Title: Contextual determinants of sexual risky behaviours among adolescents in urban Cape Town, South Africa: findings from a longitudinal study using a cumulative risk factor approach

Theme: Session 167. Adolescent Sexuality and Sexual Behavior

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Abstract

This article presents findings from the Cape Area Panel Study (CAPS) of adolescents and young adults in urban Cape Town, South Africa. The analyses adopted an innovative cumulative risk factor approach to study contextual determinants of sexual risky behaviours where risk factors are organized using the ecological framework theory. Using a discriminant function analysis, significant risk factors were identified that determined risky sexual behaviours of inconsistency in the use of condoms. Significant risk factors were integrated to create risk profiles of adolescents and informed if risk factors acted cumulatively, where increasing risk factors in the ecology was associated with an increased exhibition of sexual risky behaviors. Our findings point to important predictors of consistency in condom use, where being currently in school and aspiring to pass examinations positively impacted on consistency in condom use. While planning to marry in the near future and having a mother who was a household member had a negative impact. Participants from communities with higher levels of education and incomes had higher likelihood of reporting consistency over the follow-up. Findings also demonstrate that factors appeared at all levels of ecology to include the individual, household, and community levels and that these factors had a cumulative effect. Therefore a cumulative risk factor approach is an effective method of modeling sexual behaviours as young adults with more risk factors present in their ecology

had an increased likelihood of engaging in sexual risky behaviours. Findings from this study will inform interventions t getting to change sexual risky behaviors as previous research has only concentrated on isolated risk factors appearing at a single level of the ecology. Since risk factors act cumulatively, then interventions for sexual risky behaviours should be targeted at multiple levels of the ecology, as their effect tends to be cumulative. This is especially important for countries in sub-Saharan Africa that are grappling with HIV epidemic and high rates of teenage pregnancies. In order to change an individual or group sexual behavior, this may only succeed if risk factors are not considered in isolation, but cumulatively.

Introduction

Studies of sexual reproductive health have described correlates of sexual risky behaviors among young adults in sub-Saharan Africa. Young people's sexual behavior is said to be influenced by their social and economic context (Wamoyi et al., 2014, Kalichman et al., 2005a, Kalichman et al., 2006). Some of the aspects that lead young people to the outcomes include gender issues in relationships, families, social norms and poverty (Kalichman et al., 2005b). Studies in many sub-Saharan African countries have cited poverty where young women engage in transactional sexual activity, with multiple or casual partners, and in many cases agree to have sex without condoms (Kalichman et al., 2006, Dinkelman et al., 2008, Wamoyi et al., 2014).

Studies in South Africa have reported high levels of unsafe sexual activity among adolescents (MacPhail and Campbell, 2001, Eaton et al., 2003). According to the South African household survey on HIV prevalence, Incidence, and Behavior report released by Human Sciences Research Council (HSRC), increasing number of adolescents are starting sexual activities early, reporting multiple sexual partners, and inconsistently using condoms (Kaplan et al., 2013, Shisana et al., 2009). It was estimated that condom usage among males aged 15 to 24 years declined between 2008 and 2012 from 85% to 68% (Kaplan et al., 2013), while about 50% of young people were estimated to be sexually active by the age of 16 years in 2002 (Eaton et al., 2003). Reports of multiple sexual partnerships among youths aged 15-24 years shows an increase from 15.9% in 2002 to 18.0% in 2008 even though it was not a significant change(Shisana et al., 2009). Sexual risky behaviors of early age sexual initiation, inconsistency in the use of condoms, and multiple partnerships increase the risk of HIV infection, unwanted teenage pregnancies, and other sexually transmitted diseases (Zuma et al., 2010, Bearinger et al., 2007, McGrath et al., 2009, Zuma et al., 2011).

Understanding the determinants of risky sexual behaviours among young people (10 – 24 years) is important because of the high risk of HIV transmission in this age group. In 2012 alone, an estimated 780,000 young adults aged 15-24 years were newly infected with HIV, with 97% of these cases occurring in low and middle income countries (UNAIDS, 2013). In South Africa, HIV prevalence in young adults (15–24 years) stood at 7.3%(UNAIDS, 2013).

South Africa also reports a high rate of teenage pregnancy, with more than 35% of South African adolescents becoming pregnant before the age of 20 in 2008(Panday et al., 2009, Willan, 2013). Teenage pregnancy disrupts learning opportunities, denying teenage girls of crucial training required for future productivity(Jewkes et al., 2009). Furthermore, a high rate of teenage pregnancy is a marker of unprotected sexual activity, indicating a high prevalence of unprotected sexual activity among South African youth. Sexually active young women forms the group with the highest risk of HIV infection in the world (UNAIDS, 2011). Prevalence of risky sexual behaviors is also reportedly high at South African universities and is estimated at 68%(Mutinta et al., 2013).

Studies from South Africa have reported on determinants of risky sexual behaviours in South Africa. Dinkelman et al, (2007) reported on household level factors that influenced sexual behaviors among young adults (Dinkelman et al., 2007). Young women in households with higher incomes were less likely to engage in early sexual activities, while young men in communities with a higher poverty rates were less likely to use condoms at last sex. Negative economic experience was associated with an increase in multiple sexual partnerships (Dinkelman et al., 2008). Zuma et al (2011) reported on individual level factors of age, race, education, and geographical location as determinants of age at sexual debut

among South African youths(Zuma et al., 2011). Early sexual initiation was associated with increased risk taking and reports of multiple sexual partnerships(Zuma et al., 2010).

Despite the apparent risk posed by risky sexual behaviors among South African youths, existing studies have only used conventional methods to determine socioeconomic factors associated with risky sexual behaviors. These studies have often used cross-sectional data to report on determinants, and in cases where longitudinal datasets are available, commonly used methods of analyses consider risk factors in isolation, and no studies have reported on their cumulative effect on risky sexual behaviours. They fail to recognize the multi-faceted nature of causes for sexual behaviors, and better ways of understanding how risk factors act cumulatively to influence adolescents' sexual behaviors are urgently required. Integrating a risk factor model into an ecological framework suggests that there are not only multiple risk factors related to adolescent sexual activity, but these risk factors exist at multiple levels of the adolescent's life or social ecology.

To describe adolescents' sexual activity, researchers from developed countries adopted the cumulative risk factor approach, where ecological factors were integrated to form a unified understanding of how risk factors act cumulatively to determine sexual risky behaviours (Small and Luster, 1994, Perkins et al., 1998, Evans et al., 2013, Stephenson, 2009). This approach recognizes that sexual behaviors are determined by a complex web of factors, ranging from individual attributes, household factors, and societal factors and that these factors act together to predict sexual behaviors (Bronfenbrenner, 1979, Bronfenbrenner, 1986, Bronfenbrenner and Morris, 1998). This cumulative risk factors approach has not yet been investigated in sub-Saharan Africa, and this paper attempts to test the appropriateness of this approach in the context of South Africa.

Data and methods

This paper utilizes the Cape Area Panel Study (CAPS) data, from the five waves of the survey, conducted between 2002 and 2009. The CAPS is an ongoing longitudinal survey of young adults in urban Cape Town focusing on a wide range of sexual and reproductive health issues affecting young adults. The sampling plan was designed to produce a household sample that was representative of households and a young adult sample that was representative of the population aged between 14 and 22 years-old in urban Cape Town(Lam et al., 2008).

Statistical analysis and data manipulation were carried out in STATA version 13 (STATA Corporation, College Station, TX). Bivariate analyses were conducted using chi-square tests, and multivariate analysis conducted using both logistic regression and Discriminant function analysis. Risk factors that were significant at the multivariate analyses were included in a cumulative risk factor analysis to test whether increasing risk factors present were positively correlated with increasing likelihood of engaging in risky sexual activity. Factors were scored as either 0 or 1 using meaningful cut-off points with 1 representing the presence of risk. A cumulative risk index was constructed for each adolescent by summing the number of significant risk factors identified using the multivariate discriminant analysis.

This paper focuses more on consistency in the use of condoms, defined as always using condoms with last sexual partner among sexually active young adults during the baseline and follow-up surveys. The young adults were asked how often they used condoms with their last sex partner, with the CAPS survey asking: “How often do/did you use a condom with this last sex partner?” The expected responses were either “Always”, “Usually”, “Sometimes”, and “Rarely”. In this analyses, only participants responding “Always” in the

various waves of the survey were considered to be consistent condom users, while the comparison group was defined using the "Usually", "Sometimes", and "Rarely" categories.

Results

Results indicate that of the 2,130 adolescents and young adults reporting sexual experience by wave 1 survey, 318 (15%) reported having sexual intercourse before the age of 15 years. Average age at sexual initiation was 15.7 (SD 1.8) years for males compared to 16.6 (SD 1.7) years for females as reported in Table 1 & 2. A higher proportion of sexually active males reported early age at sexual debut at 22% when compared to 10% in females. Males reporting multiple sexual partnerships in the last year stood at 50% compared to 19% in females while 77% of males reported using condoms during their last sexual intercourse compared to 68% of females.

Table 1: Sexual and Reproductive Health Outcomes reported - Males

Males	Wave 1 (n=2,114)	Wave 2 (n=623)	Wave 3 (n=1574)	Wave 4 (n=1,485)	Wave 5 (n=1,263)
Sexually Experienced (n, %)	967(46%)	413(66%)	1,165(74%)	1,247(84%)	1,205(95%)
Age at Sexual Initiation (Mean, SD)	15.7 (1.8)	15.6(1.7)	16.0(1.9)	16.0(2.0)	n/r
Willing to have first sex*	926(96%)	301(94%)	1,037 (96%)	n/r	n/r
Contraception / Protection Use at First Sex (n, %) *	488(51%)	n/r	618(64%)	823(78%)	n/r
Multiple Sex Partners in last 12 months (n, %)*	401(50%)	n/r	265(29%)	398(43%)	415(41%)
Use protection at Last Sex (n, %)*	692(77%)	267(77%)	780(77%)	769(74%)	793(72%)
Ever made someone pregnant (n, %)	123(6%)	n/r	260(16%)	331(21%)	n/r

* % based on non-missing responses, *n/r* not reporting

Table 2: Sexual and Reproductive Health Outcomes reported –Females

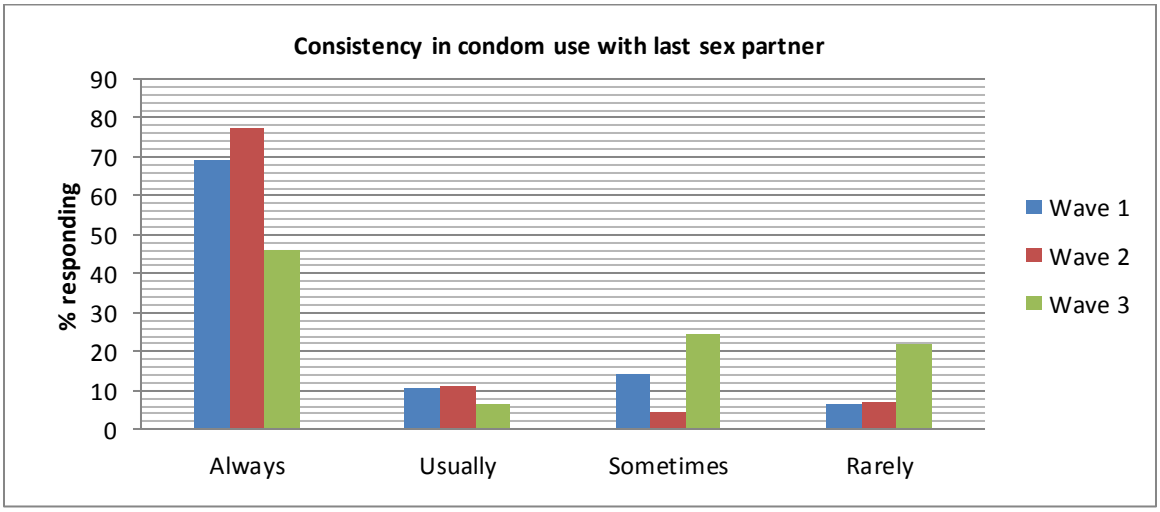
Females	Wave 1 (n=2590)	Wave 2 (n=745)	Wave 3 (n=1,852)	Wave 4 (n=1,806)	Wave 5 (n=1,560)
Sexually Experienced (n, %)	1,195(54%)	468 (63%)	1,343(73%)	1,488(82%)	1,456(93%)
Age at Sexual Initiation (Mean, SD, n)	16.6(1.7)	16.5(1.7)	16.9(1.9)	17(1.9)	n/r
Willing to have first sex*	1,010(85%)	383(82%)	1,114(83%)	n/r	n/r
Contraception / Protection Use at First Sex (n, %)*	638(54%)	n/r	748(67%)	1,006(78%)	n/r
Multiple Sex Partners in last 12 months (n, %)	198(19%)	n/r	89(8%)	150(12%)	162(13%)
Use Protection at Last Sex (n, %)	766(68%)	303(73%)	871(70%)	896(66%)	926(67%)
Ever been pregnant (n, %)	443(17%)	n/r	675(35%)	826(44%)	n/r

* % based on non-missing responses, *n/r* not reporting

Consistency in the condom use

At the time of wave 1 survey, of the 1 121 sexually active adolescents and young adults, 911(81%) reported using condoms at the time of first sex. Male condoms were predominantly used compared to female condoms, with only 3 respondents reporting using female condoms. Consistency in condom use with last sex partner was reported at 69% of the young adult respondents. Figure 1 report on the levels and trends in use of condom with last sex partner over the three waves of survey where the indicator was reported.

Figure 1: Consistency in condom use with last sex partner



Trends in consistency of condom use with last sexual partner indicates an increase between wave 1 and wave 2, and then a decrease by wave 3 surveys as indicated on Figure 1. Consistency in condom use at wave 1 differed significantly between males and females, with 72% of males reporting always using condoms compared to 66% of females. No differences were noted at wave 2, with an equal number of males and females reporting consistent condom use, both at 77%. However, more males than females reported consistency at wave 3 with 57% of males reporting always using condoms compared to 37% of females.

Determinants of inconsistency in condoms use

At wave 1 survey, 2 162 adolescents and young adults were sexually active with 1 289 (60%) reporting inconsistency in use of condoms, and were excluded from further analysis. About 2 542 respondents did not report any sexual activity, and 873 of those reporting sexual activity at wave 1, reported consistency in the use of condoms with their last sexual partners. Therefore, a total of 3 415 respondents were eligible for follow-up from baseline, to investigate their transitions into inconsistency in use of condoms.

Of the 3 415 participants reporting consistency in condom users and were sexually inactive adolescents at baseline, 1 598 responded to indicators of condom use at follow-up, with 866 (54%) classified under consistent users while 732 (46%) classified as inconsistent. Of the consistent users, males were significantly more likely to report at 62% compared to females at only 47%, a result that was significant at $p<0.01$. Consistency in condom use did not differ significantly between alcohol users and non-users, with 55% of alcohol users reporting consistency compared to 54% in non-alcoholics. The outcome differed with ethnicity, with a higher proportion of White reporting consistency at 69% compared to Black Africans at 57% and 48% of the Coloureds. Analyses performed for individual, household, and community variables separately for males and females are shown on Table 3.

In males, significant factors in bivariate associations indicated that consistency in condom use at the individual level was associated with age, where younger adolescents were more likely to consistently use condoms ($p<0.01$) with last sex partner. Also, adolescents currently enrolled in schools were more likely to consistently use condoms ($p=0.01$), while those expecting to marry in three years time were less likely to consistently use condoms compared to their counterparts.

Table 3: Bivariate association between selected risk factors and consistency in use of condoms with last sex partner by gender

MALES	Males			Females		
Independent Variables	Always	Inconsistent	P-value	Always	Inconsistent	P-Value
Individual						
Age (mean years)	17.54	18.27	<0.01	17.36	17.74	0.02
Educational Level (mean years)	9.29	9.18	0.56	9.58	9.66	0.64
Currently in school (n, %yes)	337(69)	174(59)	0.01	303(80)	292(67)	<0.01
Plan to pass matric first time (n, %yes)	298(81)	173(79)	0.45	249(94)	252(84)	<0.01
Population group n (%)			0.67			<0.01
Black/African	233(62)	145(38)		243(53)	217(47)	
Coloured	211(62)	132(38)		87(31)	196(69)	
White	43(67)	21(33)		49(70)	21(30)	
Knows someone with HIV (n, % yes)	57(12)	48(16)	0.07	81(21)	83(19)	0.39
Worked in the last 12 months(n, % yes)	131(27)	94(32)	0.16	74(20)	97(22)	0.32
Expects to have a job in 3 years**	3.07	3.23	0.12	2.98	3.22	0.01
Religiosity (n, % yes)	117(24)	58(19)	0.13	154(41)	136(32)	0.01
Alcohol Use	121(25)	89(30)	0.11	63(17)	62(14)	0.33
Expects to marry in 3 years (n, % yes)	13(3)	16(5)	0.05	9(2)	25(6)	0.02
Household						
Parents married (n, % yes)	354(73)	227(77)	0.22	259(69)	308(71)	0.45
Years of mother's education (mean)	9.5	8.6	0.38	9.7	8.5	0.05
Years of father's education	10.0	8.7	0.11	10.3	8.2	0.01
Brother/Sister helps with homework	422(87)	258(87)	0.9	83(22)	63(15)	0.01
Mother a household member (n, % yes)	358(74)	230(77)	0.25	259(68)	316(73)	0.16
Community						
% HH heads unemployed	19.3	21.1	0.04	22.4	21.3	0.24
% HH headed by females	39.9	40.7	0.16	41.2	41.4	0.90
% Individual Africans	47.7	49.9	0.47	63.5	50.5	<0.01
Mean HH incomes (ZAR)	58 000	50 000	0.07	55 000	48 000	0.70
Mean schooling years	9.4	9.2	0.04	9.5	9.1	<0.01

* Population group (1=black, 2=coloured, 3=white), ** a scale ranging from 1 (low) to 5 (high)

At the household level, participants whose parents were more educated were more likely to consistently use condoms, even though differences at this level were not statistically significant. At the community level, the proportion of household heads unemployed and community mean schooling years were significant risk factors.

In females, younger adolescents, and those currently enrolled in school reported a higher likelihood of consistently using condoms. Positive academic outlook and future prospects of working were associated with consistency in the use of condoms while planning to marry in the coming years was not. Race was also an important risk factor, with more Whites consistently using condoms compared to Black Africans and Coloureds. At the household level, a higher level of parental education, having a sibling helping with homework, was associated with consistency. At the community level, the proportion of individual Africans living in the community and the mean schooling years of the community.

In conclusion, risk factors occurred at the various levels of ecology, while many of the community level factors maybe proxy for community economic status.

Univariate and Multivariate Discriminant Function Analysis

Univariate and Multivariate discriminant function analyses were conducted where outcome variable of consistency were conducted against risk factors present. The means, and standardised discriminant scores, with associated p-values are reported on Table 4. In males, most of the risk factors included returned as significant in the univariate analyses with the exception of familial level factor of mother's level of education. This is in contrast to the findings in the previous bivariate associations where only a selected number of risk factors were found to be significant.

The second stage involved including all the significant risk factors in a full LDA model, and excluding risk factors if their contribution to explaining the variation were minimal. The final model included the age of the respondent, being currently enrolled in school, and the ethnicity to which the respondent belonged.

Table 4: Multivariate discriminant function analysis results

	MALES					FEMALES				
Independent Variables	Always	Inconsistent	F-Value	P-value *	DA**	Always	Inconsistent	F-Value	P-value *	DA**
Individual										
Age (mean years)	17.54	18.27	5.89	0.01	0.75	17.36	17.74	18.81	< 0.01	
Currently in school (1=No, 2=Yes)	1.69	1.58	9.77	<0.01	-0.15	1.80	1.67	8.66	<0.01	-0.30
Plans to pass matric (1=No, 2=Yes)	1.89	1.89	7.14	<0.01		1.97	1.89	12.84	<0.01	-0.26
Population Group (1 African, 2 Others)	1.60	1.58	9.40	<0.01	0.59	1.48	1.54	3.84	0.02	
Knows someone with HIV (1=No, 2=Yes)	1.11	1.16	9.81	<0.01		1.21	1.19	3.40	0.03	
Expects a job in 3 years **	3.07	3.23	9.30	<0.01		2.98	3.22	5.55	0.01	
Expects to marry in 3 years	1.02	1.05	9.21	<0.01		1.02	1.05	4.17	0.02	0.23
Religious (1=No, 2=Yes)	1.24	1.19	10.24	<0.01		1.40	1.31	6.02	0.01	
Household										
Parents married (1=No, 2=Yes)	1.73	1.77	10.33	<0.01		1.69	1.71	2.96	0.05	
Years of mother's education (mean, SD)	9.47	8.62	0.55	0.57		9.69	8.48	2.02	0.13	
Years of father's education (mean, SD)	10.04	8.71	3.78	0.02		10.33	8.22	3.19	0.04	
Sibling helps with homework (1=No, 2=Yes)	1.13	1.13	9.61	<0.01		1.21	1.14	6.27	0.01	-0.25
Mother a HH member(1=No, 2=Yes)	1.73	1.77	11.28	<0.01	0.39	1.68	1.72	4.13	0.01	
Community										
% HH heads unemployed	19.3	21.1	10.8	<0.01	0.65	22.4	21.3	3.84	0.02	
% HH headed by females	39.9	40.7	9.91	<0.01		41.2	41.4	3.00	0.05	
% Individual Africans	47.7	49.9	9.43	<0.01		63.5	50.5	11.01	<0.01	-0.49
Mean HH incomes (ZAR)	58 000	50 000	11.29	<0.01		55 000	48 000	4.43	0.01	0.27
Mean schooling years	9.4	9.2	12.64	<0.01	-0.36	9.5	9.1	13.79	<0.01	-0.93

* P-value for risk factor adjusted for age of the young adult, ** discriminant function coefficient for factors significant at th e multivariate model

At the familial level, only having a mother who was a household resident was retained in the multivariate model. At the community level, percentage of household heads unemployed and mean years of schooling were significant. A total of six factors were observed to be significantly different between respondents reporting consistency and inconsistency in the use of condom.

In females, being currently enrolled in school, planning to pass matric examinations, and planning to marry in the next three years were significant at the individual level. At the household level, having a brother or a sister who helped with homework, was the only significant factor in the multivariate models. Also, three risk factors at the community level were significant for females. These included the proportion of individuals in the community who were Africans, the mean household incomes, and mean schooling years of the community.

In conclusion, results from the multivariate analysis identify a number of significant risk factors that are important determinants of consistency in condom use among young adults. In males, younger respondents were more likely to report consistency in use of condoms with their last sex partners. Also, male respondents that were currently enrolled in school were more likely to be consistent condom users with their sexual partners compared to respondents who were not enrolled in school at baseline. At the familial level, having a resident mother was associated with a decline in condom use consistency, while at the community level, respondents hailing from communities with higher household incomes and higher mean level of education reported higher levels of consistency.

In females, being currently enrolled in school and planning to pass examinations, were more consistent. Females expecting to marry in the near future were less consistent. At the familial level, respondents who were at times helped by their sibling in doing their homework reported a higher tendency to consistency, while at the community level, communities with higher mean household incomes and higher mean levels of education were more likely to consistently use condoms.

Cumulative risk factor analysis

All significant factors obtained from the LDA were used in the construction of a cumulative risk index. Risk factors were scored as either 0 (if risk was absent) or 1 (if risk was present) using meaningful cut-off points considered for the risk. Cumulative risk indices were generated by summing the scores generated from the risk factors identified for each of the young adult. Proportions reporting inconsistency in the use of condoms were plotted against the cumulative risk indices.

Figure 2: Risk factors present

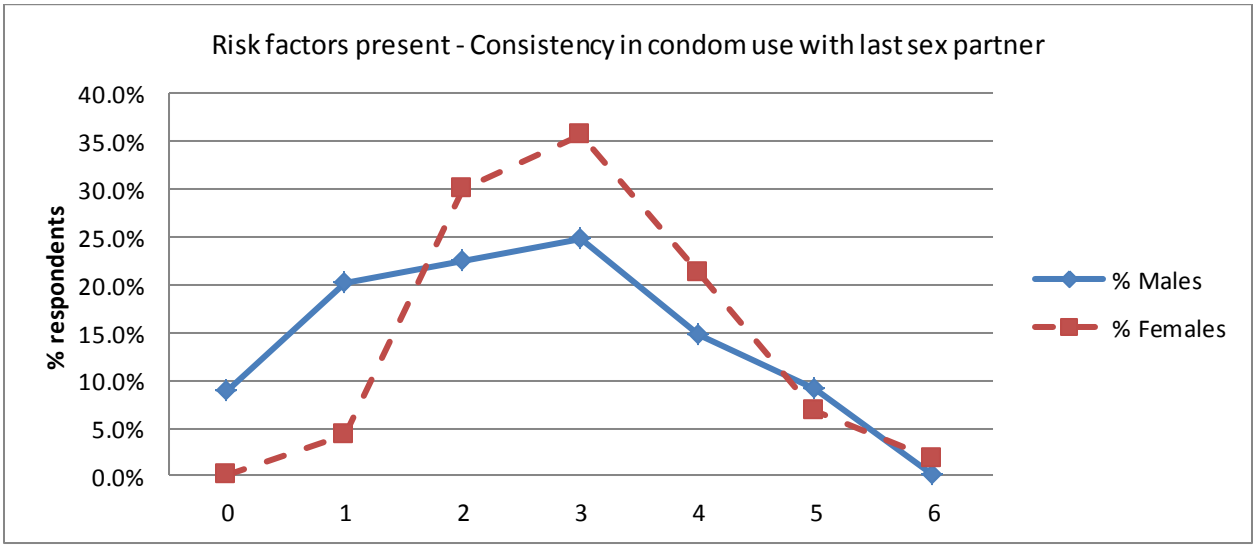
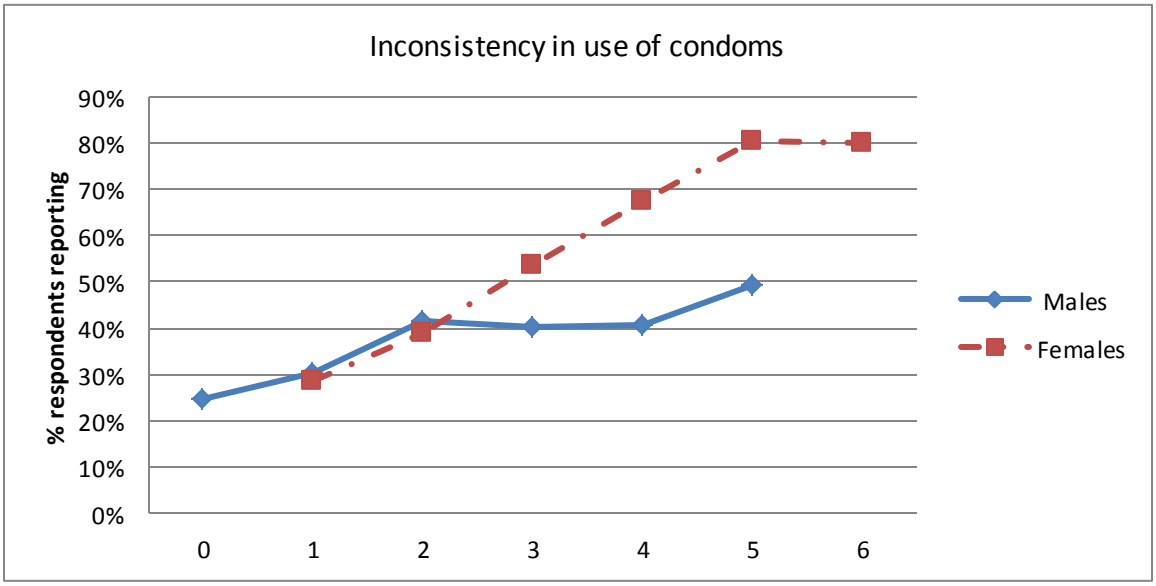


Figure 2 shows the distribution of risk factors among the respondents. For both males and females, a maximum of six risk factors were present. Females had more risk factors present, with a minimum of one and maximum of six risk factors. Males had a minimum of zero, and a maximum of five risk factors present.

Figure 3 shows the relationship between risk factors and the proportion reporting inconsistency in the use of condoms. It is evident that as more risk factors become present in the ecology, a higher proportion reports inconsistency in condom use with their last sexual partners.

Figure 3: Inconsistency in condom use against the present risk factors



This indicates the possibility that risk factors act cumulatively to determine sexual risky behaviours of condom use at last sex.

Discussion

This study examined levels, trends, and determinants of consistency in the use of condoms among adolescents and young adults in urban Cape Town. Levels in the use of condoms were found to be high during the study period, especially at the time of first sex, with predominantly male condoms used. Respondents reported using condoms for protection against disease and prevention from pregnancies. Trends indicate that consistency in the use of condoms declined over the follow-up, and is consistently lower in females than in males. Similar findings were reported in a survey conducted among young adults among the three cities of South Africa, reporting declines in the consistency use of condom between 2006 and 2010, in Johannesburg, Cape Town, and Durban(Shisana et al., 2014). The survey also found that males consistently reported higher levels of condom use in the period.

Predictors of condom use include younger age, where younger respondents were more consistent. Studies of condom use in South Africa have reported barriers to condom use; increasing age, frequent sex and longer relationship durations are factors associated with reduced consistency in condom use. It is unclear why younger respondents were more likely to be consistent condom users but perhaps their older counterparts were in more stable relationships with frequent sexual activities that lead to a reduction in condom use in their relationships. These findings have also been reported in other studies where efficacy in condom use has been associated with a decreasing age (Hendriksen et al., 2007).

For both males and females, being in school, and planning to pass Matric exams were significant factors associated with consistency in the use of condoms. It is not clear if

respondents attending schools are exposed to sexuality messages that could lead to their difference approach in the use of condoms. Previous research has also reported that being currently in school and having positive future outlook on life has been shown to delay sexual activities and reduce risk taking behaviours. This is especially true for younger respondents in schools where behavioral change sexuality messages are reported to be most effective. Expecting to marry in the near future was also a significant factor for both males and females. It is envisioned that males and females who were preparing for marriages were in stable relationships. Previous research has reported a reduction in condom use in relationships that are stable or where sexual activities are frequent (Hendriksen et al., 2007).

No differences were observed for males by ethnicity groups with Whites, Coloureds and Black African reporting similar levels of consistency in the use of condoms. However, White females were more likely to consistently use condoms compared to Blacks or Coloureds. It is unclear if White females were in more short term relationships, or why Blacks or Coloured would be less likely to consistently use condoms in their relationships. However, cultural norms and the context of sexual activity may increase the chances of reduced condom use especially among Black females, who mostly grow in contexts that define women roles in the society.

At the household level, no factors were significant for males and only a father's education and having siblings who helped with homework were significant for females. The same observation was made for community level characteristics implying that condom use is mostly influenced by peers, risk perception, and self-efficacy in the use of condoms.

Results from the cumulative risk factor analysis indicate that very few risk factors were present for determinants of consistency in the use of condoms. This might be the case where several research reports have only reported younger age, condom use at sexual debut, self-efficacy in condom use, and optimism about the future (Hendriksen et al., 2007). Analyzing the presence of risk factors and reporting inconsistency in the use of condoms, this study finds a linear positive association between the number of risk factors present and the proportion reporting inconsistency in the use of condoms with their last sexual partners. This implies that risk factors act cumulatively to predict sexual behaviour of condom use among young adults.

Conclusion

These analyses finds that a high proportion of young adults in urban Cape Town, South Africa are using condoms especially in their first sexual encounters. However, consistency in condom use declines with increasing age, which is important to understand in the context of a high HIV prevalence. Keeping young adults in school is beneficial and provides a great opportunity to target them with behavioral change messages. Ensuring learners are focused on academics, staying positive on future prospects, seems beneficial for safe sexual practices. We also find that only a select number of risk factors predict condom use among young people, a fact that could be harnessed to improve levels of condom use by targeting few but effective interventions. We missed important risk factors for consistency in condom use at the familial or community level. Interventions targeting individual level characteristics will be more effective.

In addition, we find that a cumulative risk factor approach is also practical for studying consistency in the use of condoms, as young adults reporting increased risk factors had a higher

likelihood of reporting inconsistency in the use of condoms. Therefore, a cumulative risk model is demonstrated as a powerful approach to modeling determinants of sexual risky behaviours. This is important for South Africa and sub-Saharan Africa that is currently experiencing an HIV/AIDS epidemic in informing prevention efforts that works to effectively reverse the sustained trend of high HIV infection levels among adolescents.

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References

BEARINGER, L. H., SIEVING, R. E., FERGUSON, J. & SHARMA, V. 2007. Global perspectives on the sexual and reproductive health of adolescents: patterns, prevention, and potential. *Lancet,* 369**,** 1220-31.

BRONFENBRENNER, U. 1979. The Ecology of human development: Experiments by nature and design. *Harvard University Press*.

BRONFENBRENNER, U. 1986. Ecology of the family as a context for human development:Research perspectives. *Developmental Psychology,* 22**,** 723-742.

BRONFENBRENNER, U. & MORRIS, P. 1998. The ecology of developmental processes. *Handbook of Child Psychology,* 1**,** 993-1028.

DINKELMAN, T., LAM, D. & LEIBBRANDT, M. 2007. Household and community income, economic shocks and risky sexual behavior of young adults: evidence from the Cape Area Panel Study 2002 and 2005. *AIDS,* 21 Suppl 7**,** S49-56.

DINKELMAN, T., LAM, D. & LEIBBRANDT, M. 2008. Linking Poverty and Income Shocks to Risky Sexual Behaviour: Evidence from a Panel Study of Young Adults in Cape Town. *S Afr J Econ,* 76**,** s52-s74.

EATON, L., FLISHER, A. J. & AARO, L. E. 2003. Unsafe sexual behaviour in South African youth. *Soc Sci Med,* 56**,** 149-65.

EVANS, G. W., LI, D. & WHIPPLE, S. S. 2013. Cumulative risk and child development. *Psychol Bull,* 139**,** 1342-96.

HENDRIKSEN, E. S., PETTIFOR, A., LEE, S. J., COATES, T. J. & REES, H. V. 2007. Predictors of condom use among young adults in South Africa: the Reproductive Health and HIV Research Unit National Youth Survey. *Am J Public Health,* 97**,** 1241-8.

JEWKES, R., MORRELL, R. & CHRISTOFIDES, N. 2009. Empowering teenagers to prevent pregnancy: lessons from South Africa. *Cult Health Sex,* 11**,** 675-88.

KALICHMAN, S. C., SIMBAYI, L. C., JOOSTE, S., CHERRY, C. & CAIN, D. 2005a. Poverty-related stressors and HIV/AIDS transmission risks in two South African communities. *J Urban Health,* 82**,** 237-49.

KALICHMAN, S. C., SIMBAYI, L. C., KAGEE, A., TOEFY, Y., JOOSTE, S., CAIN, D. & CHERRY, C. 2006. Associations of poverty, substance use, and HIV transmission risk behaviors in three South African communities. *Soc Sci Med,* 62**,** 1641-9.

KALICHMAN, S. C., SIMBAYI, L. C., KAUFMAN, M., CAIN, D., CHERRY, C., JOOSTE, S. & MATHITI, V. 2005b. Gender attitudes, sexual violence, and HIV/AIDS risks among men and women in Cape Town, South Africa. *J Sex Res,* 42**,** 299-305.

KAPLAN, D. L., JONES, E. J., OLSON, E. C. & YUNZAL-BUTLER, C. B. 2013. Early age of first sex and health risk in an urban adolescent population. *J Sch Health,* 83**,** 350-6.

LAM, DAVID, CALLY ARDINGTON, NICOLA BRANSON, ANNE CASE, MURRAY LEIBBRANDT, ALICIA MENENDEZ, SEEKINGS, J. & SPARKS., M. 2008. The Cape Area Panel Study: A Very Short Introduction to the Integrated Waves 1-2-3-4 Data. The University of Cape Town.

MACPHAIL, C. & CAMPBELL, C. 2001. 'I think condoms are good but, aai, I hate those things': condom use among adolescents and young people in a Southern African township. *Soc Sci Med,* 52**,** 1613-27.

MCGRATH, N., NYIRENDA, M., HOSEGOOD, V. & NEWELL, M. L. 2009. Age at first sex in rural South Africa. *Sex Transm Infect,* 85 Suppl 1**,** i49-55.

MUTINTA, G., GOVENDER, K., GOW, J. & GEORGE, G. 2013. An Investigation on Students' Risky Sexual Behavior at KwaZulu-Natal University, Durban, South Africa. *American Journal of Sexuality Education,* 8.

PANDAY, S., MAKIWANE, M., RANCHOD, C. & LETSOALO, T. 2009. Teenage pregnancy in South Africa - with a specific focus on school-going learners. Child, Youth, Family and Social Development, Human Sciences Research Council. Pretoria: Department of Basic Education.

PERKINS, F. D., LUSTER, T., VILLARRUEL, A. F. & SMALL, S. 1998. An Ecological, Risk-Factor Examination of Adolescents' Sexual Activity in Three Ethnic Groups. *Journal of Marriage and the Family,* 60**,** 660-673.

SHISANA, O., REHLE, T., SIMBAYI, L., PARKER, W. & ZUMA, K. 2009. South African National HIV prevalence, HIV incidence and behaviour and communication survey, 2008: a turning tide among teenagers? CapeTown. *HSRC Press*.

SHISANA, O., REHLE, T., SIMBAYI, L. C., ZUMA, K., JOOSTE, S., ZUNGU, N., LABADARIOS, D. & ONOYA, D. 2014. South African National HIV Prevalence, Incidence and Behaviour Survey, 2012. Cape Town, HSRC *HSRC Press*.

SMALL, S. A. & LUSTER, T. 1994. Adolescent sexual activity: an ecological, risk-factor approach. *J Marriage Fam.***,** 181–92.

STEPHENSON, R. 2009. Community influences on young people's sexual behavior in 3 African countries. *Am J Public Health,* 99**,** 102-9.

UNAIDS 2011. Global HIV/AIDS response: epidemic update and health sector progress towards universal access.

UNAIDS 2013. Global Report 2013.

WAMOYI, J., WIGHT, D. & REMES, P. 2014. The structural influence of family and parenting on young people's sexual and reproductive health in rural northern Tanzania. *Cult Health Sex,* 17**,** 718-732.

WILLAN, S. 2013. A Review of Teenage Pregnancy in South Africa, Partners in Sexual Health, 2013.

ZUMA, K., MZOLO, T. & MAKONKO, E. 2011. Determinants of age at sexual debut and associated risks among South African youths. *African Journal of AIDS Research* 01/2011.

ZUMA, K., SETSWE, G., KETYE, T., MZOLO, T., REHLE, T. & MBELLE, N. 2010. Age at sexual debut: a determinant of multiple partnership among South African youth. *Afr J Reprod Health,* 14**,** 47-54.