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Young Women's Representations of Sexually Transmitted Diseases (RoSTD): A Psychometric Study

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Abstract

Measurement of beliefs about sexually transmitted disease (STDs) is important to understanding sexual health behaviors. The purpose of this study was to develop and test the psychometric properties of the Representations of STDs (RoSTD) Scale. The RoSTD was developed to measure young women's representations of STDs, and it is intended to be used to measure beliefs about any of the seven most common STDs. Confirmatory factor analysis indicated a four-factor structure for the 40-item RoSTD: Future Perspective, Cause, Psychosocial Consequence, and Identity. Internal consistency for the subscales (measured for each of 7 different STDs) ranged from .67- . 93 and 2-week test-retest correlations ranged from .69-.90. The RoSTD shows evidence of reliability and validity in young women.

Keywords

Health Beliefs; Women's Health; Instrument Development; Theory Construction

Sexually transmitted diseases (STDs) pose a significant long-standing public health concern. It is estimated that young people (aged 15-24 years) contract almost half of the 19 million new STD cases that occur annually in the United States (Weinstock, Berman, & Cates, 2004). Both biological and social factors render young women more susceptible than men or older women to STDs and their consequences (Centers for Disease Control and Prevention, 2010). In a recent study, one in four (26%) young women (aged 14 to 19) had at least one of the most common STDs, which equates to more than 3.2 million young women currently infected (Forhan et al., 2009).

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[1]Items deleted: 1) What is the chance of getting this STD when you have sex with someone who does not look clean? 2) If I have this STD the health care provider will contact my parents, and 3) You can tell by looking at a person if she/he has this STD.

[2]Items Deleted: 1) This STD can cause cancer, 2) Very few people have this STD, and 3) If I had this STD, and did not get treatment, the symptoms would go away eventually.

[3]Items Deleted: 1) This STD can be passed to the baby during the birth process, 2) This STD, if left untreated, can cause problems with getting pregnant, 3) Having this STD means I would have to contact my past sexual partners, 4) If I have this STD the health care provider will contact my sexual partners, 5) If I have this STD the health care provider will have to contact the health department, and 6) I could have this STD and not know it.

There are eight major STDs, although more than 30 diseases can be spread by sexual contact (World Health Organization, 2007). Of the eight most common STDs, half can be cured with medication, the other half cannot. The curable STDs include gonorrhea, chlamydia, trichomoniasis, and syphilis. The incurable STDs are genital herpes (HSV), human papillomavirus (HPV), hepatitis B (HBV), and human immunodeficiency virus (HIV). Whether curable or incurable, STDs can result in a number of negative consequences for young women. For example, if not diagnosed and treated promptly, some STDs can result in pelvic inflammatory disease, sterility, and cancer (World Health Organization, 2007). Additionally, negative emotional and psychosocial consequences of an STD diagnosis are common (Nack, 2008) and include feelings of embarrassment and anger (Royer & Zahner, 2009) as well as concern about the impact of the STD diagnosis on current and future relationships (Keller, Jadack, & Mims, 1991; Melville et al., 2003). Given the large number of young women affected, as well as the serious consequences of these illnesses, there is a critical need to reduce the prevalence of STDs among this population.

Misconceptions About STDs

Many young people have misconceptions regarding the prevalence and risk of STDs, the modes of transmission, and the potential health consequences of these illnesses. According to one nationally representative U.S. sample of more than 1,800 young people ranging in age from 13-24, half (51%) did not know that 25% of sexually active young people (<25 years old) contract a STD annually. Thirteen percent were unaware that STDs can be transmitted via oral sex; 15% believed that STDs can only be transmitted when symptoms are present; and 12% believed that only those who have many partners need to worry about STDs. More than half (60%) did not know that STDs can cause certain types of cancer; 35% did not know STDs can result in an increased risk of contracting HIV/AIDS; and 18% did not know that infertility may result from STDs (Kaiser Family Foundation, 2003). These misconceptions are alarming, given the potential for these beliefs to contribute to STD transmission. It is essential that STD-related beliefs are comprehensively understood, particularly among young women who are disproportionately affected by these illnesses.

Common Sense Model

The Common Sense Model (CSM) provides a theoretical framework for examining a patient's beliefs about an illness (Leventhal, Meyer, & Nerenz, 1980; Leventhal, Nerenz, & Steele, 1983). The CSM posits that individuals have beliefs about illnesses, called illness representations, and these beliefs, regardless of whether or not they are medically accurate, guide subsequent health behaviors. For example, there is evidence that accurate HPV illness representations are associated with safer sex practices (von Sadovszky, Carlson-Dakes, Keller, 2000). According to the CSM, illness representations have five dimensions: cause, identity, timeline, consequences, and cure/control. *Cause* refers to beliefs about the sources of an illness. *Identity* refers to beliefs about the symptoms associated with an illness. *Timeline* beliefs are about the length of the illness. *Consequence* refers to beliefs about the outcomes of an illness. Finally, *cure/control* reflects beliefs about whether an illness is curable and/or can be controlled.

In previous research, STD illness representations (HPV, HSV, and HIV) were consistent with the dimensions of the CSM (Keller, 1993; Sacajiu et al., 2007; von Sadovszky et al., 2000). However, these studies were either qualitative or used representational instruments that had not been subject to statistical analyses to determine the structure of STD representations.

Measuring Illness Representations

Measuring STD illness representations is vital to understanding how people think about STDs and subsequently to improving sexual health care. However, no available instrument specifically assesses representations of STDs.

The Illness Perception Questionnaire (IPQ; Weinman, Petrie, Moss-Morris, & Horne, 1996), the IPQ-R (Moss-Morris et al., 2002), and the Brief IPQ (Broadbent, Petrie, Main, & Weinman, 2006), have been used to assess illness representations across more than 44 diseases, including HIV and HPV (Henderson, Safa, Easterbrook, & Hotopf, 2005; Ireland, Reid, Powell, & Petrie, 2005; Reynolds et al., 2007). However, the IPQ measures have significant limitations for measuring STD representations. First, the items used to measure the Cause dimension do not include most of the actual causes of STDs. For example, the sexual risk behaviors that result in STD transmission (e.g., sexual intercourse without a condom or oral sex) are not included. Second, the IPQ does not adequately address the major consequences commonly associated with STDs (e.g., sexual impact, intimate partner issues). Consequences may be an essential dimension on which to target interventions to improve STD prevention and management. Third, the IPQ as well as other measures that have been used to measure STD representations (Keller, 1993; von Sadovszky et al., 2000) have only been used to assess beliefs about HIV, HPV, and HSV. Whether these measures are also suitable for assessing beliefs about other STDs is not known. Both clinicians and researchers need a valid and reliable instrument that is specific enough to measure young women's representations of STDs yet general enough to be useful in assessing beliefs about any of the eight most common STDs.

This gap and limitations led to the development of the Representations of STD (RoSTD) instrument. Using the CSM as a guiding framework, the purpose of this study was to develop and test the psychometric properties of the RoSTD.

Methods

Study Overview

This study was conducted in three phases. Preliminary work to develop the RoSTD instrument and establish the content validity was conducted in phases 1 and 2 respectively. Psychometric testing was conducted in phase 3. Only summaries of the first two phases are provided as they were considered preliminary work. The psychometric testing conducted in the third phase is described in greater detail. Human subject approval for all phases of this study was received from a University Health Sciences Institutional Review Board.

Item Generation: Phase 1

The purpose of Phase 1 was to generate items for the RoSTD instrument. According to Lynn (1986), item generation is a three-step process: (a) identifying the full content domain, (b) sampling from the content domain and generating items for the instrument, and (c) assembling the items into a usable form. Qualitative studies for the purpose of item generation typically include 5-10 subjects (Lynn, 1986).

Semi-structured interviews (guided by the CSM dimensions) were conducted with women (n = 7) recruited from two racially and socioeconomically diverse women's health clinics located in two Midwestern states. Eligible participants were English speaking women 18-24 years of age. The interviews were conducted at the clinic following the women's gynecological examinations. Women were not asked to disclose their reason for the clinic visit, and STD status was not assessed, to enhance patients' comfort level and confidentiality. The audio-taped interviews were transcribed and content analysis

(Krippendorf, 1980) was conducted. The unit of analysis was the young women's responses to each interview question. Initial coding was conducted separately by two researchers who coded the transcripts for the major themes using a predetermined coding scheme based on the five dimensions of the CSM. Inter-rater reliability (percent agreement) for the initial coding ranged from 75%-91% (M = 85%). Differences in coding were resolved through discussion to determine the final codes. Agreement of 100% was reached in all instances of coding discrepancy.

Items were generated for the RoSTD based on the analyzed interviews as well as an extensive literature review in which other illness representation instruments were examined. The RoSTD instrument contained a total of 51 items across five subscales consistent with the dimensions of the CSM (cause, identity, timeline, consequence and cure/control).

Content Validity Testing: Phase 2

The purposes of Phase 2 were to: (a) test the content validity of the RoSTD and (b) revise the RoSTD based on feedback from the panelists. Two panels (expert n = 8 and patient n = 10) were recruited (Lynn, 1986). The patient panelists (18-24 year old women able to speak and read in English) were recruited from the same clinics as in Phase 1. The expert panelists consisted of both clinicians (n = 5) and researchers (n = 3). The clinicians had expertise in women's health and STDs, and the researchers had expertise in instrument development and the CSM. The women's health clinicians were drawn from the same clinics as the patient panelists.

A Content Evaluation Instrument (CEI) was developed so the expert and patient panels could indicate whether each item on each instrument was content valid (Grant & Davis, 1997; Lynn, 1986; Rubio, Berg-Weger, Tebb, Lee, & Rauch, 2003). The CEI asked participants to rate the *relevance* (worded as *importance* for patient panel) of each item using a 4-point ordinal scale from *Not at all Relevant* (1) to *Extremely Relevant* (4) and the *clarity* of each item using a 4-point ordinal scale from *Not at all Clear* (1) to *Extremely Clear* (4). Clarity scores were used to guide whether items needed to be rewritten for clarity. No items scored <3.00, consequently none were rewritten.

Two indices were calculated to determine which items should be retained using the relevance/importance ratings: a mean relevance score and an item level content validity index (I-CVI). The mean relevance/importance scores for each item were averaged over the expert and patient panel for a combined score. Scores ranged from 1-4 with higher scores indicating greater item relevance/importance. The content validity of the individual items (I-CVI) were identified by determining the proportion of panelists (expert and patient) that gave an item a relevance/importance rating of 3 or 4 (Polit & Beck, 2006). I-CVI scores can range from 0 - 1, with higher scores indicating greater validity (Polit & Beck, 2006). Based on these two indices, an item was retained if it had a mean relevance/importance score of ≥ 3.00 and an I-CVI of ≥ .78; three items were deleted[1] (Polit & Beck, 2006).

After the three items were deleted, the scale level content validity index (S-CVI/Ave) was calculated (Polit & Beck, 2006). The combined Expert and Patient panel's I-CVI score for each item was averaged to determine the S-CVI/Ave score for the entire instrument. S-CVI/Ave scores can range from 0 - 1, with higher scores indicating greater content validity of the overall instrument (Grant & Davis, 1997; Lynn, 1986; Polit & Beck, 2006; Rubio et al., 2003). The S-CVI/Ave for the Expert and Patient panels combined was .92. According to Polit and Beck (2006), S-CVI/Ave of .90 or higher suggests excellent content validity. Based on feedback from the expert panelists, one additional item was added to the RoSTD Cure/Control subscale: “If I had this STD and did not get treatment, the symptom would eventually go away.” The final version of the RoSTD contained 49 items with 5 subscales.

Items per subscale were: Cause = 7, Identity = 9, Consequence = 22, Timeline = 4, and Cure/Control = 7.

Instrument Testing: Phase 3

The specific aims of Phase 3 were to: (a) test the construct validity of the RoSTD and (b) determine the test-retest and internal consistency reliability of the RoSTD. Phase 3 was a cross-sectional survey study with a subgroup of individuals participating in the test-retest at a 2-week interval. Participants were asked to complete two instruments: a demographic and health information questionnaire and the RoSTD.

The eligibility criteria were: female, aged 18-24 years, able to speak and read in English. Women (n = 302) were recruited from four women's health clinics and one university class. The original sample size justification was based on the recommended 300 participants for a "good" factor analysis (Comrey & Lee, 1992). However, more stringent rules of thumb were also used to assess sample size adequacy. The sample size was adequate for confirmatory factor analysis (CFA) based on both a 5:1 subject to variable ratio (40 variables) and a 5:1 subject to parameter ratio (46 parameters; Bryant & Yarnold, 1995). Recommended sample sizes based on these ratios were n = 200 and n = 230 respectively. The adequacy of the actual sample size (n = 302) was supported by all three sample size criteria. A sample of 30 women was required to have power of .80 to detect a test-retest correlation of .90 at a significance level of .05. A total of 54 participants completed the test-retest.

Demographic and health information—Participants were asked to report the following information: age, ethnicity, race, education level, relationship status, history of STD testing, history of STD diagnosis, and, for clinic participants only, the purpose of their gynecological examination (response options were: Pap test, STD testing, I was sick, general health exam, birth control, or other).

Representations of STDs (RoSTD)—The RoSTD consists of 49 items and has five subscales: Cause, Identity, Consequence, Timeline, and Cure/Control. Six items out of 49 were reverse coded to reduce response bias. There is no total score for the RoSTD. Please see Table 1 for a description of the RoSTD.

Classroom participants were recruited from an introductory communication disorders course at a Midwestern university. Of the 280 students enrolled in the course, approximately 85% were women. At the beginning of one class a researcher distributed the survey packets to all female students and briefly explained the study. The survey packet contained the study informed consent form, demographic and health information questionnaire, two copies of the RoSTD, (original and test-retest), instructions for the test-retest, and two envelopes. The entire class was informed of the eligibility criteria, and those eligible were asked to privately complete the survey packet after class, place the survey in a sealed envelope, and bring the sealed envelope back to class the following class day. The students were instructed to complete the original surveys immediately and then wait two weeks to complete the test-retest surveys (again, outside of the classroom). The participants received $5 in appreciation for their time.

The exact response rate was difficult to determine because of procedures to protect anonymity. An estimate of the response rate was made based on the fact that approximately 85% of 280 students (n = 238) typically attended class, and we received 101 surveys back (i.e., 101/238 = 42%). This may underestimate the response rate, given that fewer than 238 students may have attended class that day.

Young women were also recruited at four women's health clinics by clinic staff. One of the clinics was located on a university campus and provided low cost health care for students enrolled in the university. Another clinic was affiliated with an urban public health department specializing in STD care, and the remaining two clinics specialized in family planning and were located in urban settings. If a clinic patient was eligible and interested in participating, the clinic-based researcher was notified and met with the patient to explain the study. Following their clinic appointments, the women received the survey packets from the researcher and completed them privately in a clinic room and placed completed surveys in a sealed envelope. All participants were asked if they would also be interested in participating in the test-retest portion of the investigation. If so, the researcher gave the participant a second packet containing the postage paid envelope and the RoSTD and instructed the participants to complete the second packet 2 weeks later and return by mail. Participants took approximately 30 minutes to complete the measures. The participants were given $5 in appreciation of their time.

IRB-required procedures to protect participant anonymity limited the ability to determine response rates. Clinic staff did not record the number of women approached nor the number of women who declined. However, all women who showed interest in the study and met with the clinic-based researcher agreed to participate in the study.

In order to assess the reliability and validity of the RoSTD for each of 8 STDs, women were asked to complete the measure separately for each of 8 STDs. The order of the STDs on the RoSTD was determined by chance and was the same for all respondents: gonorrhea, chlamydia, trichomoniasis, syphilis, human papillomavirus, herpes simplex virus, hepatitis B, and Human Immunodeficiency Virus. Although the eventual goal was that the RoSTD for each STD could be used independently, it was not feasible, in terms of time and expense, to have 8 separate samples of approximately 300 young women to complete the psychometric testing for each STD separately.

NORM version 2.03 was used to assess the randomness of missing data and to impute missing data. Two subjects with more than 50% missing data were dropped from analysis. NORM determined that all missing data was random, and the percentage of missing data was <5%. NORM was then used to impute missing data. Data were analyzed using SPSS (version 16), MPlus (version 4), and the Composite Reliability Estimator (version 1.0). Sample characteristics were examined using descriptive statistics. Construct validity was examined with exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Two indices of internal consistency reliability, Cronbach's alpha and the composite reliability, were computed for each subscale of the RoSTD (separately for each of the 8 STDs). Test-retest reliability was determined by correlating Time 1 RoSTD subscale scores with the Time 2 subscale scores. Repeated measure, within subject ANOVAs were conducted on the Time 1 data to examine whether the mean scores of the 4 subscales (which were generated based on unity weighting) differed across the various STDs, followed by post hoc pairwise comparisons.

Results

The sample consisted of young women (n = 302) with an average age of 20.3 years (SD = 1.8). One-third were recruited from the university class (n = 101, 33.4%) and other two-thirds were recruited from the clinics (n = 201, 66.7%). The majority of participants described themselves as White (n = 236, 78.1%) and not Hispanic (n = 270, 89.4%); 18% (n = 55) were racial/ethnic minorities. In 2009, among people 20-24 years of age (50% of whom are women), 77% were White, 15% were African American, 4% were Asian and 18% identified as Hispanic (U.S. Census Bureau, 2010)

The sample was well educated; 93% (n = 281) of the participants were educated beyond high school. Nearly half of the sample (n = 150, 49.7%) described themselves to be in *serious* romantic relationships, and two-thirds (n = 188, 62.3%) of the participants reported having received STD testing at some point in their lives. Some of the participants (n = 44, 12.6%) reported having a history of an STD diagnosis. The most prevalent STD diagnosis reported was HPV (n = 23, 7.6%) followed by chlamydia (n = 13, 4.3%). Among the clinic participants the most common reasons for the clinic visit were for birth control (n = 144, 47.7%), a Pap test (n = 47, 15.6%), and STD testing (n = 35, 11.6%). The retest sample consisted of 54 young women (mean age 19.2 years, SD = 1.5 years). Nearly all of the test-retest participants (n = 50, 92.6%) were drawn from the classroom setting, were White (n = 42, 80.8%), and all had education beyond high school. One-third described themselves to be in *serious* romantic relationships (n = 20, 37%), 7.4% had a history of an STD (n = 4) and 41.5% reported having been tested for STDs (n = 22).

Specific Aim 1: To Test the Construct Validity of the RoSTD

It was initially proposed that only a confirmatory factor analysis (CFA) would be conducted to confirm the theorized factor structure of the RoSTD, but due to low internal consistency scores of the proposed CSM subscales it was necessary to first explore the factor structure using exploratory factor analysis (EFA) and then conduct a CFA to confirm the factor structure using the same data set. This approach is particularly effective (even better than the split sample approach) when the data are guided by theory, experts, and clinical judgment (Kroonenberg & Lewis, 1982).

Prior to EFA, an item analysis of the theorized RoSTD subscales (identity, timeline, consequence, and cure/control) was carried out to determine if any items should be deleted. An item analysis of the Cause subscale was not conducted as the items were not expected to create a single Cause dimension. Items were deleted if they had an item-total correlation of < .30 across all 8 STDs, if deleting it increased the alpha, and if it was not theoretically necessary to keep the item (Nunnally & Bernstein, 1994). Only 3 of 49 items were deleted[2]. Item refinement prior to EFA is acceptable given the goal of developing a parsimonious measure. Three items were deleted because of lack of theoretical relevance and applicability across the 8 STDs. The final scale consisted of 46 items.

Using the MPlus statistical package, an unweighted least squares (ULS) EFA with oblique (Promax) rotation was performed on the scores of the RoSTD. In MPlus Version 4, the ULS approach was most appropriate given the categorical nature of the data. Categorical data is commonly skewed (Muthén, 1984) and the categorical estimator in Mplus corrects for any potential skewedness. The oblique rotation was used because it was likely that there was some correlation between the factors, and this rotation allowed the factors to correlate with each other during the rotation, making the results more interpretable. Sampling adequacy (factorability) was determined by assessing the correlation matrix, descriptive statistics, and feedback from our content validity testing experts. Separate EFAs were conducted for each of the eight STDs. Cause items were included in the EFA, given the exploratory nature of this study. Four criteria were evaluated for the appropriate factor solution: eigenvalues > 1, scree plots, Root Mean Square Residual values, and the parsimony of the factor solutions.

Because of the large number of preliminary results generated by the eight EFAs, only summaries are presented. The EFAs indicated that each STD had a similar number of factors with eigenvalues >1. However, the large number of factors (11-16) with eigenvalues >1 for each STD suggested a non-parsimonious solution. Scree plots were assessed to determine the number of factors (Tabachnick & Fidell, 2001). For all eight STDs, scree plots suggested four factors. Next, the 4, 5, 6, and 7 factor solutions for the eight STDs were examined using the Root Mean Square Residual (RMSR), with very small differences in RMSR scores

noted. Thus, all solutions were similar across all eight STDs. Extracting a larger number of factors (5, 6, or 7) resulted in solutions with more low level factors. When low level factors are present, combing them into higher level factors by extracting fewer factors is recommended (Comrey & Lee, 1992). Thus, the four factor solution was selected because it was consistent across the eight STDs, was the most parsimonious, and had interpretable, meaningful factors.

The loading for each item was compared across factors, and items with loadings ≥ 0.32 were retained (Tabachnick & Fidell, 2001). When items loaded on more than one factor, the following procedure was used. First, items were placed with the factor that had the highest loading. However, because the RoSTD measures representations of an STD across 8 different STDs it was important to have item consistency among the factors across the 8 STDs. Occasionally, it was necessary to place items on a specific factor because the items loaded on that factor for a majority of the STDs. Six items having consistently low factor loadings and high residual variances across the STDs were deleted from the RoSTD[3]. After these changes, the EFAs had 40 items loading on four factors that were consistent for the 8 STDs and named: Future Perspective, Cause, Psychosocial Consequences, and Identity. Table 2 displays the factor loadings for the RoSTD scales for chlamydia, which are similar to the factor loadings for the other STDs. (Tables for the remaining 7 STD EFA factor loadings are available from the author by request).

The Future Perspective factor had 14 items measuring beliefs related to the chronicity and future health-related responsibilities associated with an STD diagnosis. The Cause factor had seven items that measured beliefs about the sexual behaviors that may result in STD transmission. The Psychosocial Consequences factor had 12 items that included beliefs about the social and mental health outcomes of an STD diagnosis. The Identity factor had seven items measuring the physical symptoms believed to be associated with an STD diagnosis.

Next, to verify the factor structure identified by the EFAs, a Weighted Least Squares (WLS) Confirmatory Factor Analysis (CFA) with oblique (Promax) rotation was performed separately for each of the eight STDs. MPlus was used for this analysis, and modification indices were not requested. The WLS CFA for HIV was unsuccessful due to a lack of variance in scores for several items. This issue is discussed below.

The factor loadings for the remaining seven STDs were statistically significant as indicated by the Wald Tests (>1.96) with the exception of two items for HSV. Those two HSV items were retained, given the significance of these items for the remaining STDs. Overall, the significant loadings suggest the items were good indicators of the proposed factors for the seven STDs. Next, the Average Variance Extracted (AVE) was determined using the Composite Reliability Estimator Version 1.00 (Brown, 2006). The AVE is the amount of variance from a factor in relation to the amount of variance from measurement error (Fornell & Larcker, 1981). The AVE for each factor was calculated separately for each STD. An AVE value ≥ .5 means that a factor explains more than 50% of the variance. Across the STDs the values ranged from .33 to .51 for Future Perspective, from .45 to .55 for Cause and Psychosocial Consequence factors, and from .25 to .35 for Identity.

The fit of the model was examined with the Chi-Square Test of Model Fit, Ratio of Chi-Square to Degrees of Freedom, Comparative Fit Index (CFI), Tucker Lewis Index (TLI), Root Mean Square Error of Approximation estimate (RMSEA), Standardized Root Mean Square Residual value (SRMR), and the Weighted Root Mean Square Residual value (WRMR; Table 3). These fit indices suggested a reasonable fit for the seven STDs (without HIV).

Finally, the correlations between the factors were examined for each STD. All correlations were <.80, which suggests good discriminant validity between the four factors of the RoSTD. The ranges of the correlations were: Identity and Cause (r = .09 - .34), Identity and Future Perspective (r = .02 - .46), Identity and Psychosocial Consequence (r = .20 - .51), Cause and Future Perspective (r = .00 - .18), and Cause and Psychosocial Consequence (r = . 10 -; .30). The Future Perspective and Psychosocial Consequence factors had the strongest correlations across STDs (r = .33 - .62). Evidence for discriminant validity between the factors was also assessed by evaluating whether the AVE value (determined previously for the four RoSTD factors) was greater than the square of the factors' correlation with the other factors (Fornell & Larcker, 1981). Although the AVE value was generally greater than the squared correlation, exceptions included the correlations between the Future Perspective and Psychosocial Perspective factors for gonorrhea (.35) chlamydia (.38), syphilis (.35), and hepatitis B (.34); between the Future Perspective and Identity factors for trichomoniasis (. 25); and between Psychosocial Consequence and Identity for HSV (.26).

Overall, the proposed four factor model seemed an adequate fit of women's representations of an STD given the significant factor loadings, moderate to good amount of variance explained by each factor, good discriminant validity between the factors, and reasonable to moderate fit indices for each STDs (HIV was not evaluated). These results provide evidence for the construct validity of the RoSTD.

Specific Aim 2: To Determine the Internal Consistency and Test-retest Reliability of the RoSTD

Internal consistency reliability was established for each of the four RoSTD subscales separately for each of the seven STDs (HIV was excluded given the inability to perform CFA) by computing Cronbach's alpha and composite reliability. Composite reliability was examined because Cronbach's alpha can underestimate reliability (Graham, 2006). For a new scale to be considered satisfactorily reliable, it should have an alpha >.70 (Nunnally & Bernstein, 1994) or composite reliability score of >.70.

Based on Cronbach's alpha results, the Future Perspective, Cause and Psychosocial Consequence subscales were reliable for each STDs. The Identity subscales had reliabilities ranging from .53 to .67 (Table 4). The Composite Reliability for each factor was determined by using the Composite Reliability Estimator Version 1.00 (Brown, 2006). The Composite Reliability values (Table 4) were higher than the previously calculated Cronbach's alpha values. Good internal consistency reliability was established for the Future Perspective, Cause, and Psychosocial Consequence subscales for each of the seven STDs. The Identity subscale had internal consistency scores > .70 for all but trichomoniasis (.67) and HSV (. 69).

The temporal stability of the RoSTD was established by conducting 2 week test-retest reliability of the RoSTD subscales. All of the subscales had test-retest correlation coefficients ranging from .69 - .90, providing evidence for the stability of the RoSTD over a 2 week time period (Table 4).

The final RoSTD consists of four subscales. The Future Perspective subscale represents beliefs related to the future health implications associated with an STD diagnosis in terms of chronicity (i.e., STD is not curable). This subscale consists of 14 items. Each item is rated on a 4-point scale, ranging from *Not Likely* (1) to *Very Likely* (4). Five items are reverse coded. Scores can range from 14 – 56. Higher scores suggest stronger beliefs about the negative impact of the STD diagnosis on the future.

The Cause subscale contains seven items. This subscale represents beliefs regarding the sexual risk behaviors associated with STD transmission. Each item is rated on a 4-point scale, ranging from *Low* (1), to *High* (4). Scores can range from 7 - 28, and higher scores suggest greater recognition of the sexual behaviors that place an individual at risk for transmission of the STD.

The Psychosocial Consequences subscale represents beliefs about the psychosocial outcomes of an STD diagnosis including impact on mental health and intimate relationships. This subscale consists of 12 items. Each item is rated on a 4-point scale, ranging from *Not Likely* (1) to *Very Likely* (4). Scores can range from 14-48, high scores suggest stronger beliefs about the negative impact of the STD diagnosis on mental health and intimate relationships.

The Identity subscale has seven items. This subscale represents beliefs about physical symptoms associated with an STD diagnosis. Each item is rated on a 4-point scale, ranging from *Not Likely* (1), to *Very Likely* (4). Scores can range from 7-28, high scores endorsed the presence of more physical symptoms related to the STD, which may or may not be correct.

Although an attempt was made to conduct a confirmatory factor analysis (CFA) on the HIV RoSTD, it was unsuccessful due to the lack of variance in responses to some of the HIV RoSTD items. For example, 96% of participants responded, *Very Likely* to the item, "I could die from this STD." For this reason it was not possible to conduct a CFA using MPlus.

Although a detailed description of women's STD related beliefs exceeds the scope of this manuscript, Table 5 lists the RoSTD subscale scores for each of the 7 STDs, which were generated based on unity weighting. In general, women's beliefs significantly differed by STD type. A within subjects ANOVA with a Greenhouse-Geisser correction indicated that the mean scores of the 4 subscales significantly differed across the various STDs [Future Perspective = $F(3.30, 1800) = 403.01$, $p < .01$; Cause = $F(4.52, 1806) = 86.96$, $p < .01$; Psychosocial Consequence = $F(3.65, 1806) = 52.64$, $p < .01$; and Identity = $F(3.98, 1800) = 130.68$, $p < .01$].

Post-hoc pairwise within subject mean score comparison, with a Bonferroni correction, for each subscale mean was examined across STDs. Comparisons for the Future Perspective were significantly different from the means of the other STDs at $\alpha < .05$ with the exception of Gonorrhea and Trichomoniasis (*SE* of 0.02(−0.05), $p = .23$, 95% CI = -0.11- 0.01). The Cause means for each STD was significantly different from the means of the other STDs with the exception of three pairs: Gonorrhea and HPV (*SE* of 0.03(0.08), $p = .40$, 95% CI = −0.02 - 0.19), Trichomonaisis and Hepatitis B (*SE* of 0.03(−0.02), $p = .99$, 95% CI = −0.11 - 0.06), and Syphilis and HPV (*SE* of 0.03(−0.01), $p = .99$, 95% CI = −0.12 - 0.09). The Psychosocial Consequence mean for each STD was significantly different from the means of the other STDs with the exception of three pairs: Chlamydia and Trichomoniasis (*SE* of 0.02(0.03), $p = .99$, 95% CI = −0.29 - 0.10), Chlamydia and HPV (SE of 0.04(0.07, $p = .99$, 95% CI = −0.04 - 0.18) and Trichomoniasis and HPV (SE of 0.03(0.03), $p = .99$, 95% CI = −0.06 - 0.13). Finally, the Identity means for each STD were significantly different from the means of the other STDs with the exception of two pairs: Gonorrhea and Syphilis (*SE* of 0.03 (0.03), $p = .99$, 95% CI = −0.05 – 0.10) and Chlamydia and Syphilis (*SE* of 0.03 (−0.05), $p = .99$, 95% CI = −0.14 – 0.04).

These findings suggest that women were not responding to all of the items in the same way across the STDs. Rather, women seem to have different beliefs about the various STDs. For example, women believed that the future health related consequences of Chlamydia (Future

Perspective subscale score $M = 1.84$) are less severe than the future health related consequences of HSV (Future Perspective subscale score $M = 2.96$).

Discussion

In this study, the RoSTD instrument was developed and the psychometric properties were examined. This initial psychometric testing of the RoSTD provided evidence of both reliability and validity. This investigation is the first to conduct factor analysis on a measure of STD representations. According to the CSM (Leventhal et al., 1980; Leventhal et al., 1983) regardless of type of illness, representations have five dimensions: Cause, Identity, Timeline, Consequences and Cure/Control. The results of this analysis provided a description of the structure of representations that differs from the structure proposed by the CSM. Women's STD representations had four dimensions: Cause, Psychosocial Consequences, Identity, and Future Perspective. The Future Perspective dimension consisted of a combination of items from three of the original CSM dimensions: timeline, consequence (i.e., physical health consequences), and cure/control. The Psychosocial Consequence, Cause and Identity dimensions identified in this study were similar to the Consequence, Cause and Identity dimensions proposed by the CSM.

Previous researchers found significant relationships among some of the dimensions of the CSM. A meta-analysis of studies ($n = 45$) using the CSM across a variety of different illnesses found positive correlations between the timeline and consequences dimension (Hagger & Orbell, 2003). Leventhal and colleagues (1980) suggested that individuals will have a characteristic representation of an illness that is specific to the type of the illness. If so, conducting factor analysis on theoretically based items will result in parsimonious categories of illness representations. Therefore, it is not surprising that our factor analyses (across a variety of STDs) resulted in a dimension (Future Perspective) that combined several dimensions originally proposed by the CSM.

Of the four subscales, the Identity subscale had less robust results for both reliability and validity. This is likely due to the nature of this dimension. The Identity dimension represents beliefs about the presence of physical symptoms associated with an STD. Each of the seven most common STDs can have a symptom presentation ranging from being asymptomatic to very apparent symptoms. Not surprisingly then, people are often confused about the symptoms associated with STDs and do not recognize that STDs can be asymptomatic (Royer & Zahner, 2009). Because of this confusion, the survey sample may have responded inconsistently or with greater variability to the Identity items, which would have negatively affected the reliability and validity of this subscale. This dimension is nonetheless important. For example, the presence of symptoms is the most common reason why a young woman would seek STD testing (Royer, 2010). Given the possibility of asymptomatic infections, understanding young women's beliefs about STD symptoms is necessary to ensure adequate STD related health care.

A goal of this study was to develop a measure of women's STD representations that could be used for both research and clinical practice. Developing a measure that is theoretically guided and relevant to clinical practice and yet has sound psychometric properties was challenging. The fit indices for the four factor model of representations were generally below the standards for “good to excellent” model fit. The problems described above related to the Identity dimension may have negatively affected these indices of model fit.

Fit refers to the ability of a model to reproduce data. However, model fit indices are just one part of construct validity. When viewed within the context of the other evidence of construct validity, the proposed four factor model seemed an adequate fit of women's representations

of an STD, based on the significant factor loadings, moderate to good amount of variance explained by each factor, and good discriminant validity between the factors. Given that the RoSTD measures representations across seven STDs and has dimensions that are both theoretically and clinically relevant, the RoSTD shows a degree of promise for robust performance in both research and practice.

An attempt to conduct a confirmatory factor analysis (CFA) on the RoSTD for HIV was unsuccessful due to the lack of variance in responses to some of the items. The lack of variance in responses suggests that young women have more consistent beliefs about HIV. This may be due to the broader public awareness of HIV and its consequences. Although other measures of HIV beliefs and knowledge exist, many do not specifically examine HIV representations. Those that do have not been psychometrically examined in a population of young women. Although HIV representations may be more consistent, this does not mean they are more medically accurate or that psychosocial concerns about HIV do not exist. Understanding HIV representations is necessary to guide patient-centered HIV education and counseling. Additional work is needed to examine the psychometric properties of the HIV RoSTD as well to examine HIV representations among young women.

Two caveats about the RoSTD formatting must be addressed. First, the RoSTD was formatted to measure young women's representations across STDs solely for the purposes of this psychometric study, as it was not feasible to have 8 separate samples of approximately 300 young women complete the RoSTD. However, it was expected that the RoSTD would be used to measure women's beliefs about an individual STD. It is important to note that the order in which the STDs were listed on the RoSTD in this study may have resulted in an order effect response bias (Krosnick & Presser, 2010). If future work does include using the RoSTD to measure representations of more than one STD simultaneously, strategies such as counterbalancing the order of scales (Krosnick & Presser, 2010) must be considered to examine potential response bias due to ordering effects. Second, the RoSTD was not formatted to include a *Don't Know* response option, as this would have increased the difficulty of psychometric testing. However, clinicians may want to consider including a *Don't Know* response option to allow women to more directly indicate uncertainty.

The consequences of an STD seem to be salient in STD representations among young women. Two of the four representational dimensions are related to the consequences of an STD diagnosis: Future Perspective and Psychosocial Consequences. The Future Perspective dimension has to do with the future health implications of an STD diagnosis. The Psychosocial Consequence dimension has to do with the negative impact of an STD diagnosis on an individual's mental health and intimate relationships. The RoSTD Future Perspective subscale scores for the incurable STDs were high, suggesting negative beliefs, as were the Psychosocial Consequence subscale scores regardless of STD type. The salience of the consequences of an STD diagnosis has been supported in other investigations (Bertram & Magnussen, 2008; Nack, 2008; Waller, Marlow, & Wardle, 2007). Keller and colleagues (1991) examined the disease-related stressors of individuals ($n = 13$) with genital herpes (HSV) during the first six months after diagnosis. The participants identified 286 disease related stressors that could be organized by the representational dimensions of the CSM. At the point of diagnosis, 70% of the stressors were related to the consequences of HSV (Keller et al.). Albeit an older investigation, the findings remain highly pertinent; the consequences of an STD diagnosis are an integral part of an STD illness representation. Given the salience of the consequence dimensions, health care providers and educators should consider the consequences of an STD diagnosis in terms of both a woman's future health and psychosocial implications.

Limitations

First, in spite of attempts to recruit a diverse sample, the young women in this sample were largely well educated and Caucasian. This limits the ability to generalize the findings. Given the greater burden of STDs among other racial groups including African Americans (Forhan et al., 2009), further psychometric testing of the RoSTD in samples with greater racial diversity is necessary. Second, as previously mentioned, there was the potential for response set bias due to order effects, given that the women were asked to complete the RoSTD multiple times, once for each STD, without varying the order of presentation (Krosnick & Presser, 2010). Third, because of procedures to protect participant anonymity, the ability to determine response rates, and thus have a better idea of the generalizability of the results, was limited.

Conclusions

According to the Common Sense Model, illness representations guide health behavior. If so, clinicians and researchers must have the ability to measure and understand young women's STD representations in order to improve education and counseling and to direct the development of patient-centered interventions to improve sexual health in this population. The initial psychometric testing of the RoSTD provides evidence of reliability and validity in a sample of young women. This 40-item measure can be used to measure women's STD representations for any of the following STDs: gonorrhea, chlamydia, trichomoniasis, syphilis, human papillomavirus (HPV), herpes simplex virus (HSV), and hepatitis B. The RoSTD may allow STD education and counseling to be tailored specifically to a woman's STD illness representations and thus lead to better sexual health outcomes (Lauver et al., 2002).

Future research in this area is crucial. Further testing is necessary to assess the psychometric properties of the RoSTD among young women of diverse backgrounds. Future research should also evaluate the similarities and differences in women's beliefs about the various STDs and which representational dimensions are most strongly associated with sexual health outcomes. This research could be useful in developing interventions to promote sexual health.

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Table 1

RoSTD- Following Phase 2 Content Validity Testing

Subscale	Content Measured	# Items	Response Options	Subscale Score Interpretation	Example Item
Cause	Beliefs about the causes (i.e., sexual risk behaviors) of STD transmission	7	Four-point ordinal scale ranging from *Low* (1) to *High* (4)	A total Cause subscale score would not be computed*	What is the chance of getting this STD when you have vaginal sex without a condom with a new partner?
Identity	Beliefs about the symptoms associated with an STD	9	Four-point ordinal scale ranging from *Not Likely* (1) to *Very Likely* (4)	Higher scores indicated beliefs about the presence of more physical symptoms	If I had this STD, I would have physical symptoms.
Consequence	Beliefs about the consequences of an STD diagnosis	23	Four-point ordinal scale ranging from *Not Likely* (1) to *Very Likely* (4)	Higher scores indicated beliefs about more severe consequences	Having this STD would make me feel ashamed or embarrassed.
Timeline	Beliefs about the chronicity of an STD	4	Four-point ordinal scale ranging from *Not Likely* (1) to *Very Likely* (4)	Higher scores indicated beliefs about greater chronicity	This STD will last a long time.
Cure/Control	Beliefs about the curability or controllability of an STD	6	Four-point ordinal scale ranging from *Not Likely* (1) to *Very Likely* (4)	Higher scores indicated beliefs about greater control and/or curability	If I had this STD, it could be cured.

Note:

* Following phase 2, it was expected that a total Cause subscale score would not be calculated.

STD = Sexually transmitted disease.

Table 2

Factor Loadings of Items on the RoSTD in reference to beliefs about Chlamydia

Items	FP	Cause	PC	Identity
Having this STD means that I would always have to take medication	**.64**	-.02	.04	.13
I could die from this STD	**.44**	.05	-.10	.15
Having this STD would mean that I would always need medical treatment	**.67**	-.03	.08	.26
Having this STD means that I will have to tell future sexual partners	**.61**	.15	.19	-.08
If I had this STD and it was treated, it could come back	**.38**	.09	.02	.16
If I had this STD it would last my entire life	**.85**	-.02	.01	.06
This STD will last a long time	**.76**	-.11	.03	.15
If I had this STD it could be cured	**-.77**	.14	-.15	.13
If I had this STD, I could take a pill to get rid of the infection	**-.66**	.25	-.08	.03
If I had this STD there would be a lot I could do to control the infection	**-.70**	.23	-.10	.06
If I had this STD I could take a pill to help control the infection	**-.69**	.08	.02	.22
This STD comes and goes very quickly	**.46**	-.14	.21	-.18
If I had this STD, there would be nothing I could do about it	**-.75**	-.03	.14	-.03
If I had this STD there would be very little I could do about it	**-.77**	-.05	.04	.00
What is the chance of getting this STD when you have vaginal sex without a condom with someone who has this STD?	-.06	**.55**	.11	-.03
What is the chance of getting this STD when you have several sexual partners?	-.11	**.54**	.07	-.12
What is the chance of getting this STD when you have oral sex without a condom with a person who has this STD?	.23	**.37**	-.13	.27
What is the chance of getting this STD when you have vaginal sex without a condom with a new partner?	-.10	**.75**	.02	-.04
What is the chance of getting this STD when you have a one-night stand?	-.11	**.83**	.03	-.03
What is the chance of getting this STD when you have sex without someone and you don't know about his or her sexual past?	-.10	**.82**	.05	-.14
What is the chance of getting this STD through sexual contact with another woman?	-.01	**.66**	-.06	.12
Having this STD would negatively affect the way my partner sees me	-.06	.01	**.66**	.20
Having this STD would cause my sexual partner to not want to be with me anymore	.15	.07	**.79**	-.10
Having this STD would make me feel ashamed or embarrassed	.02	-.05	**.72**	-.01
Having this STD would cause me to stop having sex	.08	-.08	**.53**	.13
Having this STD would cause me to stop trusting my sexual partners	-.12	.36	**.57**	-.05
Having this STD would cause my sexual partner to stop trusting me	-.14	.16	**.64**	.09
Having this STD means I would always have to use a condom when I have sex	.39	.12	**.36**	-.02
Having this STD would make me feel depressed	.07	.04	**.70**	.03
If I had this STD I would worry about telling a new sexual partner that I had this STD	.17	-.03	**.55**	.08
Having this STD would ruin my sex life	.41	-.03	**.54**	.04
If I told someone what I have this STD they would not want to have sex with me	.03	.04	**.78**	.00
If I had this STD I would worry about having to tell my current sexual partner	.06	.01	**.53**	.05
Having this STD will affect my appearance	.11	-.07	.05	**.55**
If I had this STD I would have physical symptoms	-.09	-.18	.05	**.74**
If I had this STD I would have genital sores	.10	-.12	.09	**.61**
If I had this STD I would feel sick	.29	.05	-.18	**.42**
If I had this STD I would have burning when I urinate	.00	.15	-.06	**.49**

Items	FP	Cause	PC	Identity
If I had this STD I would have genital discharge	-.09	.20	-.03	**.44**
I could tell if my partner had this STD	-.09	-.02	.02	**.48**

Note: the bolded factor loading numbers indicate the factor assignment for each item. FP=Future Perspective, PC=Psychosocial Consequences, STD = Sexually Transmitted Disease.

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Table 3

Fit Indices for RoSTD for each Sexually Transmitted Disease

Fit Indices	G	C	T	S	HPV	HSV	HepB
X^2	479.89*	457.73*	560.17*	500.03*	617.28*	351.60*	409.65*
X^2/df	3.72	3.52	4.28	3.94	5.10	2.68	3.33
CFI	0.88	0.88	0.82	0.84	0.76	0.86	0.87
TLI	0.92	0.92	0.89	0.90	0.82	0.88	0.91
RMSEA	.10	.09	.10	.10	.12	.08	.09
SRMR	.10	.10	.10	.10	.12	.11	.10
WRMR	1.60	1.55	1.70	1.65	1.94	1.43	1.54

Note:

*Significant

$p < .05$.

G=Gonorrhea, C=Chlamydia, T=Trichomoniasis, S=Syphilis, HPV = Human Papillmavirus, HSV = Herpes Simplex Virus, HepB = Hepatitis B, CFI = Comparative Fit Index, TLI = Tucker Lewis Index, RMSEA = Root Mean Square Error of Approximation, SRMR = Standardized Root Mean Square Residual, WRMR = Weighted Root Mean Square Residual.

Standards for good to excellent fit estimates: X^2 = Non. Sig., X^2/df= ≤3, CFI ≥0.95, TLI ≥0.95, RMSEA ≤ .06, SRMR ≤.05, and WRMR ≤0.90.

Table 4

Reliabilities (Cronbach's Alpha, Composite and Test-Retest) of the 4 RoSTD Factors

	Gonorrhea	Chlamydia	Trich.	Syphilis	HPV	HSV	HepB
Future Perspective							
Alpha	.89	.88	.86	.87	.79	.72	.86
Composite	.93	.93	.92	.92	.86	.86	.90
Test-Retest	.90	.88	.87	.88	.73	.84	.79
Cause							
Alpha	.78	.76	.84	.8	.81	.76	.84
Composite	.86	.86	.89	.87	.88	.85	.89
Test-Retest	.83	.82	.78	.76	.78	.69	.81
Psychosocial Consequences							
Alpha	.86	.87	.87	.85	.89	.82	.85
Composite	.91	.92	.92	.91	.93	.91	.92
Test-Retest	0.9	.9	.87	.89	.89	.84	.72
Identity							
Alpha	.63	.66	.65	.64	.67	.53	.65
Composite	.72	.76	.67	.72	.78	.69	.77
Test-Retest	.79	.69	.83	.8	.75	.75	.74

Note: Trich.=Trichomoniasis, HPV = Human Papillmavirus, HSV = Herpes Simplex Virus, HepB = Hepatitis B.

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Table 5

Mean Subscale Scores for each Sexually Transmitted Disease

	Future Perspective	Cause	Psychosocial Consequences	Identity
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Gonorrhea	1.92 (0.62)	3.13 (0.57)	3.31 (0.60)	2.47 (0.57)
Chlamydia	1.84 (0.60)	3.18 (0.55)	3.27 (0.63)	2.40 (0.59)
Trichomoniasis	1.97 (0.57)	2.88 (0.69)	3.24 (0.63)	2.20 (0.55)
Syphilis	2.16 (0.62)	3.04 (0.63)	3.40 (0.54)	2.45 (0.60)
HPV	2.71 (0.54)	3.05 (0.65)	3.20 (0.69)	1.94 (0.61)
HSV	2.96 (0.44)	3.45 (0.47)	3.60 (0.43)	2.69 (0.51)
Hepatitis B	3.13 (0.53)	2.90 (0.71)	3.50 (0.51)	2.03 (0.54)

Note: HPV = Human Papillomavirus, HSV = Herpes Simplex Virus