the HERStory study conducted in South Africa (2017–2018). This study included HIV-positive adolescent girls and young women (AGYW) who knew they were HIV-positive and who were receiving antiretroviral therapy (ART; n = 299). We excluded 85 AGYW because they had missing information for these variables (n = 214). AGYW could select multiple options

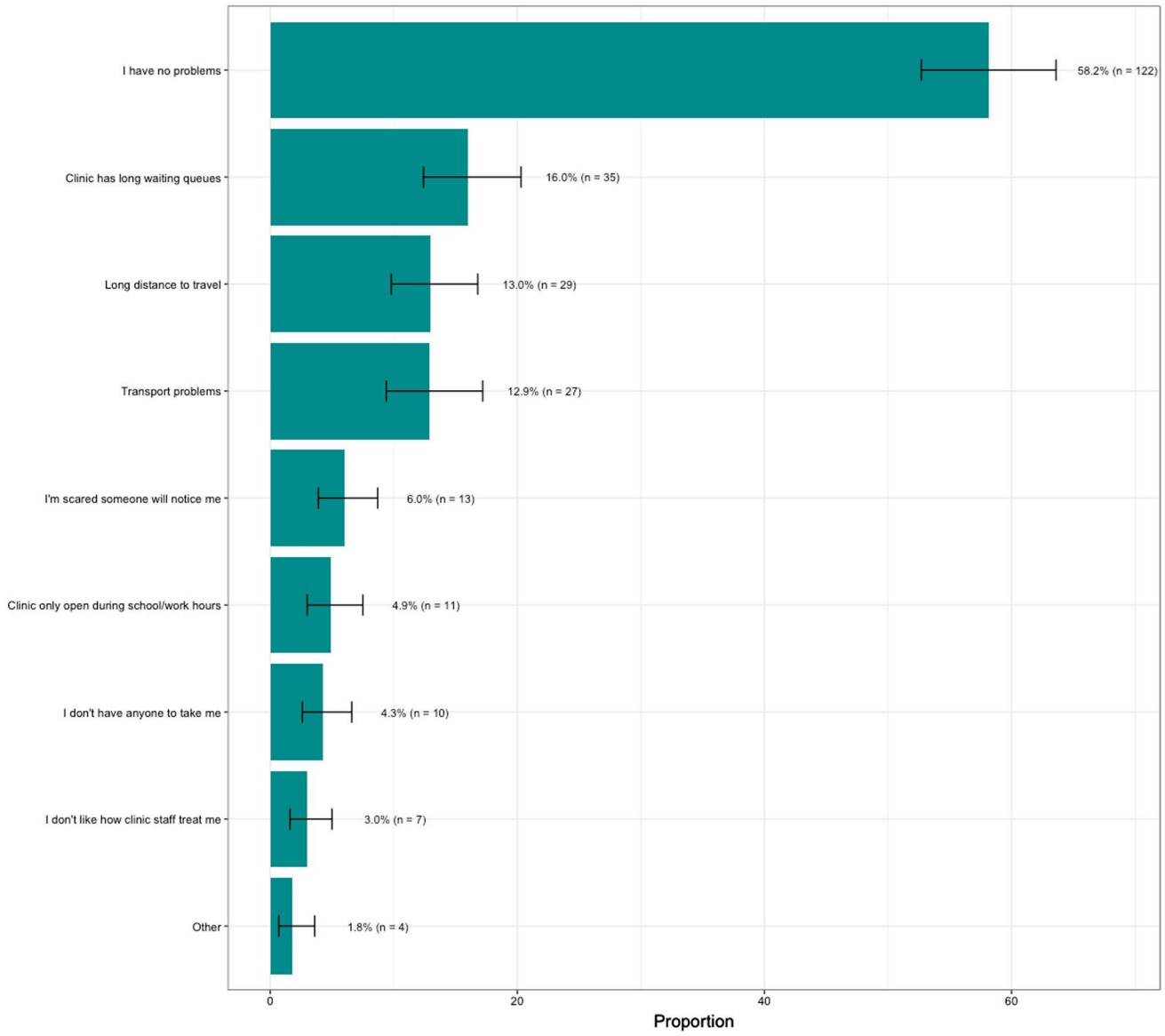

Fig. 2.

Barriers (reasons that make it difficult) for going to the clinic for HIV care in the HERStory study conducted in South Africa (2017–2018). This study included HIV-positive adolescent girls and young women (AGYW) who knew they were HIV-positive and who were receiving antiretroviral therapy (ART; n = 299). We excluded 85 AGYW because they had missing information for these variables (n = 214). AGYW could select multiple options

Table 1

Additional exposure variables included in the survey implemented in adolescent girls and young women (AGYW) living with HIV (n = 568) from the HERStory study in South Africa (2017–2018)

Categories	Variables
Socio-demographics	Age, highest grade achieved, and time lived in community
Health and wellbeing	Been to a hospital/clinic in the past year for a health problem, in the past month participant/household member went a day and night without eating, and ever pregnant
Experience of intimate partner violence	10 items from an adapted World Health Organization questionnaire evaluating past year intimate partner violence[33]
Experience of forced sex/rape	By partners or non-partners over lifetime
Sexual and reproductive health behaviors	Current relationship status, had a sexual partner aged ≥ 5 years than the participant in the past year, accessed male condoms in the past year
Clinic access	Missed clinic appointments in the past year, facilitators/factors that make going to the clinic easier, and barriers/problems in going to the clinic for HIV care. Participants could select multiple options

Table 2

Participant characteristics for adolescent girls and young women (AGYW) living with HIV (n = 568) from the HERStory study in South Africa (2017–2018)

Variable	n (%)	95% CI
Socio-demographic factors		
Age (years)		
15–19	185 (30.9)	27.9–34.1
20–24	383 (69.1)	65.9–72.1
Highest school grade passed		
None or primary	35 (5.7)	4.4–7.3
Secondary	501 (88.5)	86.4–90.4
Some post-secondary	32 (5.7)	4.3–7.5
Both parents lived at home[†]		
No	453 (81.7)	78.8–84.3
Yes	105 (18.3)	15.7–21.2
Time lived in their community		
Always	387 (69.3)	66.1–72.3
> 5 years	87 (14.3)	12.2–16.7
1–5 years	94 (16.4)	13.9–19.2
Health and wellbeing factors		
Been to a hospital/clinic in past year for health problem		
No	303 (53.6)	50.2–57.0
Yes	265 (46.4)	43.0–49.8
In past month, participant or household member went a day and night without eating because of lack of food		
No	446 (79.3)	76.5–82.0
Yes	122 (20.7)	18.0–23.5
Ever pregnant[†]		
No	163 (32.8)	29.6–36.2
Yes	330 (67.2)	63.8–70.4
Experienced any form of IPV		

Variable	n (%)	95% CI
No	395 (70.0)	66.9–72.9
Yes	173 (30.0)	27.1–33.1
Ever forced to have sex or raped		
No	501 (88.1)	85.9–90.0
Yes	67 (11.9)	10.0–14.1
Psycho-social factors		
Wellbeing score		
Med and IQR	47 (42–50)	46–47
Resilience score		
Med and IQR	24 (20–29)	24–25
Social support: family		
Med and IQR	5.5 (4.5–6)	5.2–5.8
Social support: peers		
Med and IQR	5 (3.3–5.8)	4.8–5
Social support: special person		
Med and IQR	5.8 (4.5–6)	5.5–5.8
Gender equity score		
Med and IQR	54 (49–58)	53–55
HIV stigma score		
Med and IQR	0 (0–2)	0–0
Sexual and reproductive health behaviours		
Relationship status[†]		
Single	156 (30.0)	26.4–33.7
Dating	405 (69.5)	65.7–73.1
Married	3 (0.5)	0.2–1.2
Boyfriend or partner in the past year[†]		
No	140 (24.8)	21.7–28.0
Yes	422 (75.2)	72.0–78.3
Ever had sex		
No	69 (11.3)	9.3–13.6

Variable	n (%)	95% CI
Yes	499 (88.7)	86.4–90.7
Ever had transactional sex		
No	478 (84.7)	82.3–86.9
Yes	90 (15.3)	13.1–17.7
In the past year had a sexual partner 5 or more years older[†]		
No	297 (59.9)	56.2–63.4
Yes	202 (40.1)	36.6–43.8
Accessed male condoms in the past year		
No	180 (30.3)	27.1–33.7
Yes	388 (69.7)	66.3–72.9
Accessed contraception in the past year		
No	256 (46.0)	42.4–49.7
Yes	312 (54.0)	50.3–57.6

CI confidence interval; *IPV* interpersonal violence; *IQR* interquartile range; *Med* median

[†]Observations were excluded because of skip patterns, missingness, or the participant preferred not to say

Table 3

Factors related to whether HIV-positive adolescent girls or young women (AGYW) who participated in the HERStory Study (2017–2108) in South Africa had knowledge of their HIV-positive status

Variable	HIV knowledge status				
	HIV+ status known (n = 358)		HIV+ status unknown (n = 210)		p-value
	n (%)	95% CI	n (%)	95% CI	
Socio-demographic factors					
Age (years)					
15–19	108 (29.2)	25.5–33.2	77 (33.6)	28.5–39.0	0.1742
20–24	250 (70.8)	66.8–74.5	133 (66.4)	61.0–71.5	
Highest school grade passed					
None or primary	29 (7.7)	5.8–9.9	6 (2.7)	1.3–4.8	**0.0004**
Secondary	308 (86.3)	83.4–88.8	193 (92.0)	88.7–94.6	
Some post-secondary	21 (6.1)	4.2–8.4	11 (5.3)	3.1–8.2	
Both parents lived at home[†]					
No	289 (81.4)	77.4–85.0	164 (82.0)	77.7–85.8	0.8387
Yes	62 (18.3)	14.7–22.2	43 (17.8)	14.1–22.0	
Time lived in their community					
Always	236 (66.2)	62.2–70.1	151 (73.9)	68.9–78.5	**0.0051**
More than 5 years	64 (17.3)	14.2–20.7	23 (9.8)	7.1–13.1	
1–5 years	58 (16.5)	13.5–19.8	36 (16.2)	12.5–20.6	
Health and wellbeing factors					
Been to a hospital/clinic in past year for a health problem					
No	180 (49.9)	46.5–53.3	123 (59.3)	52.9–65.4	**0.0077**
Yes	178 (50.1)	46.7–53.5	87 (40.7)	34.6–47.1	
In past month, participant or household member went a day and night without eating because of lack of food					
No	272 (76.7)	73.0–80.2	174 (83.3)	79.1–87.0	**0.0146**
Yes	86 (23.3)	19.8–27.0	36 (16.7)	13.0–20.9	
Ever pregnant[†]					
No	89 (29.7)	25.9–33.6	74 (37.7)	31.4–44.4	**0.0343**

Variable	HIV knowledge status				
	HIV+ status known (n = 358)		HIV+ status unknown (n = 210)		p-value
	n (%)	95% CI	n (%)	95% CI	
Yes	221 (70.3)	66.4–74.1	109 (62.3)	55.6–68.6	
Experienced any form of IPV					
No	253 (70.3)	66.4–74.1	142 (69.4)	63.6–74.8	0.8014
Yes	105 (29.7)	25.9–33.6	68 (30.6)	25.2–36.4	
Ever forced to have sex or raped					
No	310 (86.2)	83.3–88.7	191 (91.1)	87.4–93.9	**0.0253**
Yes	48 (13.8)	11.3–16.7	19 (8.9)	6.1–12.6	
Psycho-social factors					
Wellbeing score					
Med and IQR	46 (42–50)	45–47	47 (42–50)	45–48	0.9544
Resilience score					
Med and IQR	25 (20–29)	24–25	24 (20–29)	22–25	0.4798
Social support: family					
Med and IQR	5.8 (4.5–6)	5.5–5.8	5.2 (4.2–6)	5–5.5	**0.0009**
Social support: peers					
Med and IQR	4.8 (3.1–5.8)	4.5–5	5 (3.8–5.8)	4.8–5	**0.0280**
Social support: special person					
Med and IQR	5.8 (4.8–6.2)	5.8–6	5.5 (4.2–6)	5.2–5.6	**0.0057**
Gender equity score					
Med and IQR	54 (49–58)	53–54	55 (50–58)	54–56	**0.0247**
Sexual and reproductive health behaviours					
Relationship status [†]					
Single	97 (29.2)	25.3–33.3	59 (31.1)	24.3–38.6	0.7417
Dating	258 (70.2)	66.0–74.1	147 (68.5)	61.0–75.3	
Married	2 (0.6)	0.2–1.7	1 (0.4)	0.0–1.3	
Boyfriend or partner in the past year [†]					
No	95 (27.4)	23.5–31.7	45 (20.6)	16.3–25.3	**0.0189**
Yes	260 (72.6)	68.3–76.5	162 (79.4)	74.7–83.7	

Variable	HIV knowledge status				
	HIV+ status known (n = 358)		HIV+ status unknown (n = 210)		p-value
	n (%)	95% CI	n (%)	95% CI	
Ever had sex					
No	43 (11.5)	8.9–14.5	26 (11.0)	8.2–14.4	0.8064
Yes	315 (88.5)	85.5–91.1	184 (89.0)	85.6–91.8	
Ever had transactional sex					
No	299 (84.0)	81.2–86.6	179 (85.7)	81.6–89.2	0.4579
Yes	59 (16.0)	13.4–18.8	31 (14.3)	10.8–18.4	
In the past year had a sexual partner ≥ 5 than participant†					
No	182 (58.2)	53.7–62.5	115 (62.5)	55.6–69.0	0.3029
Yes	133 (41.8)	37.5–46.3	69 (37.5)	31.0–44.4	
Accessed male condoms in the past year					
No	109 (29.2)	25.7–32.9	71 (32.1)	26.6–38.0	0.3564
Yes	249 (70.8)	67.1–74.3	139 (67.9)	62.0–73.4	
Accessed contraception in the past year					
No	158 (43.3)	39.3–47.3	98 (50.3)	43.9–56.7	0.0637
Yes	200 (56.7)	52.7–60.7	112 (49.7)	43.3–56.1	

The CIs in boldface typing indicate statistical significance. Significance at 0.05

CI confidence interval; *IPV* interpersonal violence, *IQR* interquartile range; *Med* median

†Observations were excluded because of skip patterns, missingness, or the participant preferred not to say

Table 4

Factors related to whether adolescent girls and young women (AGYW) knew their HIV-positive status (n = 356[*]) or were receiving antiretroviral therapy (ART) in the HERStory study in South Africa (2017–2018)

Variable	ART status						
	Overall		Not on ART n = 57		On ART n = 299		p-value
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI	
Socio-demographic factors							
Age (years)							
15–19	107 (29.1)	25.3, 33.1	19 (32.8)	23.7, 43.1	88 (28.4)	24.2–32.8	0.3873
20–24	249 (70.9)	66.9, 74.7	38 (67.2)	56.9, 76.3	211 (71.6)	67.2–75.8	
Highest school grade passed							
None or primary	29 (7.7)	5.8, 10.0	6 (10.5)	5.2, 18.3	23 (7.2)	5.3–9.5	0.2287
Secondary	306 (86.2)	83.4, 88.7	49 (86.1)	77.6, 92.2	257 (86.2)	83.1–88.9	
Some post-secondary	21(6.1)	4.2, 8.4	2 (3.5)	0.9, 9.1	19 (6.6)	4.5–9.3	
Both parents lived at home[†]							
No	287 (81.3)	77.3, 84.9	44 (80.2)	71.0, 87.5	243 (81.6)	77.0–85.6	0.7582
Yes	62 (18.7)	15.1, 22.7	11 (19.8)	12.5–29.0	51 (18.4)	14.4–23.0	
Time lived in their community							
Always	235 (66.3)	62.3, 70.2	35 (60.6)	50.3, 70.2	200 (67.5)	63.2–71.6	**0.0043**
> 5 years	63 (17.1)	14.1, 20.5	6 (10.8)	5.4, 18.7	57 (18.4)	15.1–22.0	
1–5 years	58 (16.6)	13.6, 19.9	16 (28.6)	19.9, 38.6	42 (14.1)	11.3–17.5	
Health and wellbeing factors							
Been to a hospital/clinic in past year for a health problem							
No	180 (50.2)	46.8, 53.6	26 (47.0)	37.0, 57.1	154 (50.8)	47.1–54.6	0.4783
Yes	176 (49.8)	46.4, 53.2	31 (53.0)	42.9, 63.0	145 (49.2)	45.4–52.9	
In past month, participant/household member went a day and night without eating							
No	271 (76.9)	73.1, 80.3	49 (84.6)	74.6, 91.8	222 (75.3)	71.2–79.1	**0.0428**
Yes	85 (23.1)	19.7, 26.9	8 (15.4)	8.2, 25.4	77 (24.7)	20.9–28.8	
Ever pregnant[†]							
No	88 (29.6)	25.8, 33.5	15 (32.6)	22.1, 44.5	73 (28.9)	24.7–33.4	0.5477

Variable	ART status						
	Overall		Not on ART n = 57		On ART n = 299		p-value
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI	
Yes	220 (70.4)	66.5, 74.1	36 (67.4)	55.5, 77.9	184 (71.1)	66.6–75.3	
Experienced any form of IPV							
No	252 (70.4)	66.5, 74.1	42 (71.3)	60.9, 80.2	210 (70.2)	66.0–74.2	0.8343
Yes	104 (29.6)	25.9, 33.5	15 (28.7)	19.8, 39.1	89 (29.8)	25.8–34.0	
Ever forced to have sex or raped							
No	308 (86.1)	83.2, 88.7	44 (76.5)	66.4, 84.9	264 (88.1)	85.0–90.7	**0.0171**
Yes	48 (13.9)	11.3, 16.8	13 (23.5)	15.1, 33.6	35 (11.9)	9.3–15.0	
Psycho-social factors							
Wellbeing score							
Med and IQR	46 (42–50)	45, 47	46 (40.2, 49)	44, 48	46 (42, 50)	45–47	0.4151
Resilience score							
Med and IQR	25 (20–29)	24, 25	23 (16.3, 26)	21.1, 25	25 (20, 30)	24–26	0.0101
Social support: family							
Med and IQR	5.8 (4.5–6)	5.5, 5.8	5.4 (4.3, 6)	5, 5.8	5.8 (4.5, 6)	5.5–5.8	0.2756
Social support: peers							
Med and IQR	4.8 (3.2, 5.8)	4.5, 5	4.5 (3, 5.8)	4, 5	4.8 (3.2, 5.8)	4.5–5	0.9024
Social support: special person							
Med and IQR	5.8 (4.8, 6.2)	5.8, 6	5.7 (4.5, 6.2)	5.3, 6	5.8 (4.8, 6.2)	5.8–6	0.6685
Gender equity score							
Med and IQR	54 (49, 58)	53, 54	54 (I48, 57.1)	52, 54.3	54 (49, 58)	53–54	0.5641
HIV stigma score							
Med and IQR	2 (0, 3)	1, 2	2 (0.3, 3.7)	1, 2	1.7 (0, 3)	1–2	0.1158
Sexual and reproductive health behaviours							
Relationship status[†]							
Single	96 (29.1)	25.2, 33.3	13 (24.4)	15.9, 34.9	83 (30.0)	25.7–34.7	0.1003
Dating	257 (70.3)	66.0, 74.3	44 (75.5)	65.1, 84.1	213 (69.2)	64.5–73.6	
Married	2 (0.6)	0.2, 1.7			2 (0.8)	0.2–2.0	
Boyfriend/partner in the past year[†]							

Variable	ART status						
	Overall		Not on ART n = 57		On ART n = 299		p-value
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI	
No	95 (27.6)	23.6, 31.8	14 (24.3)	16.0, 34.2	81 (28.1)	23.9–32.9	0.4062
Yes	258 (72.4)	68.2, 76.4	42 (75.7)	65.8, 84.0	216 (71.7)	67.1–76.1	
Ever had sex							
No	43 (11.6)	9.0, 14.6	6 (11.3)	5.1, 20.7	37 (11.6)	8.9–14.8	0.9329
Yes	313 (88.4)	85.4, 91.0	51 (88.7)	79.3, 94.9	262 (88.4)	85.2–91.1	
Ever had transactional sex							
No	297 (84.0)	81.1, 86.6	44 (77.9)	68.1, 85.8	253 (85.2)	82.1–88.0	0.1159
Yes	59 (16.0)	13.4, 18.9	13 (22.1)	14.2, 31.9	46 (14.8)	12.0–17.9	
In the past year had a sexual partner 5 or more years older[†]							
No	181 (58.2)	53.7, 62.6	32 (62.4)	51.7, 72.2	149 (57.3)	52.1–62.4	0.3929
Yes	132 (41.8)	37.4, 46.3	19 (37.6)	27.8, 48.3	113 (42.7)	37.6–47.9	
Accessed male condoms in the past year							
No	109 (29.3)	25.8, 33.1	12 (20.2)	12.4, 30.1	97 (31.2)	27.2–35.4	**0.0266**
Yes	247 (70.7)	66.9, 74.2	45 (79.8)	69.9, 87.6	202 (68.8)	64.6–72.8	
Accessed contraception in the past year							
No	158 (43.5)	39.5, 47.5	27 (42.7)	32.1, 53.8	131 (43.7)	39.5–47.9	0.8591
Yes	198 (56.5)	52.5, 60.5	30 (57.3)	46.2, 67.9	168 (56.3)	52.1–60.5	

The CIs in boldface typing indicate statistical significance. Significance at 0.05

CI confidence interval; *IPV* interpersonal violence, *IQR* interquartile range; *Med* median; *ART* antiretroviral therapy

[*] Among 358 (60.8%) participants who had knowledge of their HIV-positive status, two had missing ART status information and were removed from the analysis

[†] Observations were excluded because of skip patterns, missingness, or the participant preferred not to say

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Table 5

Association between psychosocial constructs and knowledge of HIV-positive status (n = 568) and receiving ART among HIV-positive adolescent girls and young women (AGYW) who knew their HIV-positive status (n = 356) in the HERStory study conducted in South Africa (2017–2018)

Psycho-social constructs	Knowledge of HIV status		On ART	
	aOR	95% CI	aOR	95% CI
Wellbeing	1.00	0.98–1.03	1.01	0.98–1.04
Resilience	1.01	0.99–1.03	1.05	**1.01–1.08**
Support from family	1.14	**1.04–1.24**	1.02	0.87–1.19
Support from peers	0.90	0.83–0.97	0.95	0.83–1.09
Support from special person	1.12	**1.02–1.23**	0.93	0.78–1.11
Gender equity norms	0.98	0.95–1.00	1.01	0.97–1.05
HIV-related stigma	–	–	0.92	0.83–1.03

The CIs in boldface typing indicate statistical significance

aOR adjusted odds ratio; *CI* confidence interval