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Title: **The development and piloting of parallel scales measuring external and internal HIV and tuberculosis stigma among healthcare workers in the Free State Province, South Africa.**

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The development and piloting of parallel scales measuring external and internal HIV and tuberculosis stigma among healthcare workers in the Free State Province, South Africa.

Abstract

Background: The dual burden of TB and HIV is severely impacting the South African healthcare workforce. However, the use of on-site occupational health services is hampered by stigma among the healthcare workforce. The success of stigma-reduction interventions is difficult to evaluate because of a dearth of appropriate scientific tools to measure stigma in this specific professional setting.

Objectives: The current pilot-study aimed to develop and test a range of scales measuring different aspects of stigma – internal and external stigma towards TB as well as HIV – in a South African healthcare setting. The study employed data of a sample of 200 staff members of a large hospital in Bloemfontein, South Africa.

Results: Confirmatory factor analysis produced seven scales, displaying internal construct validity: (1) colleagues' external HIV stigma, (2) colleagues' actions against external HIV stigma, (3) respondent's external HIV stigma, (4) respondent's internal HIV stigma, (5) colleagues' external TB stigma, (6) respondent's external TB stigma, and (7) respondent's internal TB stigma. Subsequent analyses (reliability analysis, structural equation modeling) demonstrated that the scales displayed good psychometric properties in terms of reliability and external construct validity.

Discussion: The study outcomes support the use of the developed scales as a valid and reliable means to measure levels of TB- and HIV-related stigma among the healthcare workforce in a resource-limited context. Future studies should build on these findings in order to fine-tune the instruments and apply them to larger study populations across a range of different high HIV and TB-prevalence, resource-limited healthcare settings.

Background

HIV/AIDS and tuberculosis (TB) have merged into a deadly co-epidemic in South Africa. In absolute numbers, the country houses the highest number of people living with HIV: in 2013, 6.3million South Africans were infected with HIV, constituting 18.5% of the global burden of HIV infection [1]. In addition South Africa has one of the most severe TB epidemics in the world: the country had the highest incidence of TB (860 per 100,000 in 2013) and had 26,023 reported cases of rifampicin resistant or multi-drug resistant (MDR) TB in 2013 [2]. Both epidemics are intricately intertwined as approximately 73% of TB cases are co-infected with HIV and as many as 60% of HIV-infected South Africans having HIV-associated TB [3, 4].

The dual burden of TB and HIV also has a severe impact on the South African healthcare workforce. Occupational exposure to TB constitutes a major health risk for healthcare workers (HCWs), especially in resource-constrained settings with large patient numbers, resulting over-crowded health facilities and poorly implemented infection control strategies. A 2006 systematic review on low- and middle-income countries reported that the excess incidence of TB that was attributable to being a HCW ranged from 25 to 5,361 cases per 100, 000 people per year [5]. A South African study on the extent and impact of nosocomial transmission of TB amongst HCWs indicated that these professional categories were up to three times more likely to acquire TB than the general population [6]. In addition, O'Donnell et al. demonstrated that HCWs have a 5- to 6-fold increased rate of hospital admission with MDR or Extremely Drug Resistant TB compared to non-HCWs [7]. Consequently, TB is officially classified as an occupational disease. The HIV epidemic is equally affecting the health workforce as the mutually reinforcing epidemiology of HIV and TB evidently gravely affects this subpopulation. Although HIV predominantly remains a sexually acquired infection, there is also an occupational risk as the preliminary results of a 2012 survey among 513 healthcare workers in three hospitals in the Free State Province of South Africa revealed that more than 21.2% of the respondents reported needle stick injury or unprotected exposure to bodily fluids

[8]. The limited epidemiological evidence indicates that HIV prevalence among South African HCWs ranges from 11.5 to 20.0%, demonstrating the impact that HIV/AIDS is having on the workforce [9].

The high HIV prevalence among the healthcare workforce and the above-mentioned risk of TB (co-)infection render workplace health services for TB and HIV/AIDS an essential part of any overall health systems strengthening strategy [10]. Research has demonstrated that providing HIV and TB services to HCWs at work is cost-effective and is an approach preferred by the majority of HCWs – especially when part of a more comprehensive care package [11-14]. Accordingly, a joint World Health Organization – International Labour Organization – UNAIDS policy document on the provision of TB and HIV prevention and care for HCWs explicitly recommends the on-site availability of occupational health services for the entire workforce so that full access to HIV and TB prevention, treatment, care and support for this vulnerable group can be attained [15].

Despite these promising policy recommendations, a recent review paper stated that (HIV- and TB-related) stigma and discrimination act as "key barriers to both the delivery of quality health services by health providers and to their utilization by community members and health providers themselves" [16]. Stigmatization in the healthcare setting can have severe implications for HCWs and health facilities when HIV-positive and/or TB-infected HCWs delay or avoid care, causing increased morbidity and mortality and further strain on an overburdened health system [16]. Accordingly, the recent past has been marked by the development and testing of stigma-reduction tools and interventions in healthcare settings [17].

However, the success of the interventions is difficult to evaluate because of a dearth of appropriate scientific tools to measure stigma in this specific professional setting. Uys et al. (2009) indicated that the majority of papers reporting intervention outcomes did not include a validated instrument to measure change in stigma over time [17, 18]. The limited number of studies that did measure stigma in the healthcare setting focused almost exclusively on (1) HIV (and *not TB*) [19]; (2) stigmatizing attitudes of HCWs towards patients or patients towards HCWs (but *not among HCWs*) [20]; and (3)

healthcare professionals e.g. doctors, nurses (but *not the* entire *healthcare workforce*[1] (cleaners, clerks, security, etc.) [21-23], rendering a more comprehensive measurement of HIV and TB stigma in the healthcare setting – based upon a solid theoretical framework – a research priority.

Theoretical framework

Erving Goffman's (1963) seminal analyses of stigma as a social phenomenon—which built on Émile Durkheim's explorations in 1894 [24]—inspired and formed the bases of current research on stigma. Goffman defined stigma as a 'mark' or aspect of the self that is socially devalued [25]. People who display an undesirable difference from desirable norms are thought of differently—usually with negative consequences to their emotional wellbeing and social standing. Goffman's interest was in people's lived experience of stigma, but over time and in the field of health, subsequent analyses put increasing emphasis on the causes and consequences of stigma [16, 26, 27]. Also, following the influential work of Link and Phelan (2001) focus was concentrated on stigma-as-process involving, inter alia, labeling, stereotyping, rejecting, excluding, and discriminating [28-32].

While the literature is easy to assimilate in terms of causes, consequences and processes of stigma, this is less so when analyzing for different types of stigma. What emerges clearly in the literature is a set of two overarching types: external stigma and internal stigma [33, 34]. In order to produce an instrument that is conceptually clear, precise and economical we confined the types of stigma to be measured among HCWs to these two main categories: external stigma—which is directed and/or by healthcare workers towards other healthcare workers, and internal stigma—which is directed by healthcare workers towards themselves. Rather than presenting new types or groups of stigma, these categories capture different *directional dimensions* of stigma: that which is externalized and that which is internalized.

[1] A recent study by Nyblade et al. (2013) produced the only validated tool, identified in the survey of literature, which assesses HIV stigma among the entire healthcare workforce, but it did not include TB stigma and it was not executed in a high HIV-prevalence setting.

The current pilot study was conducted in the context of a muticomponent international research collaboration aiming to improve the health of HCWs [35]. Within this framework, the current study aims to develop and test a range of scales measuring different aspects of stigma – internal and external stigma towards TB as well as HIV – in the healthcare setting. In this way, we aim to address the above-cited research gaps. Firstly, we aim to develop a series of interrelated instruments which measure the different aspects of stigmatization (internal as well as external stigma) towards both HIV and TB. Secondly, we aim to develop scales that measure the stigmatizing attitudes of the healthcare workforce towards their fellow colleagues as these particular stigmatizing attitudes are likely to be the primary barrier to the optimal use of occupational HIV and TB services by this at risk group. Finally, we aim to develop and test instruments which measure stigma in the healthcare setting: we thus have to include the entire healthcare workforce – including cleaning personnel, security, food service workers, etc. – as the sum of the attitudes of all people working in the facility constitutes the level of stigma in the healthcare setting.

Materials & methods

Stage I: Instrument development

The instrument design was based on findings from a comprehensive literature review. Criteria for sourcing and selecting texts for review were that they should match as closely as possible the specific context and aims of our research by focusing predominantly on HIV- and/or TB-stigma in public healthcare facilities as perceived and experienced by HCWs. Texts for the review were sourced by searching across databases (e.g. EBSCOHost and Web of Science), following up references in the most relevant texts, and using keyword searches in Google and Google Scholar. Keyword combinations included terms such as: 'HIV stigma'; 'TB stigma'; 'discrimination'; 'healthcare worker'; 'health professional'; 'occupational health'; 'measur* stigma'; 'validat* scale; 'stigma tool'; 'Africa'. The following types of texts were sourced: peer-reviewed journal articles—including systematic reviews; reports and other resources from websites of key international, regional and national institutions as well as networks involved in stigma-focused research, interventions and evaluations; stigma intervention toolkits; and existing stigma survey tools. In addition, a limited number of texts on stigma theory and on the broader context of HIV and TB epidemiology, prevention communication and occupational health were selected based on our estimation of their reach and their relevance to our project.

In accordance with the above-described theoretical framework, different series of items were designed to measure stigma according to four scales: HIV external stigma; TB external stigma; HIV internal stigma; and TB internal stigma. Reflecting on these items, it became evident that a further differentiation was possible, one that would capture nuances in the main categories of external and internal stigma and which would differentiate the *sources* from the *targets* of stigma. This refinement resulted in six final scales:

- Others' External Stigma (OES) scales measure perceptions, attitudes and behaviors that respondents witnesses being enacted, or perceive as existing, among other HCWs[2] (referred to also as 'colleagues') in the hospital (Scale 1= HIVOES; Scale 2= TBOES);
- Respondent's External Stigma (RES) scales measure respondents' perceptions, attitudes and behaviors towards other HCWs in the hospital (Scale 3= HIVRES; Scale 4= TBRES)
- Respondent's Internal Stigma (RIS) scales measure the perceptions, attitudes and behaviors of respondents towards themselves, as well as stigma that they perceive or anticipate as being directed towards them from other HCWs (Scale 5= HIVRIS; Scale 6= TBRIS).

The items of the different scales were informed by the selected literature: items from existing stigma-scales – not targeted at the healthcare workforce – were carefully selected and if required, adapted to validly measure our six concepts. Changes in the wording of questions were sometimes needed so that they would be consistent with the strict definitions for each scale, and also to ensure that there would be enough questions allocated to each scale in order to measure the construct in a reliable and valid manner. Questions on HIV external stigma were taken, and sometimes adapted, from: Buregyeya et al. (2012); Health Policy Project (2013); Kalichman and Simbayi (2004); Kalichman et al. (2005); Nyblade and MacQuarrie (2006); USAID Health Policy Initiative (2010); Uys et al., (2009) [13, 17, 36-40]. Questions on HIV internal stigma were taken, and sometimes adapted from: Buregyeya et al. (2012); Feyissa et al. (2012); Kalichman et al. (2005); Nyblade and MacQuarrie (2006); USAID Health Policy Initiative (2010); Uys et al. (2009) [13, 17, 38-41]. Questions on TB external and internal stigma were informed by, or taken directly from, or adapted from: Bond and Nyblade (2006); Coreil et al. (2010 & 2012); Courtwright & Turner, (2010); Daftary (2012); Van Rie et al. (2008) [26, 28, 42-45]. Particular attention was devoted to parsimony as the scales needed to be

[2] The study aims to develop scales which measure stigma among the entire healthcare workforce. The representatives of the Free State Department of Health FSDoH (Kerry & Lucky) insisted that in a South African context it is understood and well accepted that 'HCWs' refers to the entire workforce from top to bottom.

as short as possible to encourage the healthcare workforce to complete it —and to do so in the context of understaffing and busy schedules.

Stage II: Pre-pilot and adaptation

A final, pre-pilot cross-examination of the instrument was carried out in a meeting of key stakeholders: four of the instrument designers; three experienced health-services field workers—one of whom is HIV-positive and understands HIV and TB stigma from an insider perspective; one medical doctor specializing in HIV-TB in local public hospitals; one local occupational health nurse who was also the coordinator of occupational health in the Free State province and; and one MPH student. Final, small edits followed the group's inputs.

Stage III: Piloting the instruments

The work of stages I and II resulted in six scales: (1) colleagues' (by which is meant HCWs *other* than the respondent) external HIV stigma (HIVOES: 9 items); and (2) colleagues' external TB stigma (TBOES: 5 items); (3) respondent's external HIV stigma (HIVRES: 9 items); (4) respondent's external TB stigma (TBRES: 5 items); (5) respondent's internal HIV stigma (HIVRIS: 8 items); and (6) respondent's internal TB stigma (TBRIS: 5 items). The instruments were piloted in this study – a cross-sectional study among the staff of a large public hospital in the Free State province of South Africa – which is the third and final stage of instrument development.

Study sample and data collection

The pilot study was conducted in one large hospital in Bloemfontein in the Free State province of South Africa. All staff members were eligible to participate. Field workers personally recruited 220 participants with the assistance of hospital department managers. Purposive recruitment was organized to be representative of the number of people in each job category: (1) doctors, (2) nurses, (3) allied health professionals, (4) administrative staff, and (5) support staff. The pilot study was granted ethical clearance by the ethics committee of the University of the Free State's Faculty of Medicine (ECUFS NR 192/2012).

After obtaining written informed consent from all of the participants, trained field workers provided the participants with the standard questionnaires that were completed in a self-administered process. Respondents with low levels of reading literacy were gathered into small groups where trained fieldworkers worked through the questions verbally and answered any queries from the group; however, respondents needed to fill in the questionnaires themselves. Field workers scanned each questionnaire very quickly in order to identify incomplete questionnaires and return these to respondents for editing. Questionnaires thus completed were then separated from the respondents' signed consent forms, sealed in an envelope and from then on treated as anonymous. The sample population interviewed, consisted of 220 healthcare staff: 127 persons involved in direct patient care (e.g. doctors and nurses), 60 support staff (e.g. messengers, porters, cleaners), and 33 admin staff.

Measures

The entire pilot study questionnaire included 87 questions and/or items and took approximately 15 minutes to complete. Apart from the six stigma-scales to be tested, the survey included a series of *socio-demographic questions* (age; sex; occupation; education). Details for different occupations and departments in the hospital came from various health services instruments used, and refined over time, by the Centre for Health Systems Research & Development of the University of the Free State [8]. In addition, the pilot study assessed the *HIV- and TB-related knowledge* of the healthcare workforce as the literature has repeatedly shown a link between knowledge and stigma [46, 47]. The instrument included five items testing the respondents' HIV knowledge (e.g. 'Can people protect themselves from HIV by only having sex with healthy looking people?') and a rapid assessment of their knowledge on TB symptoms. Finally, previous research [16, 19, 42] clearly indicates that links exist between stigma and confidentiality. As informed by existing scientific evidence [16, 19, 42], the survey included a series of questions on *confidentiality* in the workplace (e.g. 'Do you think confidentiality is maintained in your occupational health unit?').

Analysis

In a first step, and as a theory-testing model, internal construct validity was assessed by a series of separate Confirmatory Factor Analyses (CFA) using MPlus version 6 [48]. For each stigma scale, we removed items that did not successfully load (> 0.40) onto the theoretical stigma domain [49]. The fit indices that were used were the Tucker Lewis Index (TLI), the comparative fit index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). Following the recommendations of Hu and Bentler's seminal article, two of the following three criteria had to be met for satisfactory global model fit to be attained: CFI/TLI ≥ .95, RMSEA ≤ .06, and SRMR ≤ .08 [50]. Other methodologists have proposed that RMSEA values below 0.08 suggest adequate model fit [51], and CFI and TLI values in the range of 0.90-0.95 are indicative of acceptable model fit [52]. Following Brown's advice (2006), it is thus "especially important to consider the consistency of model fit as expressed by the various types of fit indices in tandem with the particular aspects of the analytic situation; for example, when N is somewhat small, an RMSEA = .08 may be of less concern if all other indices are strongly in a range suggesting "good" model fit" [49].

Secondly, the reliability of the different stigma scales was measured by the Cronbach's Alpha coefficient. For a stigma scale to be considered consistent, the value of the coefficient has to be above 0.70 [53]. We also sought to improve the internal reliability by removing items one by one and reporting the impact on the coefficient.

In a final step, we tested the correlations between the different stigma subscales in order to assess the subscales' interrelationships as well as their ability to differentiate between the different types of HIV- and TB-related stigma. External construct validity was investigated by assessing the relationship between the different stigma subscales and relevant correlates, using Structural Equation Modeling (SEM) [48]. However, the workforce interviewed is rather diverse – both health professionals, support and admin staff – necessitating us to assess these relationships while

controlling for the gender of the respondent, his/her role in the facility (health professional/not) and the level of education enjoyed. It can be hypothesized that (1) the health-related knowledge of the respondents and (2) the level of confidentiality in the workplace are correlated with the different stigma scales. Based upon the literature [16, 42], we expected the stigma scales (HIVOES and TBOES) assessing the stigmatization by others to be negatively correlated with the level of confidentiality, as a breach in confidentiality can be a proxy of stigmatizing behavior on the floor. We expected the respondent's external stigmatizing perceptions, attitudes and behaviors (HIVRES and TBRES) to be negatively correlated with his/her knowledge of the disease as this relationship has been repeatedly reported in the literature [46, 54, 55]. Finally we expect the respondent's internal stigmatizing perceptions, attitudes and behaviors (HIVRIS and TBRIS) to be positively correlated with his/her external stigmatizing perceptions, attitudes and behaviors as past studies demonstrated that past experiences of external stigma such as blame, rejection, intimidation, name-calling, exclusion and isolation influence internal stigma [56]. We furthermore expect internal stigma to be negatively correlated with the level of confidentiality in the facility as a breach of confidentiality could instigate internal feelings of stigma in affected individuals.

Results

Study population

The mean age of the members of the healthcare workforce in this sample was 40.8 years (SD = 11.4). The majority of the respondents were female (67.7%). With regard to the highest level of education achieved, 1.8% had only completed primary education, 12.3% had some secondary education, 39.3% had completed secondary education and 46.6% had completed tertiary education (university or college). The vast majority of respondents were black (79.4%) while 8.3% of the respondents were colored, 11.9% were white and 0.5% of the healthcare workforce interviewed indicated to be Asian. The majority of respondents were either married (37.7%) or single (40.0%), while the remainder of the healthcare workforce was living together (7.3%), divorced (7.7%), widowed (6.8%) or separated (0.5%).

Presentation of the items

Table 1 displays the different items ascribed to the different stigma scales as well as the spread of the responses of the healthcare workforce. Although it is not really possible to interpret these data due to a lack of normative data, it is clear that – on average – the level of reported stigma by others (HIVOES and TBOES) is higher than respondents' own reported stigma (HIVRES and TBRES).

TABLE 1

Confirmatory factor analyses: internal construct validity

A series of CFAs were carried out to test the internal construct validity of the six stigma scales. Table 2 shows the factor loadings for the different theory-based items onto the different stigma scales. Items were removed from the scale if the loading, i.e. the standardized regression coefficient, was below 0.40. Table 2 also demonstrates the model fit of the different scales.

TABLE 2

The first theory-based scale intended to measure the stigmatizing attitudes towards HIV of the healthcare workforce surrounding the respondent (HIVOES). The CFA resulted in a poor model fit with five items loading insufficiently onto the stigma factor. When looking at the pattern of loadings, it became evident that the scale was measuring different aspects of external stigma by co-workers, namely (a) the stigmatizing attitudes of the colleagues (e.g. 'I have noticed that some of my co-workers in this hospital look down on HCWs who they think may be HIV infected') and (b) the actions of colleagues against stigmatizing by other colleagues (e.g. 'I have heard that some HCWs educate co-workers who stigmatize people living with HIV'). These items are not 'positively' and negatively' phrased items measuring the same construct, as we did not detect such method effect associated with negatively and/or positively worded items using Marsh & Grayson's Correlated Traits, Correlated Methods (CTCM) framework [57, 58]. The SEM modeling the wording effect as a latent trait did not fit the data well while the loadings of the positively and negatively worded items onto the stigma factor were still too low. Consequently, we created two factors (HIVOES and HIVFightOES), each consisting of four items. The scale measuring the coworkers' stigma (HIVOES) still only displayed a borderline fit with the SRMR and CFI displaying acceptable fit and the two other measures suggesting poor fit. The scales measuring the actions of the co-workers against stigma displayed an excellent fit to the data. Item 14 (Other HCWs think it is worthwhile for the hospital to invest in the career development of HIV-positive HCWs) did not load onto any of the two factors and was omitted from any further analyses.

Nine items were piloted for the second scale measuring the respondent's perceptions, attitudes and behaviors towards other HIV-positive HCWs in the hospital (HIVRES). The factor loadings indicated that all but three items loaded well onto the over-arching factor. These items were omitted from further analysis ('In my opinion, HCWs living with HIV should probably feel shame'; 'HCWs who have HIV should not feel guilty about it'; and 'Most HCWs with HIV have many sexual partners'). The resulting scale, consisting of six items fitted the data well.

The final HIV-scale measures respondent's internal stigma (HIVRIS) – the perceptions, attitudes and behaviors of respondents towards themselves, as well as stigma that they perceive or anticipate as being directed towards them from other HCWs. The original scale, comprising 8 items, displayed a good fit, but one item did not load onto the factor ('If I had HIV, I would feel uncomfortable disclosing to some of my co-workers' (λ = 0.230)). This item was omitted from the scale which resulted in seven-item factor, displaying a good fit to the dataset.

In accordance with the theoretical framework, the first TB scale measures perceptions, attitudes and behaviors that respondents witness being enacted, or perceive as existing, among other HCWs in the hospital (TBOES). The original five-item structure displayed an acceptable fit. All five items loaded well onto the theory-driven factor.

The second TB scale assessed the respondents' perceptions, attitudes and behaviors towards other TB-infected co-workers in the hospital (TBRES). The original 5-item-scale displayed a good fit, but the first item ('I would feel uncomfortable working side-by-side with a co-worker after he/she has been on TB treatment') did not load sufficiently onto the factor (λ = 0.161). Therefore, this item was deleted from the any further analyses. The resulting factor, comprising 4 items, displayed an excellent fit to the data.

The final TB scale to be tested measured the respondent's internal stigma. The original structure fitted the data well, but one item ('If I was diagnosed with TB, I would not need to feel shame') did not sufficiently load onto the factor (λ = -0.395). After deleting this item, the resulting four-item solution fitted the data well and displayed sufficiently high loadings of the different items onto the factor.

Structural equation modeling: external construct validity

In a first step, we performed a CFA incorporating all stigma scales – after item reduction – simultaneously. We also assessed the correlations between the different types of stigma as measured by our scales (Table 3). Employing Hu and Bentler's (1999) criteria, the total CFA model

fitted the data well (RMSEA = 0.049; CFI = 0.888; TLI = 0.876; SRMR = 0.063). All items sufficiently load onto the intended stigma factor (λ > 0.400). The correlations between the different types of stigma are displayed in Table 3. We immediately see significant and moderate to very strong correlations between equivalent scales measuring the same type of stigma for HIV and TB. Evidently, these theory-based scales contain similar items. However, the research team had explicitly avoided including the identical phrasings across these equivalent scales. Correlating the error variances of such identically phased items to control for a wording effect is thus not needed. Nevertheless, we conducted a chi square difference test to assess whether the very strong correlation between the respondents' internal TB and HIV stigma meant that these two scales were measuring the same concept: the test revealed a significant difference between the two models (two separate constructs vs. two perfectly correlated constructs) demonstrating the discriminant validity of the scales. Secondly, we see very strong correlations between the respondents' reported internal TB stigma on the one hand and the external TB-related stigma measures. We also see a strong correlation between the respondents' reported internal HIV stigma and the HIV-related perceptions, attitudes and behaviors that respondents witnesses being enacted, or perceive as existing, among other HCWs (referred to also as 'colleagues') in the hospital (HIVOES). Each time we demonstrated the discriminant validity using a chi square difference test. Finally, we see that the respondents' perception of the actions by co-workers against HIV stigma is negatively correlated with almost all other stigma measures, indicating that combating stigma on the work floor is associated with less stigmatizing attitudes and with lower perceived stigma by others.

TABLE 3

Reliability analysis after item reduction

The resulting factor solutions were subjected to a reliability analysis. All but one of the final scales displayed good reliability, with alphas ranging between 0.706 for HIVFightOES and 0.866 for TBRES. Only the scale measuring the respondent's internal stigma towards TB displayed a Cronbach's alpha

of 0.650. In all scales, if final items were deleted, the alpha for that domain was lowered, demonstrating the significant contribution of each item to the reliability of the scale (Table 2).

External construct validity

In order to test the external construct validity of the seven selected scales, we tested seven structural equation models (SEM). Each model assessed the correlations between the stigma scale and (1) the level of confidentiality in the occupational health unit, (2) the respondent's knowledge of HIV transmission and (3) the respondent's knowledge of TB. Each model controlled for the impact of gender, education, and occupational role on stigma, the perceived confidentiality and the HIV/TB-related knowledge.

The first stigma scale – measuring HIV-related perceptions, attitudes and behaviors that respondents witness being enacted, or perceive as existing, among other HCWs (referred to also as 'colleagues') in the hospital (HIVOES) – was negatively correlated with the perceived level of confidentiality ($r = 0.364$; $p < 0.001$). The model fitted the data well (RMSEA = 0.066, CFI = 0.922, TLI = 0.868; SRMR = 0.052). As was expected, the scale was not significantly correlated with the knowledge of the respondent. The corresponding scale on TB (TBOES) displayed a similar pattern: it was weakly and negatively correlated ($r = 0.223$, $p < 0.01$) with the level of confidentiality in the facility after controlling for the education and sex of the respondent (RMSEA = 0.057, CFI = 0.941, TLI = 0.909; SRMR = 0.045). Finally, the related scale measuring the fighting of HIV stigma by co-workers in the facility was positively correlated with the level of confidentiality ($r = 0.256$; $p < 0.01$), while this SEM fitted the data well (RMSEA = 0.000, CFI = 1.000; TLI = 1.000; SRMR = 0.036).

The scale measuring respondents' own HIV-related perceptions, attitudes and behaviors towards other HCWs/colleagues in the hospital (HIVRES) was, as expected, weakly but significantly correlated with the HIV-related knowledge of the respondent ($r = -0.155$; $p < 0.05$) with better informed workers displaying less stigmatizing attitudes than ill-informed colleagues (RMSEA = 0.000, CFI = 1.000; TLI = 1.000; SRMR = 0.028). Similarly, the corresponding TB stigma scale (TBRES) was also

weakly and negatively correlated ($r = -0.197$; $p < 0.05$) with the respondent's knowledge of HIV transmission (RMSEA = 0.000, CFI = 1.000; TLI = 1.000; SRMR = 0.026). The respondent's knowledge of TB symptoms was not significantly associated with this HIV-stigma scale. It must be noted that – as in each of the SEMs – the respondent's educational level had a significant impact on the knowledge of HIV ($r = 0.294$; $p < 0.001$) and TB ($r = 0.259$; $p < 0.001$).

The SEM assessing the correlations with the respondent's internal stigma fitted the data well (RMSEA = 0.041; CFI = 0.932; TLI = 0.907; SRMR = 0.045). Again the level of confidentiality in the facility was negatively correlated ($r = 0.235$; $p < 0.01$) with the internal HIV stigma of the respondent (RMSEA < 0.05; CFI = 0.932; TLI = 0.907). Similarly, the internal TB stigma as reported by the respondents was weakly and negatively correlated ($r = -0.235$; $p < 0.05$) with the level of confidentiality in the facility (RMSEA = 0.000; CFI = 1.000; TLI = 1.000; SRMR = 0.035).

Discussion

The current pilot-study reports on the development and psychometric properties of a series of measures of HIV and TB stigma in the healthcare setting. In accordance with the theoretical framework, the resulting seven scales assessed (1) colleagues' external HIV stigma, (2) colleagues' actions against external HIV stigma, (3) respondent's external HIV stigma, (4) respondent's internal HIV stigma, (5) colleagues' external TB stigma, (6) respondent's external TB stigma, and (7) respondent's internal TB stigma. These instruments showed good psychometric properties in terms of internal construct validity, reliability and external construct validity. The descriptive analysis indicated that the reported levels of respondents' internal stigma were higher than the perceived stigmatization by colleagues as well as the respondents' external stigma.

The results of the confirmatory factor analyses demonstrated that the initial scale measuring the colleague's external HIV stigma should be divided into two separate scales, one measuring the intended concept and one measuring the actions taken to fight HIV-related stigma. The non-significant correlation between the two constructs confirmed this clear distinction. The internal construct validity of the other five stigma scales was confirmed in the separate CFAs. These analyses confirm the distinction made in literature between internalized and externalized stigma [33, 34, 43, 59, 60]. However the strong correlations between the colleagues' external stigma and the respondent's internal stigma – for both HIV and TB – indicate that the attitudes and behavior of colleagues is strongly linked to the internalized opinion of the individual towards him/herself. This confirms previous research by Greeff & Phetlhu (2007) reporting that past experiences of external stigma — witnessing or experiencing rejection, intimidation, exclusion and isolation — influence internal stigma [56]. Future studies should further try to disentangle these two types of stigma by fine-tuning the different items as the strong associations render a clear distinction between the two concepts difficult.

A review study by Nyblade et al. (2009) indicated that there is a link between the level of confidentiality in the facility and the potential stigma that staff is expecting to experience [16]. In accordance with these findings, the level of confidentiality in the facility was negatively correlated with our respondents' perceptions of their colleagues' externalizing stigma. In addition, respondents' internalizing stigma was also significantly and positively related to breaches of confidentiality in the facility. These findings support the external construct validity of these scales [16, 42]. The findings are in line with those of a recent study by Khan et al. (2014) conducted in this same facility, which demonstrated that stigma and confidentiality were the two main barriers to the uptake of HIV counseling and testing services within occupational health units [61]. Conversely, various studies have demonstrated that people's own stigmatizing attitudes towards others (external stigma of the respondents) are related to their knowledge of the illness [46, 47]. Accordingly, the developed scales (HIVRES and TBRES) were negatively correlated with the level of HIV-related knowledge of the respondents. No association, however, was found between respondents' external stigma with our measurement of TB-related knowledge.

The study outcomes reveal a strong link between TB-related and HIV-related stigma. The correlations between the HIV scales on the one hand and their corresponding TB scales on the other hand ranged from moderate to very strong ($r > 0.9$). Although the results of the chi square difference testing confirmed the discriminant validity of the different scales, it appeared difficult to clearly disentangle the two objects of stigma (TB and HIV). These quantitative findings confirm recent quantitative evidence of Daftary (2012) demonstrating that the confluence of the TB and HIV epidemics rendered "TB symbolic and symptomatic of HIV", thus producing a unique, overlapping double stigma [44]. Correspondingly, Bond & Nyblade (2006) already stated that in the context of high HIV prevalence, TB stigma can no longer be thought of separately from HIV stigma [26]. These authors also called for attempts to disentangle the double stigma of TB and HIV. The current study is exactly this: an attempt to develop and validate instruments to disentangle the different types of HIV as well as TB stigma in the healthcare setting. However, the results of our analyses indicate that

future research is needed to further disentangle these intricately interrelated phenomena, as the developed scales have difficulty discerning stigma towards HIV or TB among the healthcare workforce.

The strengths of this study include (1) its incorporation of different aspects of the interrelated concepts of HIV and TB stigma and (2) the application of this comprehensive theoretical framework to a very relevant population and setting, the healthcare workforce active in the facilities fighting HIV and TB. However, there were some limitations to our study. First, the current study assessed internalized and externalized stigma among the healthcare workforce. However, despite its focus on the healthcare setting, the current study did not incorporate what the Siyam'kela Project (2003) called "stigma by association". This type of secondary stigma is defined "as incidents that describe stigma against people who work or associate with HIV/AIDS-affected people" [32, 60] and is thus a relevant concept in the healthcare setting. However, as the focus of the current study is on developing scales which measure the stigmatizing attitudes of the healthcare workforce towards their fellow colleagues - because these particular stigmatizing attitudes are likely to be the primary barrier to the optimal use of occupational HIV and TB services - associated stigma fell outside of its scope [35]. Secondly, the current study should be considered as a preparatory pilot study, informing future work on these instruments. The sample size was relatively small and the results may not be applicable to alternative settings. Future research – informed by our findings and executed in a range of different high HIV-prevalence healthcare settings – is needed to unarguably validate the instruments. Finally, the study opted to include the entire healthcare workforce (i.e. health professionals as well as supporting staff), rendering the respondent group diverse. Future attempts to validate these instruments should incorporate this diversity by performing multi-group confirmatory factor analyses and structural equation modeling. The limited sample size did not allow this within the scope of the current study.

Conclusion

There is a great need for the use of appropriate scales in the evaluation of interventions to reduce HIV and TB stigma in the healthcare setting. Although the development of such specific scales for this context is still in its infancy, the current exploratory analyses have both practical and theoretical implications. Theoretically, (1) the distinction between internalized and externalized stigma and (2) the attempt to disentangle the double TB/HIV stigma can inform the further development of appropriate scales. Future studies should build on our findings in order to fine-tune the instruments and apply them to a larger study population. Practically, the successful development and piloting of parallel scales measuring different aspects of stigma in the healthcare setting will enable future studies to (1) identify which type of stigma (external/internal) acts as the primary barrier to the use of occupational health services, (2) develop appropriate stigma reduction programs which optimally address these main barriers [62]; and (3) scientifically assess the impact of these programs on the stigma levels as well as the mechanisms through which the programs impact the health of the healthcare workforce.

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Table 1: Stigma scales, presentation of the items and the distribution of responses

Others' External Stigma towards HIV (HIVOES)	Item #	Strongly disagree	Disagree	Agree	Strongly agree
6.1 I have noticed that some of my co-workers in this hospital look down on Healthcare Workers who they think may be HIV infected	1	65 (30.1)	72 (33.3)	41 (19.0)	38 (17.6)
6.4 I have heard healthcare workers making negative remarks about the health of co-workers involved in HIV care and treatment	4	80 (37.4)	80 (37.4)	31 (14.5)	23 (10.7)
6.12 I have witnessed healthcare workers suspected of having HIV being rejected by co-workers in the workplace	12	79 (36.6)	94 (43.5)	32 (14.8)	11 (5.0)
6.13 I have heard that other healthcare workers in this hospital are afraid of catching HIV from co-workers who care for HIV-positive patients	13	77 (35.6)	92 (42.6)	34 (15.7)	13 (6.0)
6.14 Other healthcare workers think it is worthwhile for the hospital to invest in the career development of HIV-positive healthcare workers	14	15 (7.0)	39 (18.2)	96 (44.9)	64 (29.9)
6.15 I have heard about other healthcare workers in this hospital who give extra support to co-workers with HIV	15	8 (3.8)	41 (19.2)	96 (45.1)	68 (31.9)
6.16 I have heard that some healthcare workers educate co-workers who stigmatise people living with HIV	16	10 (4.6)	42 (19.4)	101 (46.8)	63 (29.2)
6.17 It has been made clear by people in charge at this hospital that healthcare workers will not lose their jobs because of being HIV-positive	17	1 (0.5)	26 (12.0)	90 (41.7)	99 (45.8)
6.18 I have witnessed other healthcare workers in this hospital doing something to stop stigma in the workplace	18	19 (8.8)	55 (25.6)	92 (42.8)	49 (22.8)
Respondent's External Stigma towards HIV (HIVRES)					
6.2 I would feel comfortable being close friends with a healthcare worker who is known to be HIV-positive	2	8 (3.7)	14 (6.5)	87 (40.3)	107 (49.5)
6.3 HIV-positive healthcare workers should have the same chances for promotion as healthcare workers who are HIV-negative	3	4 (1.8)	4 (1.8)	43 (19.8)	166 (76.5)
6.5 I am comfortable having HIV-positive healthcare workers alongside me in my job	5	6 (2.8)	6 (2.8)	84 (38.7)	121 (55.8)
6.6 I am comfortable sharing a bathroom with HIV-positive co-workers	6	3 (1.4)	9 (4.1)	91 (41.9)	114 (52.5)
6.7 In my opinion, healthcare workers living with HIV should probably feel shame	7	142 (65.1)	55 (25.2)	11 (5.0)	10 (4.6)
6.8 Healthcare workers with HIV should not feel guilty about it	8	11 (5.0)	8 (3.7)	72 (33.0)	127 (58.3)
6.9 Most healthcare workers with HIV have had many sexual partners	9	108 (49.8)	87 (40.1)	12 (5.5)	10 (4.6)
6.10 HIV-positive healthcare workers can be good role models in the workplace	10	6 (2.8)	8 (3.7)	94 (43.1)	110 (50.5)
6.11 Doctors and nurses with HIV should continue to practice medicine	11	3 (1.4)	4 (1.8)	83 (38.1)	128 (58.7)
Respondent's Internal Stigma towards HIV (HIVRIS)					
7.1 If I had HIV I would feel comfortable disclosing to some of my co-workers	19	35 (16.2)	42 (19.4)	88 (40.7)	51 (23.6)
7.2 I would feel ashamed if co-workers knew that someone in my family was HIV-positive	20	75 (34.7)	107 (49.5)	26 (12.0)	8 (3.7)
7.3 If I was diagnosed with HIV, I would be afraid that some co-workers might blame me	21	62 (28.6)	80 (36.9)	58 (26.7)	17 (7.8)
7.4 I would not need to feel shame if I was HIV-positive	22	8 (3.7)	29 (13.4)	100 (46.3)	79 (36.6)
7.5 If I was HIV-positive I would worry that some co-workers might avoid touching me	23	58 (27.0)	93 (43.3)	52 (24.2)	12 (5.6)

7.6 As a healthcare worker I would feel it was my fault if I was infected with HIV	24	67 (31.2)	77 (35.8)	48 (22.3)	23 (10.7)
7.7 I have felt stigmatised by co-workers in my workplace because of a health condition	25	72 (33.5)	97 (45.1)	38 (17.7)	8 (3.7)
7.8 If I had HIV I would avoid making new friends at my workplace	26	93 (43.7)	98 (46.0)	13 (6.1)	9 (4.2)
Others' External Stigma towards TB (TBOES)					
8.1 I have witnessed healthcare workers who are suspected of having TB being stigmatised in this hospital	1	75 (35.0)	91 (42.5)	36 (16.8)	12 (5.6)
8.3 I have witnessed some healthcare workers in this hospital avoiding contact with co-workers who they think may have TB	3	66 (30.7)	96 (44.7)	42 (19.5)	11 (5.1)
8.6 Some healthcare workers in this hospital would not want to eat or drink with a co-worker who they think has TB	6	60 (27.8)	73 (33.8)	65 (30.1)	18 (8.3)
8.9 Some healthcare workers in this hospital are stigmatised when co-workers find out that they have gone for TB screening	9	68 (31.8)	83 (38.8)	52 (24.3)	11 (5.1)
8.11 I have noticed that some other healthcare workers in this hospital feel uncomfortable to work near co-workers with TB	11	55 (25.6)	82 (38.1)	67 (32.1)	11 (5.1)
Respondent's External Stigma towards TB (TBRES)					
8.7 I would feel comfortable working side-by-side with a co-worker after she/he has been on TB treatment	7	14 (6.5)	23 (10.7)	102 (47.4)	76 (35.3)
8.10 I do not want to work together with co-workers who have TB	10	102 (47.0)	92 (42.4)	16 (7.4)	7 (3.2)
8.13 I am afraid of co-workers with TB	13	93 (42.9)	103 (47.5)	16 (7.4)	5 (2.3)
8.14 Healthcare workers with Tb probably also have HIV	14	95 (44.0)	96 (44.4)	19 (8.8)	6 (2.8)
8.15 I do not want to eat or drink in the same room as a co-worker who has TB	15	98 (45.4)	95 (44.0)	16 (7.4)	7 (3.2)
Respondent's Internal Stigma towards TB (TBRIS)					
8.2 If I was diagnosed with TB I would worry that my co-workers may think I have also got HIV	2	52 (24.3)	80 (37.4)	60 (28.0)	22 (10.3)
8.4 If I was diagnosed with TB I would not need to feel shame	4	11 (5.1)	24 (11.2)	103 (47.9)	77 (35.8)
8.5 As a healthcare worker I would feel it was my fault if I was infected with TB	5	91 (42.5)	90 (42.1)	20 (9.3)	13 (6.1)
8.8 If I was diagnosed with TB I would feel comfortable to tell some of my co-workers	8	5 (2.3)	29 (13.4)	105 (48.6)	77 (35.6)
8.12 If I was diagnosed with TB I would feel alone in my workplace	12	72 (33.2)	110 (50.7)	29 (13.4)	6 (2.8)

Table 2: Seven factor scales, factor loadings (alpha reliability ezstimate if item was removed), goodness-of-fit indices and alpha reliability estimates.

Items*	HIVOES	HIVOES	HIVFightOES	HIVRES	HIVRIS	TBOES	TBRES	TBRIS
6.1	0.538 (0.560)	0.544 (0.740)						
6.4	0.654 (0.544)	0.667 (0.670)						
6.12	0.729 (0.535)	0.725 (0.691)						
6.13	0.728 (0.550)	0.722 (0.687)						
6.14	0.027 (0.659)	/	/					
6.15	-0.043 (0,587)		0.759 (0.585)					
6.16	-0.037 (0.601)		0.550 (0.663)					
6.17	-0.228 (0.549)		0.670 (0.634)					
6.18	-0.228 (0.583)		0.507 (0.687)					
6.2				0.564 (0.756)				
6.3				0.457 (0.774)				
6.5				0.744 (0.724)				
6.6				0.763 (0.723)				
6.7				/				
6.8				/				
6.9				/				
6.10				0.644 (0.765)				
6.11				0.619 (0.744)				
7.1					/			
7.2					0.568 (0.742)			
7.3					0.572 (0.733)			
7.4					-0.483 (0.753)			
7.5					0.629 (0.729)			
7.6					0.465 (0.760)			
7.7					0.640 (0.728)			
7.8					0.627 (0.732)			
8.1						0.698 (0.820)		
8.3						0.780 (0.801)		
8.6						0.670 (0.829)		
8.9						0.710 (0.817)		
8.11						0.763 (0.803)		
8.7							/	
8.10							0.841 (0.813)	
8.13							0.887 (0.795)	
8.14							0.602 (0.888)	
8.15							0.830 (0.812)	
8.2								0.663 (0.530)
8.4								/
8.5								0.453 (0.634)
8.8								-0.451 (0.521)
8.12								0.703 (0.627)
Goodness-of-fit indices								
RMSEA	0.159	0.153	0.000	0.000	0.019	0.086	0.000	0.000
CFI	0.492	0.914	1.000	1.000	0.994	0.965	1.000	1.000
TLI	0.323	0.743	1.000	1.000	0.991	0.929	1.000	1.000
SRMR	0.134	0.044	0.012	0.025	0.036	0.033	0.009	0.012
Reliability								
Alpha	0.605	0.754	0.706	0.781	0.768	0.846	0.866	0.650

*Items listed in Table 1

Table 3: Estimated correlation matrix for the latent constructs

	HIVOES	HIVFightOES	HIVRES	HIVRIS	TBOES	TBRES	TBRIS
HIVOES	1						
HIVFightOES	-0,110	1					
HIVRES	0,255**	-0.441***	1				
HIVRIS	0.654**	-0,394***	0,484***	1			
TBOES	0.791***	-0,227*	0,255**	0.854***	1		
TBRES	0.334***	-0,269**	0,494***	0.669***	0.653***	1	
TBRIS	0.689***	-0,345**	0,459***	0.979***	0.955***	0.862***	1

*p < 0.05, ** p < 0.01, *** p < 0.001