AOSIS

Condom migration after introduction of pre-exposure prophylaxis among HIV-uninfected adolescents in South Africa: A cohort analysis

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Background: Approximately 3 million adolescents and young adults (AYA), between the ages of 15 years and 24 years, are living with HIV in sub-Saharan Africa. The use of pre-exposure prophylaxis (PrEP) may be a promising HIV prevention tool to bridge the high-risk years of AYA between sexual debut and adulthood.

Objectives: Concerns have been raised that the use of PrEP could lead to an increase in sexual risk behaviour and sexually transmitted infections in general and less condom use in particular among adolescents.

Methods: This study assesses condom use among South African adolescents enrolled on a demonstration PrEP study, called Pluspills, being conducted in Cape Town and Soweto. A questionnaire on sexual risk behaviour was administered at baseline and after 4, 8 and 12 weeks. Three different questions on condom use were asked at each visit. Unless all answers indicated condom use at all times, a participant was scored 'at risk'. McNemar's tests and a Cochran's Q test were used to investigate changes in condom use over time.

Results: We interviewed 148 adolescents (66% female) at baseline. Eighty-nine participants completed all visits. In this group, an increase in condom use was observed over the period of 12 weeks. Most participants who reported behavioural changes mentioned an increase in condom use.

Conclusion: There was no sign of sexual risk compensation in the 12 weeks of the study. Observed increase in condom use can be explained by an increased awareness of personal HIV risk or by social desirability or recall biases. In future research, additional data including other biomarkers of unprotected sex and longer follow-up time would be useful to help understand the relationship between PrEP use, sexual risk perception and consequent behaviours, especially in adolescents.

Introduction

Background

HIV incidence reduction has plateaued in the recent years with some population sub-groups still being affected disproportionately.[1] One of these key populations is adolescents and young adults (AYA) with approximately 2.9 million living with HIV in sub-Saharan Africa between the ages of 15 years and 24 years.[2] Research shows that, because of a number of developmental, psychological, social and structural transitions that converge in this period of the lifespan, AYA are at increased risk of HIV acquisition.[3] Moreover, a growing body of neurobiological research and imaging studies suggest that adolescents may be prone to engage in risk behaviours, including sexual risk taking and substance abuse, because of developmental changes.[4] Risk factors for HIV acquisition seen in South African youth are the early age of sexual debut, a high number of sexual partners and inconsistent use of condoms.[5,6]

Objectives

At the end of 2015, the South African Medicines Control Council approved a fixed-dose combination of tenofovir disoproxil fumarate and emtricitabine for pre-exposure prophylaxis (PrEP) of HIV, a new prevention tool in the fight against HIV.[7] Previous research showed the

benefits of PrEP if it is prioritised to high-risk populations, is adhered to and does not lead to an increase in risk behaviour.[8,9,10] Therefore, the use of PrEP may be beneficial in preventing HIV infection during the high-risk years of youth, as PrEP could offer a time-limited strategy to bridge the developmental period in at-risk adolescents from sexual debut to adulthood. However, there is a concern that its use may result in risk compensation,[11] that is, PrEP use might inhibit the uptake of safer behaviours by reducing people's perception of their risk of infection.[12]

Trends

In the past, the potential introduction of other HIV prevention technologies, such as vaccines, barrier methods,[13] antiretroviral treatment for prevention, male circumcision[14] and vaginal microbicides,[15,16] raised the same public health concern. Yet, previous research has not found evidence for sexual risk compensation in adults using PrEP[17,18,19,20,21,22] or post-exposure prophylaxis (PEP).[23]

Contribution to the field

To date, there has been no research into sexual risk compensation among adolescents following the introduction of PrEP. With the ongoing roll-out of PrEP programmes and an upcoming United Nations Children's Fund (UNICEF) funded project for PrEP implementation for adolescents in South Africa, this research question has become urgent. In particular there is potential concern that condom use may decrease in the short-term as a result of being substituted by another prevention intervention, also known as 'condom migration'.[15] In this article, we aim to explore short-term changes in condom use among HIV-uninfected adolescents using PrEP in South Africa.

Research design

Setting

This analysis was part of the Pluspills study[24,25] which evaluates the use and effectiveness of PrEP among HIV-uninfected adolescents in South Africa. The Pluspills study is an open-label, single-arm cohort study to evaluate patterns of PrEP use and patterns of condom use among adolescents aged 15 years to 19 years.

Design

The aim was to evaluate the change in condom use (condom migration) among participants starting PrEP for a period of 12 weeks. All participants received PrEP (FTC/TDF) as part of a combination prevention package. This package consisted of an individualised adherence plan for PrEP, risk reduction counselling, free condoms and condom counselling, screening and treatment for sexually transmitted infections (STIs) and counselling and referral for other HIV prevention interventions (e.g. PEP, voluntary male circumcision). Sampling in the study was stratified by gender, because women are more vulnerable to HIV acquisition in this setting.

Community engagement via the adolescent community advisory board (CAB) and a consent education discussion group prior to screening was done at both sites. The discussion groups enabled the study team to explain the prevention package, including PrEP, to participants and enabled participants to engage with the study team. After these meetings, participants were invited to enrol in the Pluspills study. The following inclusion criteria had to be met: participants must be aged between 15 years and 19 years old, willing to provide assent or consent, have a guardian willing to provide consent, able to provide adequate locator information, HIV-uninfected, sexually active, have a negative pregnancy test, effective method of contraception, no intention to relocate, no activities that require long absences from the area and willing to undergo all study-required procedures. At enrolment, participants were asked to initiate PrEP as part of a comprehensive prevention package for at least three months. Thereafter individuals were allowed to opt out of PrEP use should they wish to, whilst remaining in the study. The choice to opt out was posed at each three-monthly visit. Participants were counselled at every visit as part of the combination prevention package. Counsellors and clinicians offered participants condoms at each visit. Condoms were also available in the bathrooms of each clinic.

Procedure

A behavioural questionnaire was administered at baseline and at each subsequent visit. The questionnaire aimed to collect information on sexual behaviour, risk taking and changes over time.

Measurements and coding

The three questions on condom use (consistency of condom use, condom use during last sexual act and frequency of condom use) were coded as 'at risk' (=1) and 'not at risk' (=0). Only an explicit confirmation of condom use on all three questions was scored as 'not at risk'. Inconsistent condom use was defined as any uncertainty in the self-report on condom use. If a participant scored 1 on any of the three questions she/he was considered 'at risk'. Participants were also asked if and how they changed their sexual behaviour between the different time points. Self-reported change was used to assess participants' perception of sexual risk. Participants were screened for STIs (Herpes Simplex Virus-2, *Chlamydia trachomatis* and *Neisseria gonorrhoeae*) at baseline and week 12.

Statistical analyses

Baseline condom use data were compared with data points after 4, 8 and 12 weeks and these were also compared with each other. McNemar's tests and a Cochran's Q test were used to look for change in condom use over time. In particular, the McNemar's test was used to see if change in condom use (=condom migration) was random or because of the intervention. Data were analysed using STATA 13.0.

Ethical consideration

This study was approved by the Division of AIDS (DAIDS), Independent Ethics Committees, and South Africa's Medicines Control Council prior to implementation. This study was conducted according to the protocol as well as the International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH) and South African Good Clinical Practices.

Results

Demographic information

Eighty-nine participants completed all subsequent visits (see Tables 1 and 2): 41 participants at the Desmond Tutu HIV Foundation Youth Centre in Masiphumelele, Cape Town and 48 participants at the Perinatal HIV Research Unit in Soweto, Johannesburg. Of the participants who completed all visits, 58 (65%) were females, as per design. All participants were of black ethnicity and lived in the townships of Masiphumelele or Soweto. At baseline 75% of the participants attended school and 11% attended a tertiary education institute. Eighty percent of the sample lived with, at least one of their parents; the other 20% lived with their grandparents, other family or a guardian. Two-thirds of the sample reported inconsistent condom use at baseline. Female participants reported more inconsistent condom usage than male participants at baseline. The STI numbers were high, with 37% of the participants having an STI at baseline. STIs were more prevalent in female participants than in male participants, respectively 47% versus 16%.

Follow-up sexually transmitted infections

In the follow-up, data regarding STI screening were only available for 81 out of the 89 participants. Of the participants, 30% had an STI (Table 3), and 19% had an STI at both time

TABLE 1: Baseline characteristics.

Characteristic	Female (n = 58)		Male (n = 31)		All (n = 89)	
	n	%	n	%	n	%
Location						
Cape Town	26	44.8	15	48.4	41	46.1
Soweto	32	55.2	16	51.6	48	53.9
School attendance						
Yes	43	74.1	24	77.4	67	75.3
Highest grade completed						
Senior phase (grade 7–9)	17	29.3	13	41.9	30	33.7
FET band (grade 10–12)	41	70.1	18	58.1	59	66.3
Attending tertiary education institute						
Yes	6	10.3	4	12.9	10	11.2
Household						
Mother and/or father	47	81.0	24	77.4	71	79.8
Grandmother and/or -father	4	6.9	2	6.5	6	6.7
Other	7	12.1	5	16.1	12	13.5
Inconsistent condom use	44	75.9	17	54.8	61	68.5
Condom use (last sexual act)	39	67.2	24	77.42	63	70.8
Sexually transmitted infections	27	46.6	5	16.1	32	36.0

FET, further education and training.

TABLE 2: Age and average grade of participants.

Characteristic	Female (n = 58)				Male (n = 31)				All (n = 89)			
	Median	IQR	Mean	SD	Median	IQR	Mean	SD	Median	IQR	Mean	SD
Age in years	18.0	16.0–19.0	17.41	1.43	18.0	17.0–18.0	17.58	0.99	18.0	17.0–18.0	17.47	1.29
Average grade	10.0	9.0–12.0	10.29	1.31	10.0	9.0–11.0	10.00	1.32	10.0	9.0–11.0	10.19	1.31

n, number; IQR, interquartile range; SD, standard deviation.

TABLE 3: Sexually transmitted infections.

Characteristics	STI rates (week 12)				All (n = 81)	
	Yes		No			
	n	%	n	%	n	%
Gender						
Male	5	6.2	19	23.5	24	29.6
Female	19	23.5	35	43.2	57	70.4
Sexual transmitted infection (baseline)						
Yes	15	18.5	15	18.5	30	37.0
No	9	11.1	42	51.9	51	63.0
Consistent condom use (week 4–12)						
At risk	19	23.5	46	56.8	65	80.2
Not at risk	5	6.2	11	13.6	16	19.8

n, number; STI, sexually transmitted infection.

points. At week 12, five participants had an STI despite reporting consistent condom use on all intermediate time points.

Condom migration

McNemar's tests showed an increase in condom use between baseline and week 8, baseline and week 12, and week 4 and week 12 (see Table 4). The Cochran's Q test with all data points also showed an increase in condom use over time (see Table 4). Approximately 28% of the participants reported a change in sexual behaviour between the different visits. Of them, 87% (81% – 92%) reported using condoms more often than before. During the follow-up period, fewer participants were classified 'at risk' because of more consistent condom use reported over time (see Figure 1).

Discussion
Outline of the results

We did not see a reduction in condom use over this relatively short period of time in a South African adolescent population commencing PrEP. Reported condom use was similar to previous research of condom use patterns in adolescents in South Africa.[5,26] What is more is that in this relatively small

TABLE 4: Change in condom use.

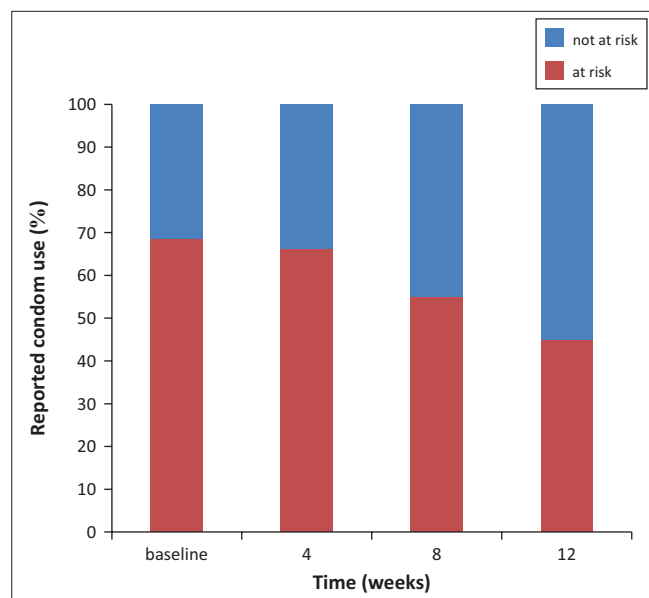| Time point	p
McNemar's test	
Baseline & Week 4	0.6698
Baseline & Week 8	0.0285*
Baseline & Week 12	0.0008**
Week 4 & Week 8	0.0330*
Week 4 & Week 12	0.0006**
Week 8 & Week 12	0.106
Cochran's Q test	
Baseline until Week 12	0.0002**

*, $p < 0.05$; **, $p < 0.01$.

FIGURE 1: Condom migration (N = 89).

sample we observed an increase in self-reported condom use. We can hypothesise multiple explanations for this finding. Firstly, this reporting is valid and may be because of the benefits of repeated risk reduction counselling, provision of condoms, enhanced awareness of potential risk because of provision of PrEP and more partner support because of enrolment in a study. Secondly, this finding can be false reporting as a result of social desirability or recall biases in self-reported condom use. Whilst ongoing surveillance of sexual risk compensation is warranted in PrEP implementation, these data are at least encouraging.

Limitations

A total of 148 participants completed the baseline visit, but only 89 participants completed all three subsequent visits. Whilst a comparison of demographic baseline data and baseline reported sexual behaviour between participants who attended their visits and the ones who missed a visit showed no difference, the analysis was carried out only in those who attended all three survey time points. This limited the number of participants in the study. Secondly, a limitation of the study was that condom use was based on self-report which can be influenced by social desirability or recall biases. Using other biomarkers of unprotected sex may be a more reliable measure of current risk behaviour.[27] STI rates can be a surrogate to validate self-reported condom use. Despite self-reported consistency in condom use, five participants had an STI after 12 weeks, perhaps raising some questions around the validity of consistent condom use.

Conclusion and recommendations

To our knowledge, this is the first study of condom migration among adolescents on PrEP. Three months is a relatively short period, although this is the time that all adolescents were expected to consistently be using daily PrEP in Pluspills. Whilst more research is needed to understand the relationship between PrEP use, sexual risk behaviour, perception of risk and consequent behaviours, especially among adolescents, these preliminary and limited results are encouraging. Whilst PrEP may well be a very important intervention prevention addition to the tool box for adolescents, it is also understood that it should always be administered as part of a broader package that also includes risk reduction counselling, condom provision, contraception and STI screening as part of adolescent-friendly services.

Acknowledgements
Competing interests

Authors' contributions

L.P.M. was responsible for the first draft. It was part of his thesis for his Master's degree in Medicine. All authors were

responsible for conceptualisation and designing of the study, proofreading and editing. L-G.B. and G.B.G. were the supervisors of the project.

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