Reliability, factor structure and validity of the Condom Barriers Scale for use with men in substance abuse treatment

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ABSTRACT

The current study assesses the psychometric properties of the Condom Barriers Scale (CBS), an instrument originally developed to measure barriers women perceive as impeding condom use, with a sample of men at high risk for HIV. Participants include 601 male patients in drug abuse treatment involved in a gender specific HIV prevention intervention for teaching safer sex skills. Second-order confirmatory factor analysis generally supported the underlying 4-factor subscale structure of the CBS previously identified with women. However, exploratory factor analysis revealed several specific discrepancies in the factor structure between men and women. Some minor modifications of item assignment to scales are indicated when using the CBS with men. Internal consistency and test-retest reliability estimates were moderate to high in value. Overall, the analysis indicates the CBS is a potentially valid and reliable instrument for assessing barriers to condom use with men.

Background

- **HIV/STI prevention programs with substances abusers routinely included messages encouraging condom use for penetrative sexual acts.**
- **Unfortunately sexual risk reduction among substance abusers has been modest at best with most of the risk reduction coming from decreasing the number of sexual partners rather than wide spread increase in condom use (Sorensen & Copeland, 2000).**
- **The Condom Barriers Scales (CBS, St. Lawrence et al. 1999) is a 29 item self report instrument developed with women to measure perceived barriers to condom use. A four factor structure has been identified in previous studies with the CBS.**
- **The purpose of this study was to determine the reliability and validity of the CBS for use with men in substance abuse treatment.**

References.

St. Lawrence, J.S., Chapdelaine, A.P, Devieux, J.G. et al. (1999). Measuring perceived barriers to condom use: Psychometric evaluation of the Condom Barriers Scale. Assessment, 6, 391-400.

Sorenson, J.L. & Copeland, A.L. (2000). Drug abuse treatment as an AIDS prevention strategy: a review. Drug and Alcohol Dependence, 59, 17-31.

METHODS

Subjects. . Men enrolled in one of 14 substance abuse treatment programs across the US were recruited to take part in an HIV/STI prevention project specifically tailored for men (NIDA Clinical Trials Network Protocol 0018). Inclusion criteria included age of 18 or more, engagement in unprotected vaginal or anal intercourse in the prior 6 months, willingness to attend HIV/STI prevention groups and complete assessments. Exclusion criteria included having a primary partner planning to get pregnant or a Mini Mental Status Exam < 25. This report focuses on the 292 methadone maintenance and 309 psychosocial program outpatients who completed the Condom Barriers Scale (CBS) as part of the baseline assessment. Demographics for the sample are provided in Table 1.

Instrumentation. The CBS is a 29 item self report instrument developed with women to measure perceived barriers to condom use. Respondents answer each item on a 1 (strongly agree) to 5 (strongly disagree) Likert scale. The following four factor structure has been identified in previous studies with the CBS: **partner barriers** (8 items), **effects on sexual experience** (7 items), **access/ availability** (8 items) and **motivational barriers** (6 items).

Also included in the assessment battery was the Sexual Behavior Inventory (SBI), an extensive structured interview concerning sexual behavior, which was administered to eligible subjects via audio computer assisted interview (ACASI) methodology. The SBI covers the following topics: number and type of sexual partners, frequency and type of sexual behavior, use of condoms, communication about sexual matters, sex under the influence of drugs and alcohol, detailed description of most recent sexual event

Procedures. Eligible men who volunteered to participate and met inclusion criteria were administered the CBS and the SBI as part of a larger assessment battery prior to intervention condition assignment, and within two weeks after attending the intervention.

Data Analysis

To assess the 4-factor subscale structure of the CBS, a second-order confirmatory factor analysis (CFA) was conducted. The initial model utilized maximum likelihood (ML) estimation, which was assessed by the χ^2 test and five model fit indices: the comparative fit index (CFI), non-normed fit index (NNFI), goodness-of-fit index (GFI), the root mean squared residual (RMSR), and the root mean square error of approximation (RMSEA). The cutoff criteria for assessing model fit were: .90 for the NNFI, GFI, .95 for the CFI, .08 for the RMSR, and .06 for the RMSEA.

Since all CBS item distributions deviated from normality in this study, which can result in an inflated χ^2 test and decreased indices of model fit, two alternative procedures were evaluated: asymptotically distribution free (ADF) and unweighted least squares (ULS) methods of CFA. Model fit for the ULS method was based on the GFI, the GFI adjusted for degrees of freedom (AGFI), and the RMSR. The GFI was interpreted in analogy with the coefficient of determination and the AGFI with the correction for bias of a squared multiple correlation, with values supporting a model structure being greater than .90 and .80, respectively. The RMSR measures the average absolute magnitude of the fitted residuals and a value of less than .08 was used as a criterion for acceptable model fit.

Subsequent to the CFA, an exploratory factor analysis was conducted, utilizing two common factor analytic procedures: alpha factor analysis (AFA) and maximum likelihood factor analysis (ML). The two different extraction procedures were used to obtain a factor solution which is not dependent on a particular extraction process. Correlations among estimated factor scores between the two methods were calculated to determine similarity across the different extraction procedures.

The number of factors to retain was based on parallel analysis, the scree test, similarity of factors extracted across the two different extraction methods based on correlations of factor scores, coefficient alpha (≥ .50) for each factor prior to rotation, and interpretability of the underlying dimensions.

Interpretation of factors was based on the results of the alpha extraction, a procedure designed to be used in scale construction and testing, by producing common factors with optimal generalizability in the sense of Cronbach's alpha coefficient. Extracted factors were allowed to be correlated by rotating to an oblique solution, using the direct quartimin procedure.

To compare the dimensionality of the CBS derived from this sample of men with the factor structure obtained by St. Lawrence et al. (1999) from two studies with responses on the CBS by women, coefficients of congruence between the exploratory factor loadings were calculated.

Additional psychometric properties of the CBS were evaluated by considering internal consistency reliability estimates of the four subscales as originally defined by the two samples of women and as defined by the factor analysis results in this study with a sample of men. Test-retest reliability estimates were obtained on a subsample of 325 men with responses to the CBS at baseline and post-intervention follow-up for the original subscale scores and on factor scores obtained with the sample of men in this study.

TABLE 1: Sample Demographics

Participant Characteristics	Methadone Maintenance (N=292)	Outpatient Psychosocial (N=309)	Total Sample (N=601)
	Mean and (Standard Deviation)		
Age	42.0 (9.9)	36.2 (10.1)	39.0 (10.4)
Education in Years	12.0 (1.8)	12.4 (1.9)	12.2 (1.9)
Monthly Net Income ($$)	269.1 (568.4)	745.7 (1499.2)	514.5 (1170.0)
Ethnicity	Percent		
White	63.7	52.8	58.1
Black	25.3	31.1	28.3
Hispanic	8.9	12.6	10.8
Amer. Indian	0.3	2.3	1.3
Asian	1.0	0.7	0.8
Other	0.7	0.7	0.7
Marital Status			
Never Married	46.6	48.2	47.4
Married	17.8	20.1	19.0
Divorced	17.5	22.0	19.8
Separated	12.7	8.7	10.7
Remarried	0.3	0.0	0.2
Widowed	5.1	1.0	3.0

RESULTS

1. Results of the CFA with ML estimation revealed that the four-factor solution did not provide a good fit to the data, as indicated by the χ^2 test value ($\chi^2_{373} = 1616.30$) which is statistically significant at p<.0001, and most indices of fit fell short of reaching the pre-specified model fit cutoff criteria. Thus, ULS was utilized to evaluate the CBS factor structure.

2. ULS indices of model fit supported the underlying factor structure: GFI=.95, AGFI=.94, & RMSR=.07. Coefficients of congruence of the factor structure between the ULS and ML solutions were high: .999, .994, .985 and .998 for the Partner Barriers, Effects on Sexual Experience, Access/Availability and Motivational Barriers subscales.

3. Overall, 86% of the factor loadings between the ULS and ML methods differed by only .10 or less (See Table 2). Factor loadings generally were higher for the Partner Barriers and Effect on Sexual Experience subscales than for Access/Availability and Motivational Barriers.

4. Composite reliability estimates for each subscale also reflect higher values for the Partner Barriers and Effect on Sexual Experience subscales (.90 and .84) than for Access/Availability (.69) and Motivational Barriers (.65). Factor loadings of each subscale with the total CBS are generally moderate to high (ranging from .57 to .94), as are the inter-factor correlations (ranging from .42 to .86).

5. For the exploratory factor analysis four factors were retained and rotated to an oblique solution. The parallel analysis procedure had indicated 7 factors, whereas the scree plot suggested, 4 strong underlying dimensions and possibly 2 to 3 less significant factors, where differences in successive eigenvalues were less than .30. Coefficient alpha prior to rotation for each of the first four factors exceeded .60 and was less than .25 or negative in value for the last three factors. Factor score correlations were greater or equal to .990 for similar dimensions with a 4-factor solution.

6. The alpha extraction (see Table 3) revealed low to moderate initial communality estimates (squared multiple correlations), ranging from .164 to .689, (*M*=.426). Four factors, with inter-factor correlations ranging from .230 to .454 (*M*=.331), generally represented the 4-subscale structure. However, two items (23 and 29) did not load on any factor (factor loading <.30). Two items originally defined by Access/Availability with women loaded significantly on Partner Barriers (item 9) and Motivational Barriers (item 4) in this study. One item originally defined by Motivational Barriers with women, loaded on the Effect of Sexual Experience (item 27) factor for men. In addition to these five items, item 5 revealed salient loadings on both the Partner Barriers (.38) and Motivational Barriers (.34) dimensions.

RESULTS, continued

7. To further compare the dimensionality of the CBS derived from this sample of men with the factor structure obtained by St. Lawrence et al. (1999) in two studies using the CBS with women, coefficients of congruence between the exploratory factor loadings were calculated (see Table 4). Similarity was highest among the Partner Barriers and Effect on Sexual Experience dimensions, approximately .90 in value, and lower (ranging from .67 to .80) for Access/Availability and Motivational Barriers.

8. Test-retest reliability estimates were obtained by calculating the correlations of the original subscale scores as defined by St. Lawrence et al. (1999) and on factor scores with the sample of men in this study at baseline and post-intervention follow-up. The results, presented in Table 5, are very similar and moderate in value for the two different methods of scoring the CBS, although estimates are slightly higher for the original scoring than with the factor scores obtained in this study. Although reliability estimates are generally moderate, coefficients of congruence generally indicate temporal stability of the factor structure.

9. For the criterion related validity analysis the total score and the factor scale scores were correlated with the percent of condom use for vaginal and anal sex in the prior three months. Correlations were calculated separately for men at low risk (n=210) for sexual transmission of HIV (being monogamous with partner of at least 6 months duration) and all other men sexually active in the prior three months (n=303). For the low risk men the correlations between percent of condom use and the CBS scores ranged from 0.08 to 0.25 suggesting little relationship between the CBS and condom use. However, for all other sexually active men the correlations were somewhat higher; access/availability 0.21, partner barriers 0.26, effect on sexual experience 0.31, motivational barriers 0.45, total score 0.39.

TABLE 2: Second-order Confirmatory Factor Analysis

	ULS	*ML*
Partner Barriers		
3. If I suggest to my partner we use a condom he/she might end the relationship.	.585	.568
5. My partner doesn't want us to use condoms.	.578	.520
6. If I suggested we use a condom my partner would think I don't trust him/her.	.765	.798
8. If I suggested we use a condom my partner would think I'm accusing him/her of cheating.	.781	.835
10. If I used a condom my partner might think I'm cheating on him/her.	.771	.813
14. If I suggested my partner use a condom she might be turned off and lose interest in having sex.	.764	.713
18. If I used a condom my partner might get angry.	.824	.806
25. If I suggested my partner use a condom he/she might think I am putting him/her down or insulting him/her.	.793	.799
Effect on Sexual Experience		
11. Condoms rub and cause irritation.	.622	.603
13. Condoms don't feel good.	.619	.738
15. Condoms interrupt the mood.	.762	.710
17. Condoms feel unnatural.	.627	.732
19. Condoms don't fit right.	.652	.594
24. I feel closer to my partner without a condom.	.625	.529
28. Condoms change the climax or orgasm.	.659	.689
Access/Availability		
4. I can never find a condom right before sexual intercourse.	.510	.465
9. I would be afraid to suggest to my partner we use a condom.	.751	.619
12. I wouldn't know where to get a condom.	.438	.549
16. Condoms are against my religious values.	.468	.508
20. Condoms cost too much.	.341	.362
21. I don't have transportation to buy or get condoms.	.424	.492
22. I would be embarrassed to buy condoms or ask for them.	.387	.468
23. It's up to the man to provide a condom.	.352	.329
Motivational Barriers		
1. Most of the time neither of us has a condom available.	.403	.424
2. I don't want my partner to put a condom on me.	.428	.445
7. I usually forget about using a condom.	.518	.498
26. I don't need to use a condom, I never catch anything.	.519	.535
27. When I use a condom I feel less involved or committed to the relationship.	.648	.593
29. I don't need to use a condom, I use another method.	.393	.423
Factor Loadings of Subscales with Total CBS		
Partner Barriers	.749	.733
Effect on Sexual Experience	.578	.566
Access/Availability	.913	.877
Motivational Barriers	.939	.922

Inter-factor Correlations

	Effect on Sexual Experience	*Access/Availability*	*Motivational Barriers*
Partner Barriers	.433 (.415)	.684 (.643)	.703 (.676)
Effect on Sexual Experience		.527 (.497)	.542 (.522)
Access/Availability			.857 (.808)

Note: Inter-factor correlations are *ULS* (*ML* in parentheses).

TABLE 3: Exploratory Factor Analysis

Partner Barriers	Factor Loadings			
3. If I suggest to my partner we use a condom she might end the relationship.	**.528**	-.131	.162	.096
5. My partner doesn't want us to use condoms.	**.379**	.159	-.189	**.336**
6. If I suggested we use a condom my partner would think I don't trust her.	**.852**	.038	-.085	-.052
8. If I suggested we use a condom my partner would think I'm accusing her of cheating.	**.871**	-.051	-.028	-.035
**** 9. I would be afraid to suggest to my partner we use a condom. [originally Access/Availability]***	**.608**	-.013	.091	.114
10. If I used a condom my partner might think I'm cheating on her.	**.830**	-.017	-.067	.006
14. If I suggested my partner use a condom she might be turned off and lose interest in having sex.	**.649**	.169	.056	-.013
18. If I used a condom my partner might get angry.	**.756**	.041	.088	.007
25. If I suggested my partner use a condom she might think I am putting her down or insulting her.	**.760**	.021	.082	-.010
Effect on Sexual Experience				
11. Condoms rub and cause irritation.	.053	**.545**	.138	-.059
13. Condoms don't feel good.	-.133	**.768**	-.024	.042
15. Condoms interrupt the mood.	.108	**.641**	.002	.058
17. Condoms feel unnatural.	-.047	**.775**	-.076	-.018
19. Condoms don't fit right.	.107	**.548**	.169	-.097
24. I feel closer to my partner without a condom.	.149	**.465**	-.088	.172
****27. When I use a condom I feel less involved or committed to the relationship.*** **[originally Motivational Barriers]**	.197	**.360**	.166	.106
28. Condoms change the climax or orgasm.	.005	**.710**	-.015	.004
Access/Availability				
12. I wouldn't know where to get a condom.	.026	-.137	**.679**	.093
16. Condoms are against my religious values.	.086	.077	**.459**	.023
20. Condoms cost too much.	-.014	.166	**.345**	.004
21. I don't have transportation to buy or get condoms.	.033	.027	**.624**	-.046
22. I would be embarrassed to buy condoms or ask for them.	.034	-.008	**.597**	-.048
Motivational Barriers				
1. Most of the time neither of us has a condom available.	-.020	-.096	.026	**.648**
2. I don't want my partner to put a condom on me.	-.011	.131	-.142	**.592**
****4. I can never find a condom right before sexual intercourse*** **[originally Access/Availability]**	.113	-.104	.117	**.557**
7. I usually forget about using a condom.	.144	.106	.018	**.392**
26. I don't need to use a condom, I never catch anything.	.011	.129	.265	**.338**
Items without Salient Factor Loadings				
****23. It's up to the man to provide a condom.*** **[originally Access/Availability]**	.154	.035	.179	.083
****29. I don't need to use a condom, I use another method.*** **[originally Motivational Barriers]**	-.077	.228	.201	.219

Inter-factor Correlations

	Effect on Sexual Experience	*Access/Availability*	*Motivational Barriers*
Partner Barriers	.284	.295	.343
Effect on Sexual Experience		.366	.230
Access/Availability			.454

***Item factor loading inconsistent with original CBS subscales.**

Factor loading > .30 in bold.

TABLE 4: Coefficients of Congruence between CBS Development Studies and Current Study Common Factor Loadings

	CBS Development Study 1 (♀)			
CBS Development Study 2 (♀)	**Partner Barriers**	**Effect on Sexual Experience**	**Access/ Availability**	**Motivational Barriers**
Partner Barriers	**.973**	.457	.513	.330
Effect on Sexual Experience	.542	**.976**	.402	.358
Access/Availability	.455	.444	**.957**	.266
Motivational Barriers	.448	.395	.509	**.820**

	CBS Development Study 1 (♀)			
Current Study (♂)	*Partner Barriers*	*Effect on Sexual Experience*	*Access/ Availability*	*Motivational Barriers*
Partner Barriers	**.883**	.329	.397	.124
Effect on Sexual Experience	.309	**.907**	.293	.327
Access/Availability	.242	.141	**.804**	.256
Motivational Barriers	.226	.225	.275	**.667**

	CBS Development Study 2 (♀)			
Current Study (♂)	*Partner Barriers*	*Effect on Sexual Experience*	*Access/ Availability*	*Motivational Barriers*
Partner Barriers	**.900**	.342	.338	.292
Effect on Sexual Experience	.228	**.887**	.028	.299
Access/Availability	.209	.099	**.754**	.345
Motivational Barriers	.238	.234	.316	**.793**

Coefficients defining congruence of factors in red.

TABLE 5: Test-Retest Reliability Estimates and Coefficients of Congruence N=443 for total sample and (N=268) for participants not attending intervention

Baseline	Post-Intervention		
	Original Scoring	Current Study Factor Scores	Coefficients of Congruence of Factor Loadings*
Partner Barriers	.63 (.49)	.62 (.59)	.983 (.976)
Effect on Sexual Experience	.66 (.68)	.66 (.71)	.986 (.983)
Access/Availability	.51 (.48)	.47 (.44)	.950 (.938)
Motivational Barriers	.54 (.46)	.55 (.53)	.934 (.914)
Total CBS	.62 (.56)		

*based on alpha extraction and oblique rotation.
Note: Values in parentheses indicate participants not attending intervention.

Conclusions

- Confirmatory factor analysis suggests the factor structure of the Condom Barrier Scale (CBS) is similar for women and men.
- Exploratory factor analysis also supports a similar factor structure of the CBS for women and men. However, not surprisingly, a few items appear to have somewhat different meaning for men than for women as indicated by loading on different factors.
- Reliability estimates indicate high internal consistency, but only modest test-retest reliability.
- Correlations between CBS factors and condom use by men with high risk sexual partners provide modest evidence for criterion related validity.
- The differences in factor loadings between the original sample of women and the current male sample may, in part, be due to ethnic and geographic influences on attitudes toward condom use barriers.
- Overall, the CBS could help substance abuse treatment staff and public health educators improve their understanding of specific clients' needs and beliefs related to condom use.

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