



The Development and Psychometric Evaluation of the HIV Stigmatizing Attitudes Scale (HSAS) in Tanzania

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Abstract

HIV stigmatizing attitudes are embedded in social context, making it important to develop culturally specific tools for accurate measurement. The goal of this study was to develop and evaluate the psychometric properties of the HIV Stigmatizing Attitudes Scale (HSAS) in Moshi, Tanzania. Items were adapted based on a scale developed by Visser et al. which was one of the first to measure HIV stigmatizing attitudes in the general population (i.e., people not living with HIV). Items were translated into Swahili and modified with iterative feedback. The HSAS was administered to participants ($N = 1494$) in an HIV stigma reduction intervention study at two antenatal care clinics in Moshi, Tanzania. The HSAS was found to have strong domain coherence and high reliability based on Cronbach's alpha, Omega 6 coefficient values, and the composite reliability coefficient, and high validity based on content-oriented evidence, relations to other variables, and response process. Factor analysis revealed a two-factor structure (Moral Judgment and Interpersonal Distancing), consistent with the original Visser scale. The HSAS provides a robust way to measure HIV stigma in the Tanzanian context and can be culturally adapted to other settings.

Keywords Tanzania · HIV · Stigma · Psychometric evidence · Measurement

Introduction

HIV stigma has been shown to impede all steps in the HIV care continuum. From HIV testing and initial linkage to care, through to long-term retention and viral suppression, the impact of stigma on care engagement is well documented [1–4]. Even though HIV treatment can allow individuals living with HIV to live a full and productive life [5], making HIV a chronic disease like many others, community-level stigma toward individuals living with HIV persists. The stigmatizing attitudes held by the general population drive stigma experienced by people living with HIV (PLWH),

which deters the realization of ambitious targets to end the HIV epidemic. Stigmatizing attitudes held by the general population are driven by a variety of beliefs held by individuals, including fear and prejudicial attitudes [6]. Misconceptions about HIV transmission, as well as stereotypes of certain groups associated with HIV, fuel HIV stigmatizing attitudes. Blame and judgment also drive stigmatizing attitudes, including the belief that HIV is a punishment for immoral behavior. Furthermore, social and gender norms, which are contextually specific, contribute to perpetuating HIV stigmatizing attitudes [6]. Reducing HIV stigmatizing attitudes in the general population is a crucial component of a robust response to HIV prevention and treatment [7]. However, there is a dearth of tools for measuring HIV stigmatizing attitudes, which has been cited as a leading challenge in fighting the epidemic [8, 9].

In developing valid measurements of HIV stigmatizing attitudes, it is important to adapt and refine scales to a variety of geographical regions, because studies show that the nature of HIV stigmatizing attitudes (its drivers, facilitators, and manifestations) varies by culture and region [10, 11]. Therefore, items designed to measure HIV stigma must be translated, modified, and validated for specific cultural

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contexts [11–14]. Qualitative research conducted in East Africa has shown that HIV stigmatizing attitudes are primarily driven by a fear of infection through casual social contact, associations of HIV with physical weakness that therefore affects economic productivity, and the association of HIV with sexual promiscuity by the general population [15]. Stigmatizing attitudes manifest in behaviors such as gossip, physical and social isolation, and termination of intimate partner relationships [15]. These manifestations of stigmatizing attitudes are especially detrimental because they strip away the networks of social support that people need to facilitate HIV testing, linkage to HIV care, and long-term retention in care to support viral suppression [1, 16].

While much observational research has been conducted to characterize HIV stigma in East Africa, few quantitative measures exist to measure stigmatizing attitudes as a multidimensional construct. Furthermore, while much research has been conducted to understand perceptions of HIV stigmatizing attitudes from the point of view of people living with HIV, limited psychometric evidence exists for scales measuring stigmatizing attitudes of those not living with HIV, pointing to a need for culturally specific tools that can quantify stigmatizing attitudes of the general population. Berger et al. developed one of the first scales to measure how people living with HIV perceived the community's stigmatizing attitudes [17]. This tool has been adapted to a variety of settings, including Sweden, India, Kenya, and the United States and Puerto Rico [18–20]. While valuable, the scale is limited to individuals living with HIV and does not measure the HIV stigmatizing attitudes of the general population. Some scales have been published to measure stigmatizing attitudes, but these have limitations.

One of the first scales to measure HIV stigmatizing attitudes in a general population was developed by Visser et al. for a South African context [21, 22]. This scale has benefits over briefer, unidimensional scales of stigmatizing attitudes [23], and scales that measure response-based dimensions (such as patient vs. community perspectives) [24] as opposed to content-based dimensions. The Visser scale was based on an attributed HIV stigma scale developed by Westbrook and Bauman that aimed to measure how people perceived the stigmatizing attitudes that others held. Through focus group discussions with health care workers and caregivers of young people living with HIV, Visser et al. transformed Westbrook and Bauman's 24-item attributed stigma scale into a 17-item scale, adapting items for local context, and changing the sentence structure of the items to measure people's own stigmatizing attitudes, rather than how they perceived the attitudes of others. The questionnaires were translated into Sepedi, Setswana and Isizulu, the most common languages spoken in the area. The internal consistency of the final 12-item scale was evaluated and was acceptable, with Cronbach's alpha ranging from 0.70 to 0.87. Analysis

of data collected in the area revealed a two-factor structure: blame and moral judgement (stigmatizing attitudes and dispositions driven by blame or judgment), and interpersonal distancing and social isolation (stigmatizing attitudes that also manifested as behavior). The scale was validated with other constructs, including a measure of knowing someone with HIV/AIDS and a measure of knowledge of HIV. However, no analysis was conducted to see how the scale performed among different demographic groups, which is key because literature shows that we can expect to see differences in stigmatizing attitudes, particularly among people of different education levels [25, 26].

While this scale was validated and culturally adapted by Visser et al. in South Africa, no such instrument exists for the region of East Africa, where stigma is a high barrier to care engagement [4, 9, 11, 25]. In Tanzania, stigmatizing attitudes manifest not only as beliefs and dispositions, but also translate into behavior, as literature has documented that social distancing and isolation are still common manifestations of HIV stigma [4, 9, 11, 15, 25]. A reliable and validated HIV Stigma Attitudes Scale in the Tanzania context and Swahili language can be used in the broader East African context to facilitate studies of HIV stigmatizing attitudes among the general population. In this paper, we aimed to assess the psychometric properties and evidence of reliability and validity of the first Swahili translation and Tanzanian adaptation of an HIV Stigmatizing Attitudes Scale (HSAS), which measures the stigmatizing attitudes held by the general population toward PLWH.

Methods

Development, Translation, and Adaptation of the HSAS Instrument

We developed the HIV Stigma Attitudes Scale (HSAS) for Tanzania in three phases: (1) addition of new items to the original Visser scale to address missing content areas based on our team's formative qualitative research [15, 27], and a USAID HIV Stigma in Tanzania field report [28]; (2) translation into Swahili and reordering of items for ease of answering; and (3) pilot testing of the scale with 88 individuals, a sample of men and women attending appointments for antenatal care (ANC) at one of the clinics where the study took place. The qualitative research involved in-depth interviews with 32 pregnant and postpartum women (20 living with HIV) and interviews and two focus group discussions with ANC clinic employees and community health workers. These interviews and focus group discussions sought insights into the drivers of HIV stigma in the community, and the manifestations of HIV stigmatizing attitudes [15, 27]. The data were thematically analyzed by a team of U.S.

and Tanzanian researchers, with a goal of identifying expressions of stigmatizing attitudes.

Development and translation were overseen by an expert panel of native and non-native skilled Swahili speakers with prior experience working with HIV stigma in Tanzania (two Tanzanian physicians and a nurse with research backgrounds, a research professor with twenty years of experience working with HIV in sub-Saharan Africa, and a Tanzanian statistician). The expert panel, familiar with the dimensions of HIV stigma in this population, reviewed the original Visser scale to suggest missing content areas and oversaw the translation and adaptation of items. In developing a Swahili version of the items, the teams used a cultural translation process, which prioritizes cultural relevance and nuance over literal translations [29]. The instrument was independently translated into Swahili by members of the expert panel and independently back translated, as recommended by the WHO [30]. The back-translations were compared, and the expert panel discussed until they reached consensus. The pilot test of the HSAS included cognitive interviewing to understand how individuals understood the items, and to identify items that were confusing or unclear. We opted to use a four-point Likert response instead of the dichotomous response option used in the Visser scale [21]. This decision was informed by psychometric theory, whereby more response options increase score variance and in turn improves score reliability [31]. The cognitive interviews confirmed that these response options were understood in the audio computer-assisted self-interview (ACASI format), and that participants used response options across the four-point scale.

Participants

The scale was administered to participants enrolled in a larger HIV stigma reduction intervention study in Moshi, Tanzania [32]. Individuals were eligible for the HIV stigma reduction intervention study if they were: a woman attending a first ANC visit or a man accompanying his partner to an ANC visit; at least 18 years of age; and able to consent to study participation. Only individuals who reported on the survey that they were HIV negative or did not know their HIV status were administered the HSAS and therefore included in the analysis. The final sample was 1494 participants.

Recruitment, Enrollment and Data Collection

Participants were enrolled by research staff at one of two study clinics (primary government health clinics in the Moshi municipality). The clinic nurses introduced the study to all women and their partners arriving for a first ANC visit

and referred them to the research office to learn about the study, and, if interested, consent to participate.

Once enrolled, participants completed a baseline survey via ACASI technology on tablets running Questionnaire Development System (QDS) software [32, 33]. The ACASI modality was selected for this study as it can ensure participant privacy and improve data validity by minimizing social desirability bias, particularly when collecting data related to sensitive information such as HIV stigma [34, 35]. As a quality check for the ACASI modality, items were placed throughout the survey instructing participants to choose a specific response.

Relevant for this analysis were the HSAS and a six-item measure, “Contact with People Living with HIV,” which asked about living in the same house as someone living with HIV, and having a family member, close friend, partner or spouse, or other acquaintance who was living with HIV. If a participant reported in the survey that they had been previously diagnosed with HIV, the HSAS measure was skipped, so as not to introduce undue distress.

Data Analysis

All analyses were conducted with IBM SPSS Statistical Analysis Software and R Language for Statistical Computing [36, 37]. Sociodemographic data were presented as frequencies. Descriptive statistics were presented for each item in the HSAS, including item means, standard deviations, and frequency of response option endorsement. In order to assess the psychometric properties of the scale, we evaluated evidence of reliability and validity [38, 39]. All coefficients were calculated using the lavaan [40] and psych [41] packages in R.

Results

Development, Translation, and Adaptation of Instrument

Table 1 summarizes the changes made and items added to the Visser scale that made up the piloted HSAS. The investigators and expert panel decided to add six items: three items from the USAID field test results of measuring HIV stigma in Tanzania [42], and three items from the team’s formative work on drivers and manifestations of HIV stigmatizing attitudes [15, 27]. In formative qualitative interviews, fear of infection from children living with HIV (or parents living with HIV) to one’s own children was consistently brought up as a driver of social isolation of children living with HIV. This concept was not reflected in the original Visser scale, so the investigators decided to add two items (HSAS16 and HSAS18) about this concept. Similarly, USAID items

Table 1 Summary of the final HIV stigmatizing attitudes scale (HSAS) with sources and modifications

	Final item in HSAS	Source	Latent construct	Modification
HSAS1	Getting HIV is a punishment for bad behavior	Visser	Blame/Judgment	
HSAS2	I would think less of someone if I found out the person has HIV	Visser	Blame/Judgment	Swahili revised to simplify phrase and omit the word “infection” (left just as “HIV”)
HSAS3	I would be upset if someone with HIV moved in next door to me	Visser	Interpersonal distancing	Modified from “I would not like someone with HIV to be living next door.”
HSAS4	I feel uncomfortable around someone with HIV	Visser	Interpersonal distancing	
HSAS5	People with HIV have only themselves to blame for getting HIV	Visser	Blame/Judgment	
HSAS6	People with HIV must have done something wrong to get it	Visser	Blame/Judgment	
HSAS7	People with HIV should feel ashamed about having HIV	Visser	Blame/Judgment	
HSAS8	I would be ashamed if someone in my family has HIV	Formative data		
HSAS9	If I was in public or private transport, I would not like to sit next to someone with HIV	Visser	Interpersonal distancing	
HSAS10	I would not like to be friends with someone with HIV	Visser	Interpersonal distancing	Swahili revised to clarify that “friend” did not have a sexual connotation
HSAS11	I would not employ someone with HIV	Visser	Interpersonal distancing	Swahili revised to use more common vernacular
HSAS12	I would not eat together with someone I knew had HIV	Visser	Interpersonal distancing	Modified from “I would not drink from the same tap as someone I knew had HIV” as drinking from tap was not considered common
HSAS13	If a relative of mine became ill with HIV, I would not want to care for that person in my home	USAID		Modified from “If a relative of mine became ill with HIV, I would be willing to care for him/her in my home.”
HSAS14	I would not want to buy food from someone I know has HIV	USAID		
HSAS15	If a teacher has HIV but is not sick, she should not be allowed to continue teaching in the school	USAID		
HSAS16	I would not want someone with HIV to look after my child	Formative data		
HSAS17	I do not want to get too close to someone with HIV because I am afraid I might get infected with HIV	Visser	Interpersonal distancing	Modified from “I am afraid to be around people with HIV.”
HSAS18	I would not want my child to play with a child who has HIV or whose parents have HIV	Formative data		

(HSAS13, HSAS14, HSAS15) were added because they reflected potential drivers of HIV stigma specific to field-work conducted in Tanzania that were not reflected in the original Visser scale.

Questions were reordered so that negatively phrased questions (i.e., questions that contained “not”) were grouped together for ease of answering the questions. The one reverse-scored item (HSAS13) was reworded so that it would be scored normally and could be answered more easily. The expert panel modified three scale items slightly

for cultural context (HSAS3, HSAS12, HSAS17). Based on the data collected on the items during the pilot study, slight modifications were made to the Swahili translation of three items (HSAS2, HS10, HSAS11). The English meanings of the items were not changed.

The final HSAS consisted of 18 items with a 4-point Likert scale response option (strongly disagree, disagree, agree, strongly agree). Items were summed to create an overall HIV stigmatizing attitudes score (0 points per item for non-stigmatizing attitudes, and 3 points per item

indicating high stigmatizing attitudes, for a possible range of 0 to 54).

Table 2 Sociodemographic profile of sample (N=1494)

	n	Percentage (%)
<i>Sex</i>		
Male	487	32.6
Female	1007	67.4
<i>Age</i>		
18–25 years	700	46.9
26–34 years	601	40.2
35 years and older	192	12.9
<i>Education</i>		
Primary or none	766	51.3
Secondary	624	41.8
High	104	6.7
<i>Relationship status</i>		
Married	918	61.4
Living together	251	16.8
Not living together	289	19.3
Divorced/Separated/Widowed	33	2.2
<i>Religion</i>		
Muslim	682	45.6
Christian	808	54.1

Sample Characteristics

The sample included 1007 pregnant women and 487 men. Table 2 describes the demographics of the sample. The average age of female participants was 25.6 years old (SD=5.47), and the average age of male participants was 30.2 years old (SD=7.11). About half the sample (51.3%) had no more than a primary school education. Over half the participants reported being married (61.4%), and nearly all said that they were in a relationship (97.8%).

HSAS Descriptive Statistics

The observed range of the HSAS was 0–54 (possible range of 0–54). Overall, the mean sum score was 13.79 (SD=11.74, median 12). The data were heavily right skewed, with item endorsements ranging from 69 to 84% in favor of the disagree/strongly disagree spectrum. Individual item means and standard deviations were calculated (Fig. 1). Ceiling effects (0.002734 ceiling percentage) and floor effects (0.1189 floor percentage) were less than 15% and therefore not considered significant. For comparison, the normal sample mean and variance were 13.785 and 137.728 respectively, and 12.566 and 186.652 adjusted for ceiling and floor effects.

Evidence of Reliability

Evidence of reliability was evaluated using item-scale correlations and internal consistency coefficients. Corrected item-scale correlations were calculated (item correlation with the

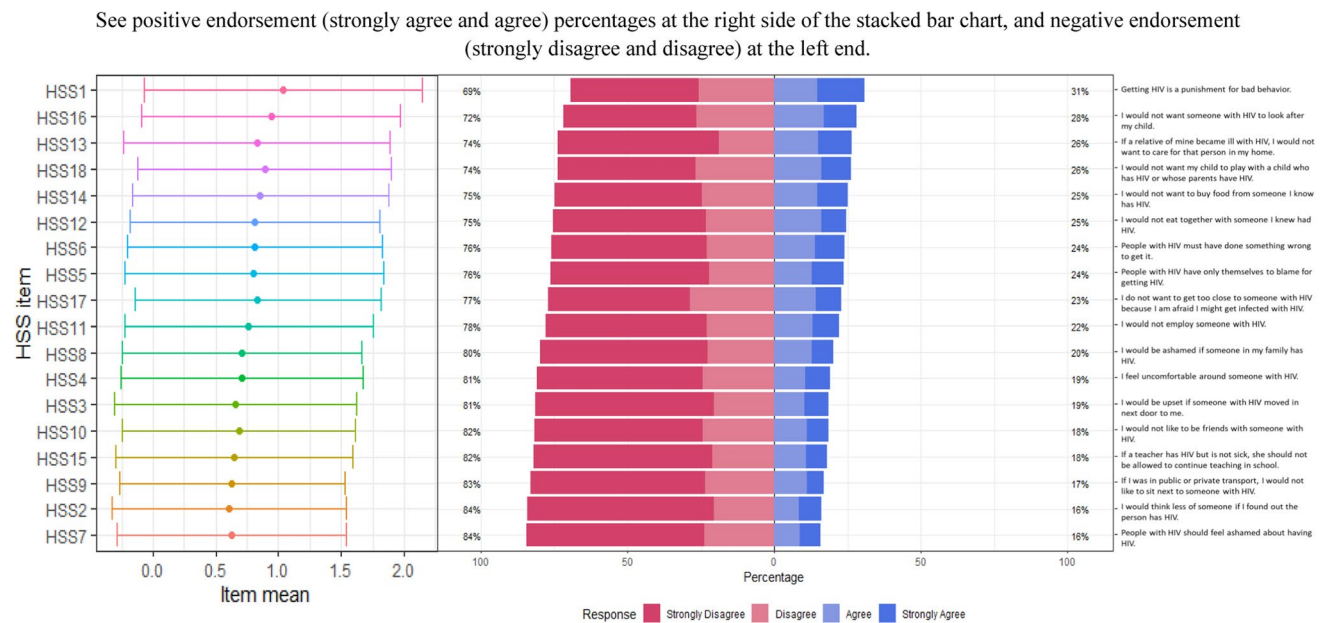


Fig. 1 Item endorsements, means, and variance for full sample. See positive endorsement (strongly agree and agree) percentages at the right side of the stacked bar chart, and negative endorsement (strongly disagree and disagree) at the left end

other items in the scale, not including the item itself) to identify any poor-performing items. Items were considered poor-performing if they showed a correlation of $r < 0.3$ [39], and such items were removed from the scale. In our analysis, all items performed with item-scale correlations of $r > 0.3$, and almost all (17 out of 18 items) performed with correlations of $r > 0.5$ (Supplementary Material, Table S1).

Internal consistency was evaluated with the Cronbach's Alpha coefficient for the unidimensional scale and the theorized dimensions (blame/judgment and interpersonal distancing/isolation from the Visser model). Coefficients above 0.7 are considered acceptable in the literature [39]. In addition, the Omega 6 coefficient and the Composite Reliability coefficient were calculated with the parameters obtained from confirmatory factor analysis (CFA) models; values above 0.7 considered acceptable [43, 44]. Measures of internal consistency were high, with Cronbach's alpha values, Omega 6 coefficient values, and composite reliability coefficient values all over 0.80 (Table 3). The Blame and Moral Judgment subscale had adequate internal consistency (Cronbach's alpha = 0.84), and the Interpersonal Distancing and Social Isolation subscale had high internal consistency (Cronbach's alpha = 0.92), comparable to that of the overall scale (Cronbach's alpha = 0.92).

Evidence of Validity

Evidence of validity was evaluated through content validity, validity of internal structure, and relationships with other variables. Internal structure was evaluated using confirmatory factor analysis (CFA). Relationships with other variables were evaluated by looking at the association of the HSAS score with the Contact with People Living with HIV scale and with participant education level.

Content-Oriented Evidence

In developing the scale, the expert panel reviewed the dimensions of HIV stigmatizing attitudes included in the original Visser scale and added items to the scale based on missing content specific to the relevant population. Items were added to reflect specific dimensions of HIV stigmatizing attitudes. The experts' opinions on theoretical domain

adherence were discussed collectively and documented. Swahili translations were completed individually and then discussed collectively until consensus was reached. Swahili adaptations recommended by the expert panel were also documented.

The expert panel discussed domain coherence of items added to the original scale. Items were pulled from a validated field-test conducted in Tanzania and formulated based on in-depth interviews conducted with the participants at the study site prior to the study's start. Therefore, items represented drivers and manifestations of HIV stigmatizing attitudes well-rooted in theoretical evidence. All native Swahili speakers who were part of the expert panel agreed that Swahili translations represented the stigma domains. Revisions after pilot testing ensured that items were clear and reflected the intended constructs. The modifications made to items based on recommendations from the expert panel are reported in Table 1.

Evidence Regarding Internal Structure

Exploratory factor analysis was conducted with oblique rotation (oblimin) to account for potential correlation among underlying factors. Scree plots (Supplementary Material Figure S1) and exploratory factor loadings (Table 4) were used to determine factor structure. Items that had a factor loading of > 0.5 were kept as part of the final factor for confirmatory factor analysis models [43, 45]. Items that loaded on multiple factors or had a low factor loading were not kept on any factor when building models for the confirmatory factor analysis. An analysis of eigenvalues and scree plots suggested a two-factor structure. Exploratory factor analysis with oblimin rotation accounting for correlation among two factors confirmed the two-factor structure. Apart from two items, all items had a factor loading of > 0.5 on one factor. Two items loaded on both factors and had factor loadings of < 0.5 on each factor (HSAS3 and HSAS4); these items were removed before creating the confirmatory factor analysis models.

Using EFA factor loadings, confirmatory factor analyses (CFA) models were built to evaluate the internal structure of the HSAS. CFA models were fit using the Weighted Least Square Means estimation method with Variance Adjusted (WLSMV) correction because of the ordinal structure of our scale responses. Model fit was tested through Chi-square (χ^2 and P-value), Root Mean Square Error of Approximation (RMSEA), Tucker-Lewis Index (TLI) and comparative fit index (CFI). Non-significant Chi-square p-values (> 0.05) indicated good model fit [46]. RMSEA values of 0 suggested perfect fit, < 0.06 suggested good fit, 0.06 to 0.07 suggested fair fit, and > 0.07 indicated inadequate fit [47, 48]. TLI and CFI values of > 0.95 were considered good fit and > 0.90 were considered acceptable fit [47]. The overall fit of the

Table 3 Measures of reliability

	Blame and judgment subscale	Interpersonal distancing subscale
Cronbach's alpha (95% CI)	0.84 (0.82, 0.85)	0.92 (0.92, 0.93)
Omega 6 coefficient	0.83	0.92
Composite reliability coefficient	0.84	0.92

Table 4 Exploratory factor analysis— factor loadings

Factor #	1 Factor	2 Factors		3 Factors			4 Factors			
	1	1	2	1	2	3	1	2	3	4
HSAS1	0.44	-.09	0.65	-0.09	0.60	0.09	-0.17	0.47	0.27	0.04
HSAS2	0.68	0.20	0.60	0.15	0.44	0.39	-0.05	0.15	0.74	0.03
HSAS3	0.70	0.39	0.40	0.33	0.22	0.45	0.12	-0.08	0.77	0.02
HSAS4	0.71	0.37	0.43	0.33	0.29	0.34	0.13	0.06	0.59	0.07
HSAS5	0.67	-0.04	0.88	-0.04	0.87	0.03	0.07	0.79	0.08	-0.04
HSAS6	0.63	-0.04	0.82	-0.03	0.90	-0.11	0.05	0.88	-0.10	0.03
HSAS7	0.70	0.02	0.84	0.03	0.83	0.03	0.09	0.74	0.10	-0.01
HSAS8	0.67	0.12	0.69	0.13	0.72	-0.05	-0.03	0.63	0.10	0.19
HSAS9	0.81	0.59	0.30	0.56	0.20	0.25	0.70	0.14	0.17	-0.09
HSAS10	0.80	0.68	0.19	0.65	0.13	0.16	0.79	0.13	0.00	-0.04
HSAS11	0.85	0.85	0.05	0.82	0.01	0.14	0.91	0.03	-0.03	0.01
HSAS12	0.83	0.88	-0.01	0.86	-0.04	0.11	0.70	-0.04	0.06	0.19
HSAS13	0.82	0.81	0.07	0.77	0.01	0.18	0.79	-0.01	0.08	0.04
HSAS14	0.80	0.89	-0.05	0.88	-0.03	-0.01	0.54	-0.01	0.01	0.37
HSAS15	0.78	0.76	0.06	0.74	0.04	0.10	0.58	0.02	0.08	0.18
HSAS16	0.67	0.81	-0.11	0.83	-0.03	-0.16	0.10	-0.03	0.06	0.70
HSAS17	0.75	0.78	0.01	0.82	0.12	-0.24	-0.03	0.13	0.02	0.85
HSAS18	0.73	0.87	-0.11	0.88	-0.03	-0.14	0.21	-0.03	0.05	0.65

factor structure obtained from exploratory factor analysis was assessed and was compared to the fit of a one factor solution. Measurement invariance was evaluated with chi-square difference tests, and evaluation of CFI and RMSEA model fit indices using a multi-group approach [49, 50]. Invariance was assessed for education and gender by comparing the free model (with factor weights and variances/covariances of free factors) with a constrained model in which the factor weights and variances/covariances of the two groups were fixed.

One, two, three, and four-factor structures were compared (Table 5). The RMSEA, CFI, and TLI values favor the 4-factor model. However, theoretical analysis and network analysis of the 4-factor model revealed that the 4 factors did not map onto any theoretical constructs, while the 2-factor model did. Furthermore, our scree plot showed evidence of 2 factors as opposed to 4 (Supplemental

Material, Figure S1). The two-factor structure showed significant improvement after removing the two cross-loading items. A model was built using only the original 12 Visser items that were included in the HSAS to evaluate if the original factor structure would hold, and to see how HSAS3 and HSAS4 would perform with the original factor structure. In this model, items 3 and 4 continued to cross-load on the two factors and perform poorly (data not pictured in table), confirming our exclusion of those items from our final model. In the final two-factor structure, the factors were consistent with the factors identified in the original Visser scale: “Blame and Moral Judgement” and “Interpersonal Distancing and Social Isolation.” In the final model, items 1, 2, 5, 6, 7, and 8 loaded on the Blame/Judgement factor. Items 9–18 loaded on the Interpersonal Distancing/Isolation factor. All items had factor loadings ranging from 0.487 to 0.815 (Table 6, Fig. 2).

Table 5 Confirmatory factor analysis (CFA) model fit indicators

	HSAS 1 factor model	HSAS 2 factor model	HSAS 4 factor model	Only Visser items (2 factor model)	Final HSAS 2 factor model ^a
χ^2 (Df) /p-value	4792.716 (135) / 0.000	946.092 (134) / 0.000	438.575 (113) / 0.000	473.605 (64) / 0.000	561.743 (103) / 0.000
RMSEA(95% CI)	0.152 (0.148, 0.156)	0.064 (0.060, 0.068)	0.044 (0.040, 0.048)	0.065 (0.060, 0.071)	0.055 (0.050, 0.059)
TLI	0.855	0.872	0.942	0.885	0.919
CFI	0.872	0.888	0.952	0.905	0.930

CFA confirmatory factor analysis, χ^2 chi-square, Df degree of freedom, RMSEA root mean square error of approximation, TLI Tucker-Lewis index, CFI comparative fit index

^aafter dropping HSAS3 and HSAS4

Table 6 Confirmatory factor analysis models – factor loadings

Factor #	1 Factor	2 Factor model		4 Factor model				Only visser items model		Final model	
	1	1	2	1	2	3	4	1	2	1	2
HSAS1	0.367	0.487		–	–	–	–	0.491		0.487	
HSAS2	0.563	0.701		0.676				0.680		0.679	
HSAS3	0.585		0.588	0.698					0.631	–	–
HSAS4	0.595		0.597	0.715					0.652	–	–
HSAS5	0.557	0.749			0.769			0.758		0.753	
HSAS6	0.514	0.694			0.716			0.699		0.705	
HSAS7	0.553	0.749			0.786			0.761		0.754	
HSAS8	0.544	0.714			0.747			–	–	0.718	
HSAS9	0.716		0.727			0.735			0.764		0.719
HSAS10	0.713		0.729			0.741			0.739		0.733
HSAS11	0.778		0.801			0.819			0.761		0.815
HSAS12	0.765		0.790			0.805			0.731		0.800
HSAS13	0.748		0.769			0.783		–	–		0.782
HSAS14	0.730		0.754			0.768		–	–		0.772
HSAS15	0.686		0.706			0.716		–	–		0.711
HSAS16	0.604		0.623				.717	–	–		0.636
HSAS17	0.679		0.698				.806		0.627		0.713
HSAS18	0.661		0.684				.794	–	–		0.700

Note that a cell filled with “–” indicates that the item was not part of the model

Measurement invariance analysis revealed that there was invariance for both sex and education, showing that the HSAS was equivalent among these groups (Table 7). The invariance was observed through ΔCFI, where a variation < 0.05 is expected for groups of unequal size and fewer than 300 subjects (as in the comparison between education levels) and a variation of < 0.010 is expected for groups of greater than 300 subjects, such as in the invariance by sex (50). Furthermore, there was an improvement in RMSEA, indicating invariance.

Evidence Based on Relations to Other Variables

Validity was assessed by comparing known groups whose HIV stigmatizing attitudes should theoretically differ based on other variables. Validity was first assessed by comparing those who did not know anyone living with HIV to those who did know someone living with HIV, using the “Contact with PLWH” scale to create the two sample groups. Previous literature has shown that people who know someone living with HIV tend to have less stigmatizing attitudes about PLWH [51, 52]. Validity was then assessed with participant education information, as having more education has been shown in the literature to correlate with less stigmatizing attitudes [25, 26]. Thus, the stigmatizing attitudes scores of those with no more than a primary-level education, a secondary-level education, and higher education were compared.

Validity assessed whether the HSAS could discern people who knew PLWH as having less stigmatizing attitudes than those who did not know PLWH (Fig. 3). Results showed that people who had some form of contact with people living with HIV had significantly lower HIV stigmatizing attitudes than those who did not have any contact with people living with HIV (Fig. 3A; mean score 16.31 versus 12.18, $t=6.56$, p -value < 0.001, 95% CI 2.90, 5.36). This held true for both subscales as well. Those who had some form of contact had significantly lower Blame/Judgement attitudes (Fig. 3B; mean score 5.69 versus 3.86, $t=7.62$, p -value < 0.001, 95% CI 1.36, 2.30) and significantly lower Interpersonal Distancing/Isolation attitudes (Fig. 3C; mean score 9.04 versus 7.10, $t=4.83$, p -value < 0.001, 95% CI 1.15, 2.72), compared to those who had no contact with people living with HIV.

Validity analysis also showed that the scale behaved as anticipated when comparing groups of no formal education, secondary education, and higher education (Fig. 4). Group comparisons showed significantly lower HIV stigmatizing attitudes for those with higher education than those with secondary education (Fig. 4A; mean score 7.42 versus 10.49, $t=3.55$, p -value < 0.001, 95% CI 1.36, 4.79), and significantly lower HIV stigmatizing attitudes for those with secondary education than those with no formal education (Fig. 4A; mean score 10.49 versus 17.30, $t=11.32$, p -value < 0.001, 95% CI 5.63, 7.98). This held true for both subscales as well (Fig. 4B, C).

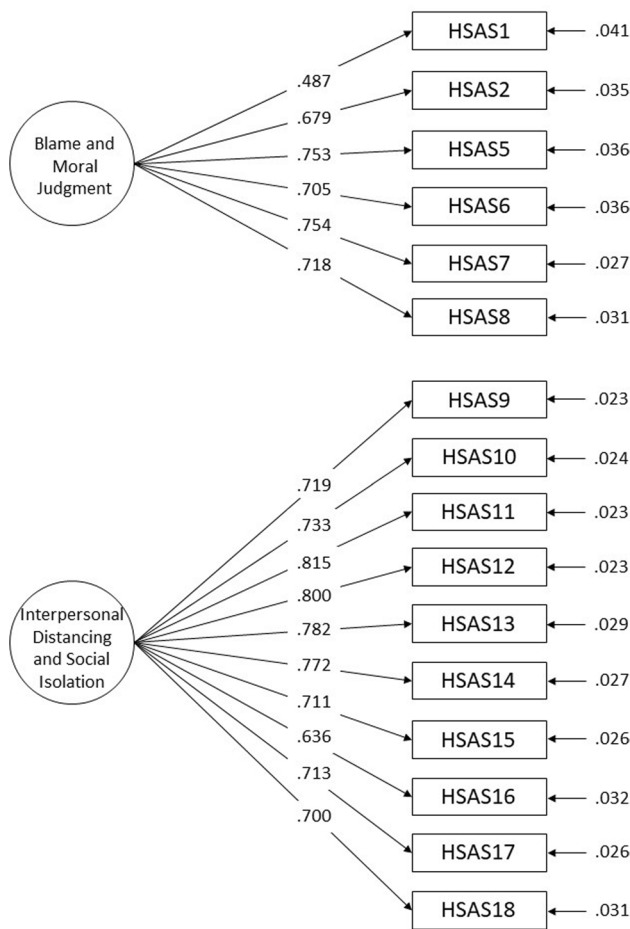


Fig. 2 SEM plot for final CFA model

Evidence of Validity Related to Response Process

All analyses were conducted both with the entire population, and with removal of participants who missed a certain threshold of quality check items. Results of both samples were compared. Out of the entire population, 89% of respondents (*n* = 1329) correctly answered two or more of the three quality check items. All metrics for validity and reliability were assessed once for the entire population, and then again with the 89% of participants who met the quality check threshold. None of these comparisons were

statistically different, indicating good response validity for this population. All values reported are with the full sample (1494).

Discussion

Nearly half a century after the inception of the epidemic, and over twenty years since the first highly active antiretroviral drugs for HIV were distributed, HIV stigma continues to persist as a barrier to HIV testing and treatment. HIV stigma has evolved and manifested uniquely in populations across the globe; because of stigma’s pervasive and culturally specific hold, it is critical that we have context-specific tools to examine the prevalence and distribution of HIV stigmatizing attitudes. Measurement of stigma presents a persistent challenge in the development of evidence-based interventions to reduce community-level stigma [8]. Accurate measurement of HIV stigmatizing attitudes can then help us to design and evaluate targeted interventions to reduce HIV stigmatizing attitudes, which in turn can improve outcomes across the HIV care continuum.

There have been very few scales developed to measure HIV stigmatizing attitudes in the general population, even though these attitudes are what engender manifestations of stigma that affect people living with HIV. Visser developed a scale to measure stigmatizing attitudes for a South African context [21]. In this study, we adapted the Visser scale to develop the HIV Stigmatizing Attitudes Scale (HSAS) for a Tanzania population and the Swahili language. Using robust psychometric analyses and data from a large population, we demonstrated that the scale showed strong markers of reliability and validity. The overall HSAS and the subscales had strong internal consistency, with high reliability coefficients and no items having poor item-scale correlations. Content validity, concurrent validity, and criterion-oriented validity were all strong; the scale was able to distinguish those who had prior contact with PLWH [51, 52], and those with higher levels of education [25, 26], which we expected based on prior literature.

Factor analysis of the HSAS in the Tanzanian context identified two factors, which were consistent with the original Visser scale. The first factor was identified as “blame

Table 7 Measurement invariance: confirmatory multigroup factor analysis

	Invariance	X ²	df	RMSEA (90% CI)	TLI	CFI	ΔCFI
By gender	Form	1582.203	206	0.095 (0.090, 0.099)	0.954	0.961	–
	Loadings	1413.950	220	0.085 (0.081, 0.090)	0.963	0.966	0.005
	Variance	1406.510	218	0.085 (0.08, 0.090)	0.962	0.966	0.000
By education	Form	1403.505	309	0.084 (0.080, 0.089)	0.962	0.967	–
	Loadings	1211.455	337	0.072 (0.068, 0.077)	0.972	0.974	0.007
	Variance	1202.250	333	0.072 (0.068, 0.077)	0.972	0.974	0.000

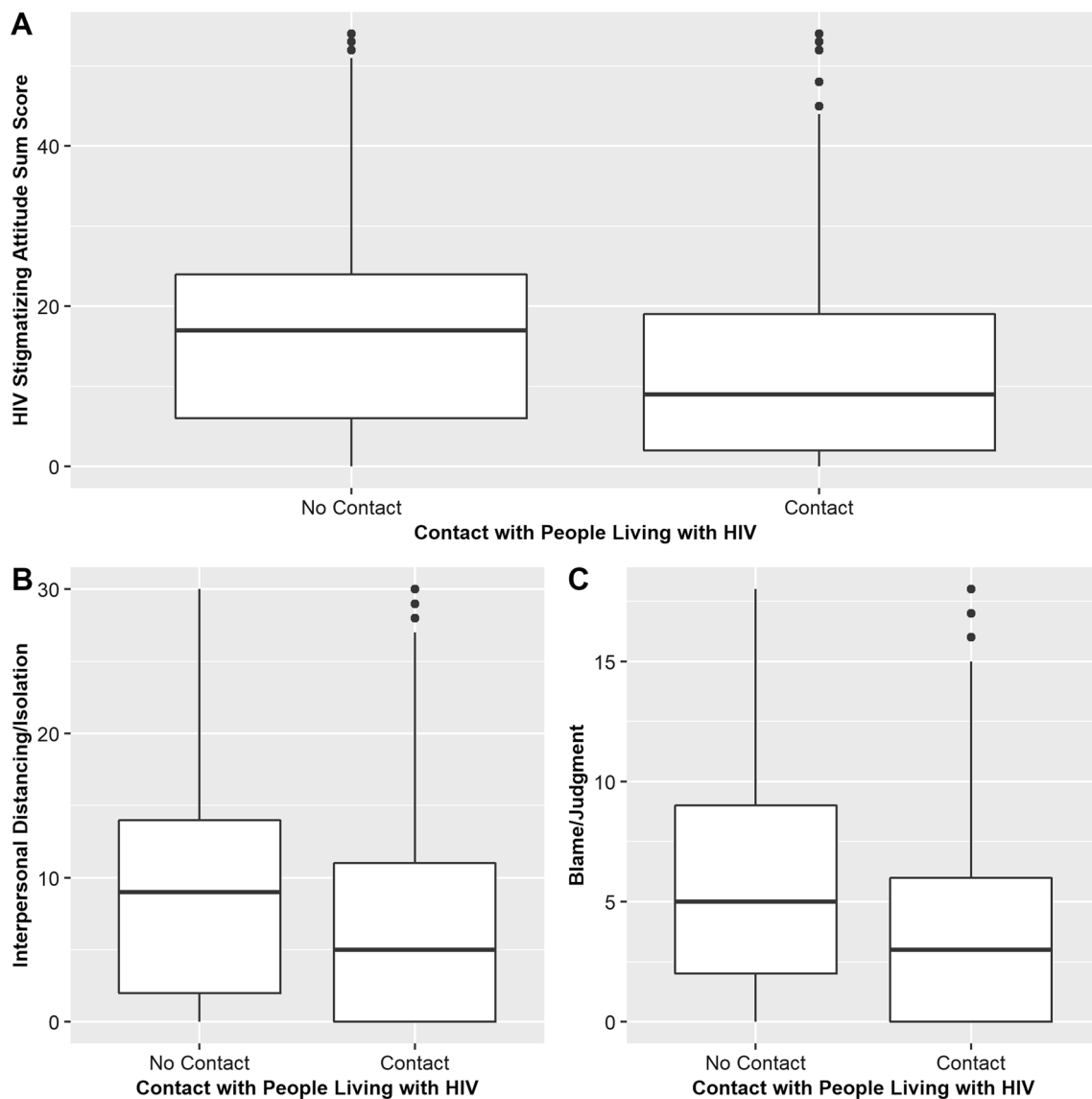


Fig. 3 Differences in HIV stigmatizing attitudes based on prior contact with PLWH

and moral judgement,” representing the dimension of HIV stigma that is driven by the association of HIV with punishment for behavior such as sexual promiscuity. The second factor was identified as “interpersonal distancing and social isolation,” representing the dimension of HIV stigma that is often driven by misconceptions about HIV transmission and fears about transmission to children and relatives, and manifests as social isolation of people living with HIV, still one of the most prevalent manifestations of HIV stigma worldwide [4, 53]. Being able to distinguish between these two domains of stigma is important in the evaluation of stigma reduction interventions. In our team’s intervention work, we found that a stigma reduction intervention in ANC had a positive impact on moral judgment toward PLWH, but did not impact attitudes about interpersonal distancing and

social isolation [54]. While knowledge about HIV, including modes of transmission, increased over time [55], this may not translate into behavior change. A study of HIV stigma across contexts found that individuals were often fearful of casual interactions with PLWH because of “preoccupation with unlikely modes of transmission” [9]. Differentiating these two domains can help to better refine and target intervention content, and could be particularly beneficial for interventions that intend to target a specific aspect of HIV stigmatizing attitudes.

Measurement invariance analysis revealed that the factor structure was stable across sexes, which is important for a scale that is administered to both men and women. In many societies in Sub-Saharan Africa, gender norms and constructs of masculinity may influence men to demonstrate

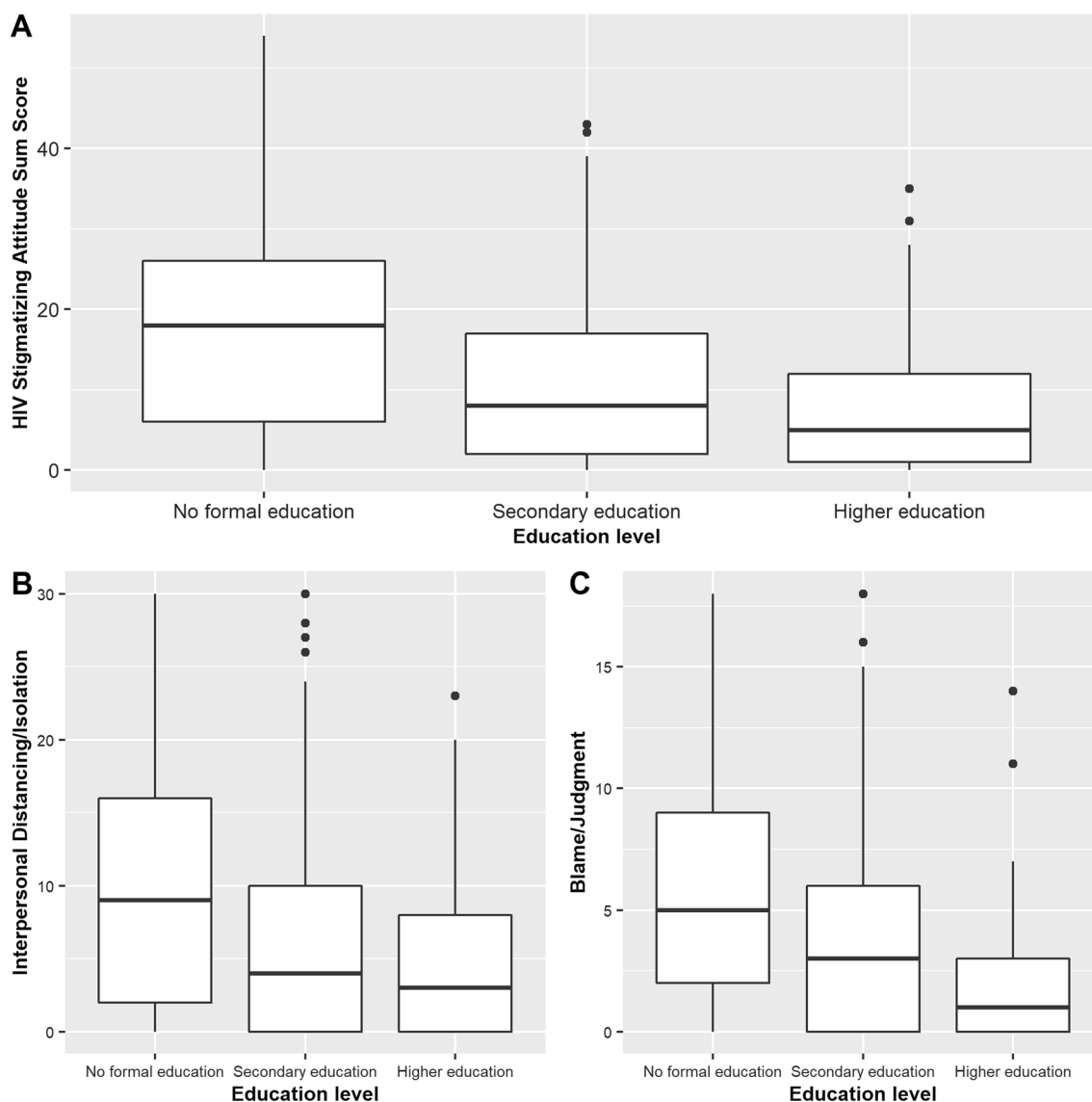


Fig. 4 Differences in HIV stigmatizing attitudes by education level

risky health behaviors and reduced health-seeking behavior [56]. Manifestations of HIV stigmatizing attitudes for men often include decreased HIV testing, prevention, and treatment. Therefore, it is important to have a scale that can accurately measure stigmatizing attitudes among both women and men in order to differentiate stigma levels between women and men and examine differential impacts of stigma reduction interventions.

The factor structure was also stable across education levels and was accurately able to predict stigmatizing attitudes based on education level. Because of the research that has been conducted that suggests that having higher levels of education correlates with lower levels of stigma, it is a testament of a scale's validity to be able to predict stigma attitudes based on education level [25, 26]. Although HIV

knowledge wasn't included in the validation of the scale as it was in the Visser study [21], we measured validity through correlations of stigmatizing attitudes with educational level instead.

Precautions were taken to mitigate social desirability bias in responses, which is especially important when measuring a sensitive topic like HIV stigma [57]. All participants self-completed the survey using an ACASI platform. The ACASI modality allowed participants to respond to survey items without direct administration by research staff, and was possible in a low-literacy population, as all questions and answer options were prerecorded in Swahili and corresponding text lit up on the tablets as the text played. All surveys were conducted in private rooms, and participants were given headphones. As some participants still may have

adjusted their responses to seem less stigmatizing, a social desirability scale could have been incorporated into the overall survey, with correlation analyses conducted to evaluate validity [39, 57]. Our findings suggest that using the ACASI modality did not interfere with measurement, as the factor structure of our scale was consistent with the original Visser scale which was administered in person.

The development of the HSAS for the Tanzanian population and Swahili language was undertaken with careful consideration to the local context and included iterative adaptation with pilot testing and cognitive interviewing. However, some improvements could have been made during the scale development phase. When adding items to the original Visser scale to create the HSAS, a different number of items were added to each stigma dimension, resulting in a slightly unequal number of items in each factor (only one item was added that fell on the blame/judgment factor, and five items were added that fell on the interpersonal distancing/isolation factor). Scale order could have been rearranged so that all the items that were expected to measure one construct were not grouped together (1–2 and 5–8 for one factor, 9–18 for the second factor). In future validation testing, it could be beneficial to test the measure in a random order, so that items on one factor are not completely grouped together. Further, there may be more factor operationalizations of HIV that could be studied with this scale. While the focus of this paper was on the cultural adaptation and validation of this scale, future research should explore other structures that may fit this data.

The population used to validate this scale may limit generalizability. We administered the HSAS to participants in an ANC setting who were all preparing to test for HIV. It is possible that this anticipation of HIV testing impacted the performance of the scale. The scale also might perform differently in another population. This scale was administered to pregnant women and male partners who were presenting to ANC, and therefore represented a sample of people who were willing to take an HIV test. Furthermore, only 54% of the women in our study attended with a male partner, and it is possible that men who did not attend ANC have HIV stigmatizing attitudes that are driven by other factors than those captured by this study, such as gender-based traditional roles [58, 59]. This population consisted only of people of reproductive age; older individuals may have different attitudes toward PLWH. Also, the validity of the scale may be limited by the diversity of ethnic groups represented by our sample. We did not collect an ethnic group field but recommend that future studies collect this field and assess ethnic group differences.

In conclusion, this study presents the first validation of a Swahili language scale to measure HIV stigmatizing

attitudes in a general population not living with HIV. This instrument can be used to characterize HIV stigmatizing attitudes of a population, examine characteristics of groups that differ in stigmatizing attitudes, evaluate impacts of HIV stigma reduction interventions, and monitor changes in stigmatizing attitudes over time. Given the cultural and linguistic expressions of HIV stigma, this scale would need to be adapted for other contexts.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10461-021-03506-3>.

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Author Contributions JV and MW conceived the study. All authors contributed to study design. Data analysis was performed by SS, LM, and JV. The first draft of the manuscript was written by SS. MW, LM, and JV provided substantial editing and review. All authors read and approved the final manuscript.

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Data Availability Anonymized data supporting the findings of this study can be found on the Mendeley Data Repository, <http://dx.doi.org/10.17632/kp9f37th5w.1>, and is cited in the manuscript. De-identified data supporting this study are available [60] for public viewing.

Code Availability All code used to produce the results reported in this manuscript is available upon request. Contact the first author, Saumya Sao, saosaumya@gmail.com, for code.

Declarations

Conflict of interest The authors declare that they have no conflicts of interest or competing interests.

Ethical Approval The study received ethical approval from the Tanzanian National Health Research Ethics Committee of the National Institute for Medical Research (Reference No. 2183), the Kilimanjaro Christian Medical Centre (Reference No.915), and the Institutional Review Boards of Duke University (D0371) and the University of Utah (00127605).

Consent to Participate All participants provided written informed consent to participate in this study.

Consent for Publication Not applicable.

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