Trends and Determinants of Condom Use in Uganda

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Abstract

Background: Documenting trends in condom use and exploring factors associated with their utilization are important for broadening the information base for the design of HIV intervention programs. This paper aims to document Uganda's nationwide trends in condom use from 1995 to 2006 and seeks to understand some of the socio-demographic variables that may be associated with their use, using Uganda Demographic Health Surveys (UDHSs).

Method: Data from UDHSs conducted in 1995, 2000/2001 and 2006 were analyzed. Socio-demographic variables as well as 'survey year' were selected to assess their interaction with condom use. Multivariate regression analyses were performed. Odds ratios and confidence intervals were computed.

Results: Socio-demographic factors such as being male and living in an urban setting were significantly associated with an increased likelihood of reported use of condoms. All results indicated a far greater increase in condom use between 1995 and 2000/2001 than between 2000/2001 and 2006.

Conclusion: Policies need to intensify condom use campaigns especially among women and rural populations. The wane in increase in condom use between 2000/2001 and 2006 may be due to the large-scale influx of antiretrovirals (starting in 2004) which may be lowering the anxiety associated with the social construct of HIV/AIDS.

Introduction

Hailed as a model for the rest of Africa, Uganda's fight against HIV/AIDS has been extensively documented. In the early 1990s strong government leadership and partnerships worked to successfully contain the high prevalence of the disease – estimated at a high of 18% in rural areas and 25% to 30% in urban areas at that time (Uganda AIDS Commission and the Uganda HIV/AIDS Partnership 2008). The 2008 United Nations (UN) General Assembly Special Session (UNGASS) report on Uganda states that HIV prevalence has now stabilized at between 6% and 7% (Uganda AIDS Commission and the Uganda HIV/AIDS Partnership 2008).

Many public health campaigns in Uganda were introduced as a greater understanding of the complexity of the nature of the HIV epidemic developed. Because the majority of infections in the country occur via sexual transmission, the promotion of a comprehensive ABC approach (Abstinence, Be faithful, use Condoms), similar to that used in a number of sub-Saharan African countries, has been an important mainstay in the public health message to fight the epidemic (Hogle et al. 2002). Indeed, being the "single, most efficient, available technology to reduce the sexual transmission of HIV" (UNAIDS et al. 2004), condom use is an important indicator of risky sexual behaviour and, consequently, is a potential predictor of future HIV infection rates. For instance, recent estimates by UNAIDS (2010) indicating that HIV incidence may be on the increase again in Uganda were preceded by data illustrating a decrease in reported condom use between 2000 and 2006: self-reported condom use with someone other than one's regular partner had decreased from 39% to 35% among women and 59% to 57% among men during this period (UNAIDS and the World Health Organization [WHO] 2011).

In light of the fact that seroincidence in Uganda is on the rise and that ensuring condom use is one of the essential strategies to combat the epidemic, this paper aims to broaden the information base for the design of future HIV intervention programs by documenting changing trends in condom use and exploring the factors associated with their use. It also aims to document nationwide trends in reported condom use between 1995 and 2006, using Uganda Demographic and Health Surveys (UDHSs), and it seeks to understand some of the socio-demographic variables that may be associated with their use.

Methods

Study Setting

This study makes use of data collected in Uganda between 1995 and 2006. Between these two dates, the World Bank estimates that the country's life expectancy rose from 45 to 51 years and that the population grew from 21 to 30 million, with an average annual population growth rate of 3.3%. Throughout the period, the population remained mostly rural (accounting for 88% of the entire population), and GDP per capita increased from 274.4 US dollars to 334.6 US dollars (World Bank 2011). UNESCO (United Nations Educational, Scientific and Cultural Organization) estimates that the literacy rate increased from 56.1% to 71.4% for persons aged 15 years and over between 1991 and 2006 (UNESCO Institute for Statistics 2011).

Demographic and Health Surveys (DHSs), from which data for this study are drawn, are conducted every few years in selected low- and middle-income countries. The primary objective of the surveys is providing detailed information to stakeholders and researchers on demographic, health, reproductive health and family planning trends within the country. The surveys are conducted for monitoring and evaluation and for policy development purposes. All surveys aim to be nationally representative and collect information on women aged 15 to 49 and men aged 15 to 54. This study makes use of all the UDHSs that addressed sexual behaviour:

- 'The 1995 survey was conducted in all of the country's districts except Kitgum. It included 7,070 female and 1,996 male respondents.
- The '2000/2001 survey was conducted in all of the country's districts except Bundibugyo, Gulu, Kasese and Kitgum. It included 7,246 female and 1,962 male respondents.

- 'The 2006 survey was conducted in all of the country's districts and included 8,531 female and 2,503 male respondents.

Data Collection and Ethical Clearance

Data for DHSs are collected with the respondents' informed consent, and ethical clearance is given before the commencement of the data collection process. The data are publicly accessible, and analyzing DHS data from any country, including Uganda, does not require ethical clearance.

Data Analysis

Data were analyzed using SPSS-PASW, Version 18 (SPSS, Inc., Chicago, IL). Condom use was registered if used by either the male or female partner. The following condom use indicators were selected in the 1995, 2000/2001 and 2006 surveys:

- "At last intercourse with anyone was a condom used? (Yes/No)" was recoded as "Condom used during last intercourse." This indicator had a recall period of 12 months.
- "At last intercourse with man/woman other than your partner was a condom used? (Yes/No)" was recoded as "Condom used during last intercourse with man/woman (1) other than partner." Although this indicator had a recall period of 12 months in the 2000/2001 and 2006 surveys and a recall period of 6 months in the 1995 survey, the authors did not consider this difference an important source of bias (as discussed in the limitations section of this paper).

The following condom use indicator was also selected, although only in 2000/2001 and 2006:

- "At last intercourse with third man/woman was a condom used? (Yes/No)" was recoded as "Condom used during last intercourse with man/woman (2) other than partner." This indicator had a recall period of 12 months.

The following independent variables were selected in order to study their interaction with the condom use indicators just mentioned: Year (1995, 2000/2001, 2006), Sex (Male, Female), Current age in 5-year groups (15–19, 20–24, …, 50–54), Type of place of residence (Urban, Rural), and Highest education level (No education, Primary, Secondary, Higher).

The association between each condom use indicator and each independent categorical variable was first assessed using Chi-square or Fisher's exact test. The independent variables with a p-value equal to or less than .25 were then entered into multiple logistic regression models. '2000/2001' was used as the baseline indicator for the variable 'Year' in the regression models in order to compare condom use before and after this point. Both backward and forward stepwise logistic regression analyses (Wald test) were performed, and they gave the same results. P-values less than .05 (two-sided test) were considered significant in the final model. Odds ratios (OR) and their 95% confidence intervals (CI) were computed. The final multivariate models were tested for goodness of fit with the Hosmer–Lemeshow test.

Results

The socio-demographic characteristics of the 29,308 respondents are presented in Tables 1 and 2. Demographic Health Surveys were initially set up to assess the health of households – notably of women and children – and as a result almost 80% of respondents are female. The data reflect the fact that Uganda is predominantly a young and rural-based population and that the majority of respondents have a primary education.

These tables cross-tabulate the condom use indicators against the independent variables. Males, urban populations, respondents with higher education, and younger generations appear to be correlated with higher condom use. Interestingly, for all condom use indicators, condom use was highest in 2000/2001 but dropped in 2006. For "Condom used during last intercourse," condom use

increased from 6.8% in 1995 to 10.5% in 2000/2001 but dropped to 9.9% in 2006. For "Condom used during last intercourse with man/woman (1) other than partner," condom use increased from 10.9% in 1995 to 47.5% in 2000/2001 but dropped to 37.3% in 2006. For "Condom used during last intercourse with man/woman (2) other than partner," condom use decreased from 57.5% in 2000/2001 to 41.5% in 2006. Figure 1 presents these observations in a line graph.

Figure 1. Condom use in 1995, 2000/2001 and 2006

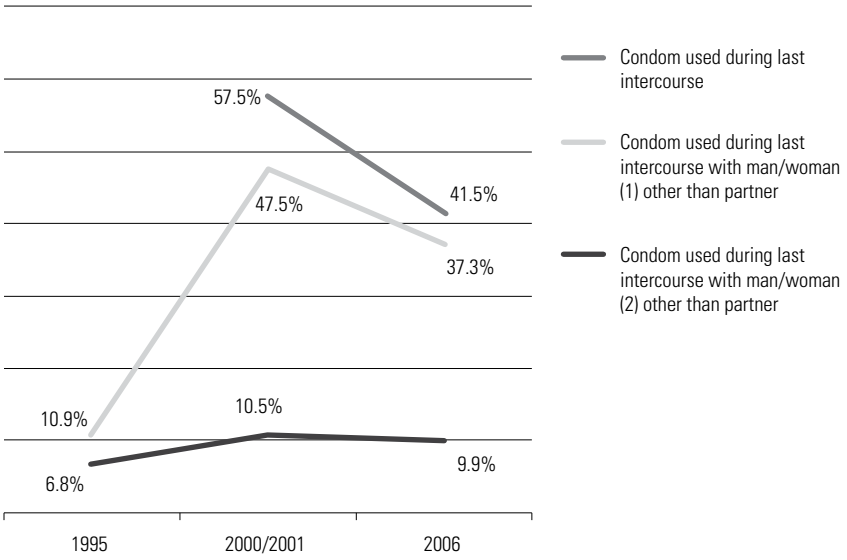

Table 1. Year, sex, educational level and condom use behaviour of respondents

			Condom used during last intercourse			Condom used during last intercourse with man/ woman (1) other than partner			Condom used during last intercourse with man/ woman (2) other than partner		
			No	Yes	Total	No	Yes	Total	No	Yes	Total
Year	1995	**N**	7093	518	7611	2726	334	3060	0	0	0
		Row %	93.2%	6.8%	100.0%	89.1%	10.9%	100.0%	.0%	.0%	.0%
	2001	**N**	6240	731	6971	269	243	512	31	42	73
		Row %	89.5%	10.5%	100.0%	52.5%	47.5%	100.0%	42.5%	57.5%	100.0%
	2006	**N**	7234	794	8028	416	247	663	62	44	106
		Row %	90.1%	9.9%	100.0%	62.7%	37.3%	100.0%	58.5%	41.5%	100.0%
Sex	Male	**N**	4233	766	4999	1447	520	1967	82	85	167
		Row %	84.7%	15.3%	100.0%	73.6%	26.4%	100.0%	49.1%	50.9%	100.0%
	Female	**N**	16334	1277	17611	1964	304	2268	11	1	12
		Row %	92.7%	7.3%	100.0%	86.6%	13.4%	100.0%	91.7%	8.3%	100.0%

Table 1. Continued

			Condom used during last intercourse			Condom used during last intercourse with man/ woman (1) other than partner			Condom used during last intercourse with man/ woman (2) other than partner		
			No	Yes	Total	No	Yes	Total	No	Yes	Total
Highest educational level	No education	**N**	4514	73	4587	594	39	633	8	1	9
		Row %	98.4%	1.6%	100.0%	93.8%	6.2%	100.0%	88.9%	11.1%	100.0%
	Primary	**N**	12228	884	13112	2139	424	2563	68	44	112
		Row %	93.3%	6.7%	100.0%	83.5%	16.5%	100.0%	60.7%	39.3%	100.0%
	Secondary	**N**	3246	840	4086	639	294	933	14	31	45
		Row %	79.4%	20.6%	100.0%	68.5%	31.5%	100.0%	31.1%	68.9%	100.0%
	Higher	**N**	578	246	824	39	67	106	3	10	13
		Row %	70.1%	29.9%	100.0%	36.8%	63.2%	100.0%	23.1%	76.9%	100.0%

Adjusting for all potential confounding factors listed in Tables 1 and 2, all condom use indicators demonstrate that males and urban populations are strongly associated with an increased likelihood of reported use of condoms, just as the previously mentioned cross-tabulations suggested. For the variable "Condom used during last intercourse" (Table 3), the odds of females reporting use of a condom compared to males is significantly lower (OR=.377, 95% CI .338–.419), as is the odds ratio of rural persons using a condom compared to urban persons (OR=.369, 95% CI .331–.411). For the variable "Condom used during last intercourse with man/woman (2) other than partner" (Table 4), the odds ratio of females reporting use of a condom compared to males is significantly lower (OR=.553, 95% CI .450–.679), as is the odds ratio of rural persons using a condom compared to urban persons (OR=.378, 95% CI .310–.461). For the variable "Condom used during last intercourse with man/woman (2) other than partner" (Table 5), the odds ratio of females reporting use of a condom compared to males is significantly lower (OR=.040, 95% CI .004–.452), as is the odds ratio of rural persons using a condom compared to urban persons (OR=.300, 95% CI .116–.779).

Table 2. Age, residence and condom use behaviour of respondents

			Condom used during last intercourse			Condom used during last intercourse with man/ woman (1) other than partner			Condom used during last intercourse with man/ woman (2) other than partner		
			No	Yes	Total	No	Yes	Total	No	Yes	Total
Age	15–19	**N**	2268	530	2798	242	109	351	5	6	11
		Row %	81.1%	18.9%	100.0%	68.9%	31.1%	100.0%	45.5%	54.5%	100.0%
	20–24	**N**	4380	625	5005	597	211	808	5	17	22
		Row %	87.5%	12.5%	100.0%	73.9%	26.1%	100.0%	22.7%	77.3%	100.0%
	25–29	**N**	4291	373	4664	741	204	945	17	21	38
		Row %	92.0%	8.0%	100.0%	78.4%	21.6%	100.0%	44.7%	55.3%	100.0%

Table 2. Continued

			Condom used during last intercourse			Condom used during last intercourse with man/ woman (1) other than partner			Condom used during last intercourse with man/ woman (2) other than partner		
			No	Yes	Total	No	Yes	Total	No	Yes	Total
Age	30–34	**N**	3503	219	3722	621	153	774	19	17	36
		Row %	94.1%	5.9%	100.0%	80.2%	19.8%	100.0%	52.8%	47.2%	100.0%
	35–39	**N**	2747	141	2888	537	89	626	9	15	24
		Row %	95.1%	4.9%	100.0%	85.8%	14.2%	100.0%	37.5%	62.5%	100.0%
	40–44	**N**	1824	105	1929	346	33	379	18	4	22
		Row %	94.6%	5.4%	100.0%	91.3%	8.7%	100.0%	81.8%	18.2%	100.0%
	45–49	**N**	1304	40	1344	228	18	246	16	3	19
		Row %	97.0%	3.0%	100.0%	92.7%	7.3%	100.0%	84.2%	15.8%	100.0%
	50–54	**N**	250	10	260	99	7	106	4	3	7
		Row %	96.2%	3.8%	100.0%	93.4%	6.6%	100.0%	57.1%	42.9%	100.0%
Type of place of residence	Urban	**N**	4879	1106	5985	964	406	1370	11	32	43
		Row %	81.5%	18.5%	100.0%	70.4%	29.6%	100.0%	25.6%	74.4%	100.0%
	Rural	**N**	15688	937	16625	2447	418	2865	82	54	136
		Row %	94.4%	5.6%	100.0%	85.4%	14.6%	100.0%	60.3%	39.7%	100.0%

Furthermore, younger generations and persons with higher education are also associated with an increased use of condoms, except within the context of "Condom used during last intercourse with man/woman (2) other than partner" (Tables 3, 4 and 5).

Table 3. Factors included in the final multivariable logistic model analyzing the association with "Condom used during last intercourse"

	p-value	Odds ratio	95% CI for odds ratio	
			Lower	Upper
Year (2000/2001)	Reference group			
Year (1995)*	<.001	.602	.530	.684
Year (2006)**	.001	1.217	1.083	1.369
Sex (Male)	Reference group			
Sex (Female)*	<.001	.377	.338	.419

Table 3. Continued

	p-value	Odds ratio	95% CI for odds ratio	
			Lower	Upper
Age (15–19)	Reference group			
Age (20–24)*	<.001	.516	.450	.591
Age (25–29)*	<.001	.293	.252	.342
Age (30–34)*	<.001	.211	.176	.252
Age (35–39)*	<.001	.188	.153	.231
Age (40–44)*	<.001	.217	.172	.275
Age (45–49)*	<.001	.128	.091	.181
Age (50–54)*	<.001	.080	.041	.154
Residence (Urban)	Reference group			
Residence (Rural)*	<.001	.369	.331	.411
Education (No)	Reference group			
Education (Primary)*	<.001	2.614	2.044	3.342
Education (Secondary)*	<.001	6.591	5.121	8.483
Education (Higher)*	<.001	11.189	8.377	14.945

*p<.001. **p<.01.

With regards to the independent variable Year, the logistic regression analyses indicate that for "Condom used during last intercourse" (Table 3), the odds ratio of using a condom in 1995 is significantly lower than in 2000/2001 (OR=.602, 95% CI .530–.684), and the odds ratio of using a condom in 2006 is almost 22% higher than in 2000/2001 (OR=1.217, 95% CI 1.083–1.369). These odds differences are statistically significant. With regards to "Condom used during last intercourse with man/woman (1) other than partner" (Table 4), the odds ratio of using a condom in 1995 is significantly lower than the odds of using a condom in 2000/2001 (OR=.154, 95% CI .121–.196), but there is no statistically significant difference in condom use between 2000/2001 and 2006. For "Condom used during last intercourse with man/woman (2) other than partner" (Table 5), there is no statistically significant difference in the odds of using a condom between 2000/2001 and 2006. When adjusted for age, sex, education and type of residence, the logistic model no longer depicts a drop in condom use from 2001 to 2006: condom use either increases at a slower rate or there is no statistically significant change in condom use between 2001 and 2006 compared to the period between 1995 and 2001.

Table 4. Factors included in the final multivariable logistic model analyzing the association with "Condom used during last intercourse with man/woman (1) other than partner"

	p-value	Odds ratio	95% CI for odds ratio	
			Lower	Upper
Year (2000/2001)	Reference group			
Year (1995)*	<.001	.154	.121	.196
Year (2006)	.358	.883	.678	1.151
Sex (Male)	Reference group			
Sex (Female)*	<.001	.553	.450	.679
Age (15–19)	Reference group			
Age (20–24)	.069	.741	.536	1.024
Age (25–29)*	<.001	.475	.342	.659
Age (30–34)*	<.001	.383	.271	.540
Age (35–39)*	<.001	.237	.162	.347
Age (40–44)*	<.001	.135	.084	.219
Age (45–49)*	<.001	.111	.061	.201
Age (50–54)*	<.001	.071	.030	.170
Residence (Urban)	Ref.			
Residence (Rural)*	<.001	.378	.310	.461
Education (No)	Reference group			
Education (Primary)**	.004	1.720	1.190	2.486
Education (Secondary)*	<.001	3.408	2.312	5.022
Education (Higher)*	<.001	7.491	4.183	13.416

*p<.001. **p<.05.

Table 5. Factors included in the final multivariate model analyzing the association with "Condom used during last intercourse with man/woman (2) other than partner"

	p-value	Exp(B)	95% CI for odds ratio	
			Lower	Upper
Year (2000/2001)	Reference group			
Year (2006)	.898	.952	.450	2.014
Sex (Male)	Ref.			
Sex (Female)*	.009	.040	.004	.452

Table 5. Continued

	p-value	Exp(B)	95% CI for odds ratio	
			Lower	Upper
Age (15–19)	Reference group			
Age (20–24)	.290	2.520	.454	13.975
Age (25–29)	.944	.947	.205	4.367
Age (30–34)	.477	.566	.118	2.711
Age (35–39)	.755	1.298	.252	6.698
Age (40–44)	.056	.165	.026	1.045
Age (45–49)	.051	.141	.020	1.011
Age (50–54)	.367	.368	.042	3.224
Residence (Urban)	Reference group			
Residence (Rural)**	.013	.300	.116	.779
Education (No)	Reference group			
Education (Primary)	.652	1.718	.164	17.979
Education (Secondary)	.094	7.973	.701	90.629
Education (Higher)	.210	5.887	.369	93.992

*$p<.01$. **$p<.05$.

Discussion

All condom use indicators demonstrate that males and urban populations are strongly associated with an increased likelihood of using condoms. These differences are at times very striking. For instance, for the indicator "Condom used during last intercourse," the odds of males using a condom was 2.65 times that of females (Odds Male/Odds Female), and the odds of urban populations using a condom was 2.7 times that of rural populations (Odds Urban/Odds Rural). Indeed, males and urban populations are more likely to use condoms when it comes to all condom use indicators. This may be due to the fact that males and urban populations generally have greater access to awareness campaigns on safe sex than females and rural populations and consequently may be more informed on the importance of condom use (Sarkar 2008). Furthermore, gender inequalities could explain why males seem to be able to determine the use of condoms more readily than women (Sarkar 2008). As expected, persons with higher educational attainment are also associated with increased condom use (Sarkar 2008), although this finding was not consistent across all sexual behaviour indicators. In turn, perhaps because the accessibility of education in Uganda has drastically increased over the past 20 years (UNESCO Institute for Statistics 2011), younger generations are also associated with increased condom use, although, again, this finding is not consistent across all sexual behaviour indicators.

Having adjusted for potential confounding factors, the condom use pattern over time gives interesting readings: for all indicators, there was a far greater rate of decrease in high-risk sexual behaviour between 1995 and 2000/2001 compared to the rate of decrease between 2000/2001 and 2006. For the indicator "Condom used during last intercourse," condom use increased by 66% (Odds 2001/

Odds 1995) between 1995 and 2000/2001, and, for the indicator "Condom used during last intercourse with man/woman (1) other than partner," the odds ratio of using a condom in 2000/2001 was almost 6.5 times (Odds 2001/Odds 1995) that of 1995. Comparing the results between 1995 and 2000/2001 indicates a substantial decrease in high-risk sexual behaviour over the course of this period. However, the results comparing sexual behaviour indicators between 2000/2001 and 2006 read otherwise. Considering the fact that condom distribution in Uganda almost doubled between 2001 and 2006 and that donor funding for HIV programs increased more than ten-fold between 2003/2004 and 2006/2007 (Uganda National AIDS Commission and UNAIDS 2009), the country should also have expected a further significant increase in condom use between the 2000/2001 and 2006 surveys. That said, for the indicator "Condom used during last intercourse," the odds ratio of using a condom in 2006 was only 21.7% higher than in 2000/2001 – a much slower rate of increase compared to that of 66% between 1995 and 2000/2001. For the indicators "Condom used during last intercourse with man/woman (1) other than partner" and "Condom used during last intercourse with man/woman (2) other than partner," the difference in condom use between 2000/2001 and 2006 was not even statistically significant.

Thus, one of the more important findings of this paper is the fact that the rate of increase in condom use between 1995 and 2000/2001 was far greater than the rate of increase between 2000/2001 and 2006. This wane in increase may be the result of a dramatic, large-scale, nationwide recall of faulty condoms in 2004 (Kirumira 2006) and/or a shift in prevention policy toward one by the United States PEPFAR (President's Emergency Plan for AIDS Relief), which visibly promoted abstinence-only programs over condom use programs from 2004 onwards (although condom use was not actively discouraged). Indeed, since the late 1980s, Uganda had' been promoting a comprehensive ABC approach to combat the HIV epidemic.

However, this increase in high-risk sexual behaviour may also be as a result of PEPFAR's large-scale distribution of antiretroviral therapy (ART) starting in 2004 (ART coverage increased from 12% in 2004 to 27% in 2006 [WHO et al. 2008]). Indeed, during the 1990's, some high-income countries reported an increase in high-risk sexual behaviour among men who have sex with men when ART was made extensively accessible in their public health systems (International Collaboration on HIV Optimism 2003; Katz et al. 2002; Mechoulan 2007). Although inconclusive, more recent studies exploring heterosexual behaviour among non-antiretroviral (ARV) users in low-income settings suggest that access to ART may have led to an increase in risky behaviour (Abbas et al. 2006; Crepaz et al. 2004; Ezekiel et al. 2008). One retrospective study on a clinical cohort established between 2002 and 2009 in rural South–West Uganda suggests that the availability of HIV treatment may have led to an increase in risky sexual behaviour among HIV-uninfected people (Shafer et al. 2011). However, this finding was inconsistent across the study's chosen behavioural indicators. Hence, there is a possibility that between 1995 and 2000/2001, the social construct of HIV/AIDS – built around suffering and death – led to risky sexual behaviour being rapidly reined in. However, the radical increase in ART accessibility (from 2004 onwards, PEPFAR) may have lowered the anxiety associated with HIV/AIDS – either because HIV transmission appeared less likely (since HIV carriers are no longer as visibly distinguishable as they once would have been) or because HIV is no longer perceived the death sentence it once was – and this may have led to the increase in risky sexual behaviour observed between the 2000/2001 and 2006 surveys.

Implications and Further Studies

There is a striking difference in condom use between males and females. This suggests that more has to be done to educate and empower women so that they understand the importance of using condoms and feel empowered enough to use them or to urge their partners to do so. The same can be said of rural populations: more needs to be done to get people living in rural areas to use condoms, perhaps by increasing the coverage of awareness campaigns to the most rural areas. It is encouraging to see that younger generations were more strongly associated with increased condom use, because younger people will be the ones contributing to the future of their communities and

instilling change among their peers as well as their own children. It is also encouraging that increased condom use was associated with higher education, since the country is increasingly educating its people. However, more research needs to be conducted to further assess the associations between condom use and the aforementioned socio-demographic characteristics.

That said, the trends in condom use over time were worrying. If indeed the lack of expected increase in condom use between 2000/2001 and 2006 was due to the nationwide recall of faulty condoms in 2004 (Kirumira 2006) and/or the shift in prevention policy toward PEPFAR-backed abstinence-only programs, then more needs to be done at the governance level to provide for easy and consistent access to condoms for all. However, if it is the large scale distribution of ART that has led to an increase in risky sexual behaviour, then this will undoubtedly affect the epidemiology of the HIV/AIDS epidemic. Ironically, the expansion in provision of HIV/AIDS treatment, without addressing the general population's increase in risky sexual behaviour, could offset Uganda's public health achievements since the 1990's. The dearth of articles available when carrying out research on ART and population-wide sexual behaviour in low-income settings is either indicative of the lack of importance attached to the issue or to the relatively recent emergence of its importance in low-income countries (since ART was, in general, made extensively available only during the mid-2000s, thanks to PEPFAR). Either way, it is evident that a lot more research needs to be conducted in order to explore the association between ART and risky sexual behaviour. Mathematical models are particularly useful in understanding the epidemiology of the HIV/AIDS epidemic, but these must now begin to take into account the potential population-wide impact of ART on sexual behaviour change both among ARV users and non-ARV users.

Ultimately, policy makers are urged to intensify public health campaigns addressing risky sexual behaviour and HIV and promote the practice of safe sex. Indeed, efforts to address the increase in high-risk sexual behaviour are needed if we aim to control the HIV epidemic efficiently.

Limitations

For the indicator "Condom used during last intercourse with man/woman (1) other than partner," the recall period in 2000/2001 and 2006 was 12 months, whereas in 1995 it was only 6 months. This may explain the drastic increase in condom use between 1995 and 2000/2001, although we felt that there was still some comparison we could carry out between 1995 and the other surveys. That said, even if the denominator in 1995 was adjusted (in order to approximate for condom use over 12 months instead of 6), we would still have expected to observe a significant increase in condom use in 2000/2001. Nevertheless, important for this study's conclusions, this indicator is not associated with a statistically significant difference in condom use between 2000/2001 and 2006.

The Demographic and Health Surveys organization explains that their surveys in low-income settings are prone to sampling errors and incomplete and inconsistent data reporting (Croft n.d.). Furthermore, the fact that the three surveys do not cover exactly the same geographical areas is a limitation for a comparative cross-sectional study such as this. The organization, however, assures its data users that it has considered all of the above and has done its utmost to maximize the reliability and validity of the data collected (Croft n.d.; Uganda Bureau of Statistics and Macro International Inc. 2007). Still, the three surveys show an unusual decreasing trend in persons living in urban areas, when we expected the opposite. However, DHS informed the authors that their samples have improved with regards to representativeness over time, since surveys have increasingly been able to reach and interview those living in rural areas. This may explain the decreasing trend in persons living in urban areas. Ultimately, a comparative cross-sectional study does not allow us to establish why there were changes in sexual behaviour over time. For instance, in Uganda the rate of condom distribution varies quite significantly between 1995 and 2006 – a major limitation when citing "condom use" as a proxy for high-risk sexual behaviour. By 1996 the number of condoms delivered in Uganda had risen to nearly 10 million, from 1.5 million in 1992 (Timber 2011). However, condom scarcity, as a result of a nationwide recall of faulty products in 2004 (Kirumira 2006) and a shift in prevention policy toward PEPFAR-backed abstinence-only programs may erroneously be

read as an increase in high-risk sexual behaviour in this study. That said, access to condoms was facilitated in mid-2006 with an influx of 80 million condoms for free access (Kirumira 2006).

Conclusion

All sexual behaviour indicators demonstrate that males and urban populations are strongly associated with an increased likelihood of using condoms. Younger age groups and those who have attained a higher education are also associated with increased condom use, although these findings were not consistent across all of the sexual behaviour indicators.

For all sexual behaviour indicators, the rate of increase in condom use between 1995 and 2000/2001 was far greater than between 2000/2001 and 2006. Although a comparative cross-sectional study cannot establish causality, the authors suggest that this wane in condom use may be a result of the decreased access to condoms between 2000/2001 and 2006. This wane may also be as a result of the large-scale influx of ARV's (thanks to the PEPFAR initiative implemented in 2004), which may be lowering the anxiety associated with HIV/AIDS.

Policy makers are urged to intensify public health campaigns addressing risky sexual behaviour and HIV and to promote the practice of safe sex. Uganda had promoted a comprehensive ABC approach to tackle the HIV epidemic since the late 1980's, but the promotion of condom use was dropped in 2004 when PEPFAR began supplying ARV's to the country. The importance of condom use needs to be emphasized with renewed fervour in order to challenge the decreasing rates of condom use this research outlines. Furthermore, although the supply of condoms was boosted by the free distribution of 80 million condoms in 2006 (Kirumira 2006), a shortage was again reported in 2010 (IRIN PlusNews 2010). Health systems need to assess ways in which to improve the efficiency of procurement processes, delivery systems and storage facilities in order to ensure a consistent distribution of condoms to the general public.

Authors' Contributions

Zaake De Coninck conceptualized the research idea, is the main author of the manuscript and was involved in all aspects of the study. Gaetano Marrone also conceptualized the research idea, provided statistical support, supervised the analysis and edited the paper.

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