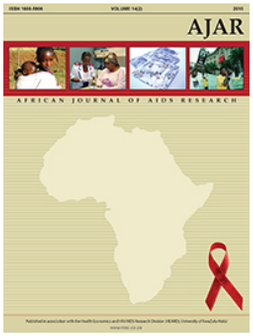

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On the road again: concurrency and condom use among Uganda truck drivers

Elizabeth C Costenbader[1*], Kathryn Lancaster[1], Leonard Bufumbo[2], Angela Akol[2] and Greg Guest[1]

[1]FHI 360 Headquarters, Blackwell Street, Durham, North Carolina
[2]FHI 360 Uganda Country Office, Kampala, Uganda
**Corresponding author, email: bcostenbader@fhi360.org*

Long-distance truck drivers have been shown to be a critical population in the spread of HIV in Africa. In 2009, surveys with 385 Ugandan long-distance truck drivers measured concurrency point prevalence with two methods; it ranged from 37.4% (calendar-method) to 50.1% (direct question). The majority (84%) of relationships reported were long-term resulting in a long duration of overlap (average of 58 months) across concurrent partnerships. Only 7% of these men reported using any condoms with their spouses during the past month. Among all non-spousal relationships, duration of relationship was the factor most strongly associated with engaging in unprotected sex in the past month in a multivariable analyses controlling for partner and relationship characteristics. Innovative intervention programs for these men and their partners are needed that address the realities of truck drivers' lifestyles.

Keywords: HIV/STI prevention, mobile population, sexual risk behaviour, sub-Saharan Africa, concurrency; condom

Introduction

On the African continent, the role of truck drivers in contributing to the spread of HIV/AIDS has been well documented (Bwayo et al., 1994; Gysels, Pool, & Bwanika, 2001; Oduwole, Jeminusi, Aderogba, & Okuboyejo, 2002) and is generally accepted as resulting from the lifestyle that accompanies truck-driving. Male truck drivers are highly mobile and spend long periods of time travelling away from their families. Multiple studies have documented that in migrant and highly-mobile populations, such as truck drivers, when one or more partner is away from home for long periods of time, extramarital affairs and visits to sex workers are more common (Gysels et al., 2001; Rakwar, Lavreys, Thompson, Jackson, Bwayo, Hassanali et al., 1999; Ramjee, 2002; Cassels, Jenness, Biney, Ampofo, Dodoo, 2014). Truck drivers themselves have attributed having multiple partners to the nature of their job that requires time on the road, visiting different towns, meeting new women and missing the companionship of their spouses and regular partners back home (Marck, 1999; Ntozi, Mulindwa, Ahimbisibwe, Ayiga, & Odwee, 2004; Orubuloye, Caldwell, & Caldwell, 1993). Consequently, studies among this group of men have documented high rates of HIV and other sexually transmitted infections (STIs) and have found that these are correlated with longer time on the road and less frequent visits home to their wives (Bwayo et al., 1994; Mbugua et al., 1995; Morris & Ferguson, 2006; Rakwar et al., 1999). For example, in South Africa, a study of 320 truck drivers found HIV prevalence to be as high as 56% (Ramjee, 2002). Earlier studies conducted in Eastern Africa found prevalence rates of long distance truck drivers to range from 25% in Kenya (Mbugua et al., 1995) to 32% in Uganda, the setting of this study (Bwayo et al., 1994).

As a result of a strong public awareness campaign at multiple levels and a well-resourced and organised National AIDS programme (Slutkin et al., 2006), Uganda was the first country in sub-Saharan Africa to reverse its HIV/AIDS epidemic (Stoneburner & Low-Beer, 2004). Various claims have been made as to the extent of the decline, but prevalence rates peaked in the early 1990s and were documented to be as high as 22.0% to 27.5% in some surveillance statistics (Uganda AIDS Commission, 2012). Despite the progress made since then, rates of HIV in Uganda of 7.3% (Uganda Ministry of Health & ICF International, 2012) are still high by international standards. A behaviour that continues to be of concern and is thought to potentially be a key driver of the generalised epidemic in Uganda is having multiple sexual partnerships (Opio et al., 2008).

Concurrency is a specific form of multiple sexual partnerships in which two or more sexual relationships overlap in time. Concurrency has been shown to significantly accelerate transmission of HIV within a community (Hudson, 1996; Pilcher et al., 2004; Watts & May, 1992) although whether it is a "driving force" in the spread of HIV is still unclear (Kretzschmar & Carael, 2012; Lurie & Rosenthal, 2010). Research has also shown that there are different patterns of concurrency and that these patterns contribute differentially to the spread of disease (Morris & Kretzschmar, 1997). For example, having a short-term or one-time sexual relationship during the course of a long-term relationship is a different pattern of concurrency than having more than one long-term relationship simultaneously. Relationship length and thus the length of overlap in concurrent relationships

has been shown to be an important factor in transmission dynamics as it affects the probability of sexual contact during different phases of infection (Mah & Halperin, 2008). Sexual contact during the acute phase following recent infection has been shown to increase the infection rate as viral loads peak during this phase of infection (Pilcher et al., 2004; Pinkerton, 2008; Wawer et al., 2005).

Other behavioural parameters known to affect the rate of sexual spread of HIV are the frequency of coitus and the consistency of condom use (Gray et al., 2001; Wawer et al., 2005). A previous study in Uganda found a higher frequency of reported coital acts by respondents in trading centres than in other locations (Morris, Epstein, Wawer, & Jones, 2010). There is mixed evidence regarding whether or not truck drivers use condoms more or less consistently than other populations. Two studies conducted in Nigeria reported a high prevalence of inconsistent condom use among male long-distance truck drivers (Oduwole et al., 2002; Sunmola, 2005). Other studies among truck drivers have shown high rates of reported consistent condom use with sex workers or non-spousal partners (Gysels et al., 2001; Morris, Wawer, Makumbi, Zavisca, & Sewankambo, 2000; Pickering, Okongo, Nnalusiba, Bwanika, & Whitworth, 1997).

Condom promotion interventions among truck drivers have similarly had mixed results. Specifically, a peer intervention promoting condom use among truck drivers in Tanzania found self-reported rates of condom use as high as 72% post-intervention (Laukamm-Josten et al., 2000). However, a similar intervention conducted with truck drivers in Malawi found self-reported condom use with last casual partner post-intervention was 61% and 41%, in intervention and non-intervention districts respectively, but that this difference was not statistically significant (Walden, Mwangulube, & Makhumula-Nkhoma, 1999).

Here we report the results of a secondary analysis of data from a cross-sectional study undertaken in 2009 in Uganda. The parent study was undertaken to document the extent and correlates of concurrent sexual partnerships and related sexual risk behaviours among Ugandan male truck drivers to inform potential intervention efforts. Previous research has documented the central role that truck drivers played in the spread of HIV on the African continent by having more than one sexual partner while on the road. There has also been considerable previous research on the role of sexual concurrency in the spread of HIV. To date, however, most of the evidence that concurrency facilitates HIV spread has come from modelling studies rather than from empirical evidence (Eaton, Hallett, & Garnett, 2011; Goodreau et al., 2010; Kretzschmar & Morris 1996; Morris & Kretzschmar, 1997; Watts & May, 1992). Two factors frequently cited as limiting the strength of evidence put forward by empirical concurrency research have been measurement challenges (Glynn et al., 2012; Lurie & Rosenthal 2010; Rosenberg, Rothenberg, Kleinbaum, Stephenson, & Sullivan, 2014) and the examination of concurrency as an isolated phenomenon without relating it to other important behavioural cofactors (Kretzschmar & Carael, 2012). Indeed, recent work by modellers themselves suggests that "studying the impact of concurrency on HIV transmission should be differentiated by taking more insight from social and behavioral studies on sexual partnerships into account" (Kretzschmar & Carael, 2012, p. 1746). For this analysis we were interested in adding to the knowledge base on factors that affect sexual transmission of HIV by calculating and comparing two different measures of concurrency in this population and by documenting and assessing the correlation between other social and behavioural correlates known to affect the rate of sexual spread of HIV, that is, condom use, type of relationship, coital frequency and duration of relationship.

Methods

Study design

Between September and December 2009 we recruited male long-distance truck drivers from along the Trans-Africa Highway, which extends across Uganda from Kasese in the west to Tororo in the east. Eligibility criteria for the male truck drivers included being 18–45 years old, born in Uganda, driving a truck for a living, and typically being away from home, due to the job, for seven or more days per month. Although a large proportion of the truck drivers on Ugandan roads at any given time are non-Ugandans, this study was restricted to truck drivers of Ugandan nationality, as it was sponsored by the United States Agency for International Development (USAID)-Uganda to inform programming for Ugandan truck drivers.

A sampling frame was generated by combining truck driver registry lists obtained from several truck driver organisations and using chain-referral techniques to generate additional names, creating as exhaustive a list as possible. Names were randomly selected from this list and men were contacted until the desired sample size was obtained. Men were initially contacted by phone at which point appointments were made and surveys were subsequently administered in person.

A total of 385 truck drivers were targeted for survey participation. This target number was calculated based on results from a 2005–2006 Ugandan general population survey which showed that nearly 30% of men reported multiple relationships (Uganda Bureau of Statistics [UBOS] & Macro International, 2007). Since it was assumed that truck drivers would have more sexual partners than men in the general population, for sample size calculation purposes it was estimated that 50% of truck drivers would have more than one sexual partner. Using this expected prevalence of concurrency, a sample size of 380 men would allow an estimation of the true prevalence of concurrency to within plus or minus 5% using a 95% confidence interval.

Trained interviewers administered the surveys in the local languages of Luganda or Kiswahili. Participants provided written informed consent before each data collection event and were given a participation reimbursement of 20 000 Uganda shillings (approximately US$10) to compensate them for their time and travel. The study was approved in the US by the Protection for Human Subjects Committee at Family Health International, and by the Uganda National Council for Science and Technology.

Data collection and analysis

The survey instrument was informed by two focus groups conducted with truck drivers: one with 12 participants in Busia and the other with 11 participants in Malaba. The focus groups were organised around four domains of inquiry

— communication with one's partner, HIV messaging, recruitment of truck drivers and concurrency (i.e., definitions and prevalence of having multiple sexual partners). The inductive focus group methodology also allowed for new domains of inquiry to emerge that the researchers had not originally considered. Findings from the focus groups were used to inform both the recruitment procedures for the survey and the survey questions. The survey contained 51 questions organised into three sections: respondent characteristics, sexual behaviour and attitudes, and a separate section that collected information on specific sexual events in the past 30 days. The survey was translated and back-translated, and then pre-tested with five individuals for wording and comprehensibility. The survey was interviewer-administered and took approximately one hour to complete. During data entry, all survey data was double entered to ensure accuracy, and any discrepancies were resolved by reviewing the original survey.

Measurement of concurrency and condom use

On the survey, participants were asked a direct question about current concurrency: "In total, how many partners are you currently having sex with, including wives, girlfriends, casual and regular partners?" In addition, we used a calendar timeline follow back (TLFB) method to measure concurrency. The TLFB method uses a calendar and life events as temporal landmarks to facilitate recall of past events to document all sexual events with all partners in the past 30 days (Sobell & Sobell, 1995). The TLFB method has been shown to be valid and highly informative in the context of sexual behaviour (Carey, Carey, Maisto, Gordon, & Weinhardt, 2001; Weinhardt, 1998).

Specifically, to help them remember what they were doing on each of the last 30 days, participants were first asked to note on the calendar personal and historical events that they recalled occurring throughout the past month. Then they were asked whether or not they had sex on each of the last 30 days; if yes, an X was placed on the calendar for that day. Subsequently, they were asked for the initials of the person with whom they had sex on each of the days marked with an X, the profession of that person, and whether condoms were used in that sexual event. Our analysis looked across reported sexual events per partner on the calendar to determine relationship overlap, coital frequency and whether the respondent had engaged in any sexual events where condoms were not used within the past 30 days.

As per the Joint United Nations Programme for HIV/AIDS (UNAIDS) Reference Group on Estimates Modelling and Projections (2009) and Morris et al. (2010), we calculated and report concurrency point prevalence which is the fraction of respondents who had more than one ongoing sexual partnership on the day of the interview (see Table 1 for comparison of our measure to others). We report two versions of the measure: one as calculated from the sexual calendars and the other from the direct question asked on the survey about the number of ongoing sexual partnerships.

Measurement of coital frequency and other partnership characteristics

We report the mean and median overlap duration of the last three partnerships and the mean number of coital acts in the past month with all partners and with the most and least frequent sexual partner. Only respondents with concurrent partnerships contributed observations to the overlap calculations. Individuals reporting more than one concurrent relationship contributed as many observations. Ongoing partnerships were censored (i.e., considered to be at their end point) on the day of the interview as we did not have any information after this date.

Statistical analysis

We conducted an event-level analysis of any sexual encounter reported on the TLFB calendar with a non-spousal partner in which condoms were not used. Specifically, we examined the correlation between respondent and relationship characteristics and unprotected sexual events controlling for clustering among partnership data from the same individual using a generalised estimating equations (GEE) analysis (Zeger & Liang, 1986). Covariates that were significantly associated with engaging in unprotected sex in the past month in bi-variable analyses at the 0.05 level were entered into an event-level multiple logistic regression model. We restricted this analysis to non-spousal partnerships.

Results

Study population

Of the 385 male truck drivers who participated in the study survey, 80% were 30 years of age or above and married or living with someone (Table 2). Of the study sample, 25% reported having more than one wife. Most of the male truck drivers (91%) made 101 000 to 399 000 shillings per month (approximately $42–160). The men were equally distributed between Muslim and Christian. Nearly 50% of the truck drivers had attained ordinary level of schooling (i.e., the equivalent of secondary school education) and 38% had attained primary school or less. More than half of the men (67%) considered a town their primary place of residence. By design, this was a highly itinerant population with men reporting taking on average 49 different trips per year for an average duration of 7 days each trip. In combination 49 trips at 7 days each trip would result in 343 days a year away from home.

Concurrency and other partnership characteristics

Table 3 displays the multiple concurrency measures and related sexual partnership data. The point prevalence of concurrency on the day of the interview was 50.1% as measured by the direct question regarding current number of sexual partners but only 37.4 % as measured on the calendars by the number of sexual partners reported as ongoing partnerships.

On the calendars, participants reported anywhere from 0 to 14 sexual partners in the past month and less than half (42.1%) reported 2 or more partners. Nearly two-thirds of truck drivers (63.4%) reported feeling "very confident" that they could discuss using condoms with their sexual partners. Participants reported that most partnerships they reported on the calendars had been in existence for 2 years or more (83.6%). This was consistent with the long average overlap of the truck drivers' concurrent sexual partnerships, which was 58.4 months or just under 5 years. We chose to

Table 1: Concurrency and multiple partner measures and definitions

Article	Measures utilised	Measure definitions	Measure time period	Study population	Year collected	Reported rates
Costenbader et al., this paper	Point prevalence (calendar method)	Proportion of respondents reporting on day of interview more than one ongoing sexual partnership*	Day of interview	Ugandan male truck drivers from along the TransAfrica highway, ages 18–45	2009	37.4
	Point prevalence (direct question)	Proportion of respondents reporting more than one current sexual partnership on the day of interview	Day of interview			50.1
UNAIDS Reference Group, 2009	Point prevalence	Proportion of adults aged 15–49 reporting on day of interview more than one ongoing sexual partnership at the point in time six months before the interview	Day of interview			
Morris et al., 2010	Point prevalence	Proportion of respondents reporting on day of interview more than one ongoing sexual partnership**	Day of interview	Ugandan rural male resident of Rakai district, ages 15–49	1993–1994	13.1–16.8
Kajubi et al., 2011	Point prevalence	Proportion of respondents reporting on day of interview more than one current partner with whom the respondent expected to continue having sex in the future	Day of interview	Ugandan urban males, residents of Kampala, ages 20–39	2009	21.2
DHS, 2006	Multiple partners	Proportion of respondents reporting having two or more sexual partners during the past year	1 year	Nationally representative sample of Ugandan males, ages 15–49	2005	29

*Ongoing assessed by asking whether each partnership named on the calendar was ongoing.
**Ongoing based on participants answer to one of the following questions for each of the three most recent partners: “Are you still sexually active with this partner?” or “Do you expect to have sex with this partner again?”

include truck drivers who reported multiple co-wives in these calculations since polygyny is one form of concurrency and because, of the men who reported polygyny, only 6 reported closed polygynous units such that their only partners were co-wives. Notably, of all the 618 sexual events that these men provided information on in their TLFB calendars, 64.6% involved spouses. As such, over one-third (37%) of the overlapping relationships in this calculation were overlapping spousal relationships. The median number of truck driver reported coital acts in the past month with all partners on the calendar was six acts; four times with their most frequent partners and two times with their least frequent partners.

Correlates of sex without a condom

Given the absence of condom use in close to 100% of spousal relationships (e.g., only 7% of respondents reported any use of condoms with their spouses in the past month), we limited our analysis of factors associated with condomless sex to non-spousal relationships. Therefore this analysis includes a little over half (56%) of the total respondents who contributed a total of 216 non-spousal relationships.

In bivariate GEE logistic regression analyses (Table 4), four factors were significantly associated with a decreased likelihood and two factors were significantly associated with an increased likelihood of condoms not being used during a sexual event with a non-spousal partner in the past month. If the respondent reported confidence discussing condom use with a sexual partner (OR = 0.28, CI 95% 0.13, 0.64), sex with a sex worker (OR = 0.08, CI 95%: 0.03, 0.19), having been in a relationship with that partner for six months or less (OR = 0.07, CI 95%: 0.04, 0.12) and having more than one partner at the time of the interview (OR = 0.62 CI 95%: 0.39, 0.98) then the encounter was significantly less likely to not have used condoms. In contrast, if the respondent reported having been in the relationship with that partner for two years or more (OR = 14.53 CI 95%:8.37, 25.24) or having sex with that partner more than once a week (OR = 1.88 CI 95%: 1.10, 3.20) then the encounter was significantly more likely to not have used condoms.

When the six factors with significant association at the bivariate level were added to a multiple logistic regression model (Table 4), the resulting model found three factors with significant associations with sexual encounters in which a condom was not used. If the respondent reported having been in a relationship with the partner for more than two years (OR = 3.10, 95% CI: 1.38, 6.97) then the encounter was significantly more likely to not have involved condoms. However, if the partner was a sex worker (OR = 0.42, 95% CI: 0.19, 0.90) or the relationship had only been in existence for six months or less (OR = 0.32, 95% CI: 0.14, 0.72) then the encounter was significantly more likely to have involved condoms.

Table 2: Demographic characteristics and travel profiles of participants (*N* = 385)

Characteristic	Per cent of respondents
Age in years 18–24	6.0
25–29	13.5
30–34	22.6
35–39	30.1
40–45	27.8
Marital status	
Single, separated, divorced or widowed	7.8
Married or living with someone	92.2
Has co-wives	25.7
Income category in Ugandan shillings per month[a]	
50 000 or less	0.3
51 000–100 000	1.6
101 000–399 000	54.6
400 000 or more	36.4
Missing	7.3
Religion	
Christian	50.9
Muslim	47.3
Other	0.8
Missing	1.0
Highest level of schooling	
Primary or lower	38.4
Ordinary	49.4
Advanced or Beyond	12.2
Missing	0.0
Primary place of residence currently	
City	15.3
Town	67.5
Village	16.6
Missing	0.5
Time spent traveling	Mean
Average number of trips away from home per year	49.0
Average length of trip in days	7.3

[a]The exchange rate at the time of this study was US$1 equivalent to 2 259 Uganda shillings

Table 3: Concurrency prevalence, coital frequency and partnership characteristics (*N* = 385)

Characteristic	Per cent of respondents
Concurrency	
Point prevalence (calendar)	37.4
Point prevalence (direct question)	50.1
Number of partners reported on the calendar	
0	9.6
1	48.3
2	29.9
3	7.5
More than 3	4.7
Confident could discuss using condoms with partners on the survey	
Not at all	19.2
Somewhat	16.4
Very confident	63.4
Missing	1.0
Durations of Partnerships	Per cent of partnerships*
0–3 months	4.9
More than 3 months up to 6 months	3.6
More than 6 months up to 2 years	7.9
2 years or more	83.6
Type of partners	
Wife	64.6
Steady girlfriend	7.9
Casual or one-time	16.0
Sex worker	11.0
Missing	0.5
Median coital acts past month on the calendar	Median or mean
With all partners	6 acts
More frequent partner	4 acts
Less frequent partner	2 acts
Duration of partnership overlap among truck drivers with more than one sexual partner in the past month	
Mean	58.4 months
Median	28.5 months

**N* for these percentages is 618 total relationships reported on the calendars by the 385 respondents

Discussion

We found that over a third of the Ugandan truck drivers sampled for this study reported engaging in concurrent sexual relationships at the time of the interview. Most of these relationships were with long-term partners averaging 4 or more years, and with whom condoms were not currently being used. In comparison to other published measures of multiple and concurrent partnerships among Ugandan men, the point prevalence of concurrency in this sample was markedly higher than was found among men in the Rakai Project in 1993 and 1994 (37% to 50% vs. 13% to 16%) (Morris et al., 2010). It was also notably higher than the 21.2% point prevalence of concurrency reported among men living in poor urban dwellings in Kampala in 2009 (Kajubi et al., 2011), and higher than the proportion of general population Ugandan men who reported more than 1 sexual partner in the past 12 months in the 2006 Uganda Demographic and Health Survey (DHS) population (29%) (UBOS & Macro International, 2007).

The fact that the point prevalence of concurrency in our sample was higher than in that of other population groups is not unexpected given that truck drivers are known to have multiple sexual partnerships more often than the general population. However, the magnitude of the difference between the rate of concurrency in this sample and in the other Ugandan samples is notable, especially since the men in the Rakai Project were surveyed over a decade ago and we would have expected risk behaviours to have declined since then. Fortunately, evidence from the 2011 Uganda DHS shows a decline in the prevalence of multiple and concurrent relationships in Uganda as a whole, as the proportion of men who reported more than 1 sexual partner in the past 12 months was down to 18.7% and the point prevalence of concurrent sexual relationships 6 months before the survey reported by men was 9.7% (UBOS & Macro International, 2012).

Most relationships reported by the men in this sample were long-term resulting in a long duration of overlap

Table 4: Crude and adjusted odds ratios between selected factors and any sex event without a condom past month with a non-spousal partner (*N* = 216)

	Odds ratios	
	Crude OR (95%)	Adjusted OR (95%)
Respondent characteristics		
<25 years old	0.60 (0.23, 1.56)	
Has co-wives	1.70 (0.98, 2.93)	
Muslim	0.93 (0.59, 1.48)	
Income category	0.90 (0.53, 1.53)	
Less than high school education	0.67 (0.42, 1.07)	
Resides in a village	1.44 (0.78, 2.64)	
Confident could discuss using condoms with partner(s)	0.28 (0.13, 0.64)	0.25 (0.08, 1.44)
Partner & relationship characteristics		
Partner is a Sex Worker	0.08 (0.03, 0.19)	0.42 (0.19, 0.90)
Currently has more than one partner	0.62 (0.39, 0.98)	0.86 (0.40, 1.82)
Has Sex with Partner More than once a week	1.88 (1.10, 3.20)	2.15 (0.91, 5.10)
Duration of sexual partnership		
6 months or less	0.07 (0.04, 0.12)	0.32 (0.14, 0.72)
More than 6 months & less than 2 years (reference)	1.00	
2 years or more	14.53 (8.37, 25.24)	3.10 (1.38, 6.97)

(average of 58 months) across concurrent partnerships. This duration of overlap is the same number of months of relationship overlap reported by men in the Rakai Project (Morris et al., 2010). Numerous studies have shown the importance of contact during the acute stage of infection in accelerating HIV transmission (Epstein & Morris, 2011; Epstein et al., 2010; Kalichman & Grebler, 2010; Morris, 2010). Despite the debate over empirical evidence demonstrating concurrency as the main driver of the African HIV epidemic (Lurie & Rosenthal, 2010; Sawers & Stillwagon, 2010), the long duration of sexual overlap with multiple partners, frequency of coitus, and complacency over condom usage in our study provide ample opportunity for sexual transmission if one of the partners in the overlapping relationships was in the highly infectious acute stage of infection.

In terms of condom use, only 7% of truck drivers in this study sample reported using condoms at any point with their spouses during the past month. Among all *non-spousal* relationships, we found that duration of relationship was the factor most strongly associated with engaging in sex without a condom in the past month in a multivariable analyses controlling for partner and relationship characteristics. These results are consistent with those of previous studies of heterosexual partnerships that show low condom use rates with long-term sexual partnerships (Anderson, Wilson, Doll, Jones, & Barker, 1999; Macaluso, Demand, Artz, & Hook III, 2000; Manning, Flanigan, Giordano, & Longmore, 2009; Westercamp et al., 2010) and highlight the vulnerability of spouses and long-term partners of truck drivers to HIV acquisition through unprotected sex.

A recent analysis of sample of Ghanaian and Tanzanian men demonstrated the importance of how combinations of relationship types across multiple partners may affect condom use decisions (Fleming et al., 2014). In their analysis they found that men were more likely to use condoms with a non-spousal partner if their other partner was a wife. We excluded spousal relationships from the analysis of condom use but 92% of these men were married and among this sample they were more likely to use condoms if their partner was a sex worker than if she was a girlfriend. Future research using qualitative methods would be well-suited to further explore this issue of how relationship combinations affect condom use decisions among individuals who have multiple concurrent sexual partnerships.

The UNAIDS Reference group has encouraged the use of approaches to improve recall and elicit sexual partner information (UNAIDS Reference Group on Estimates Modelling and Projections, 2009). This study utilises one of the recommended approaches, the TLFB method. Notably, however, the point prevalence measure using a TLFB method captured fewer reports overall of concurrent sexual partnerships than did the direct survey question asking for numbers of partners currently. Despite its more robust performance in this instance and the fact that it was simpler to collect, we are hesitant to advocate the use of a single survey question as a stand-alone measurement of concurrency, as the relationship overlap is not actually measured but merely implied by the term “currently”. We suspect that one reason for the smaller estimates using the TLFB is that a one-month time frame is too short to sufficiently capture ongoing sexual partnerships that connect on an infrequent, potentially less than monthly, basis. The UNAIDS Reference group also recommends asking about the preceding six-month time window for capturing concurrency of relationships (UNAIDS Reference Group on Estimates Modelling and Projections, 2009). Unfortunately, this study instrument was designed before that recommendation. Alternately, it could be that the survey question asking for number of current partners is an overestimate as the term “current” is imprecise and thus overlap is merely implied. Research on comparing and refining concurrency measures continues to date and a new web-based partnership-timing module (Rosenberg, Rothenberg, Kleinbaum, Stephen son, & Sullivan, 2014) shows promise in using a compromise between date overlap and direct question methods and remedying reporting biases.

In addition to limitations in our concurrency calculations, our analysis has several other weaknesses that should be

noted. Although, we are not making any statements about the relationship between concurrency and HIV rates in this sample population, the fact that neither biological nor self-reported measures of HIV were collected for respondents nor asked about for partners, limits our ability to examine the potential for HIV acquisition and transmission in this study sample and among their partners. The fertility desires of the men and their partners were also not collected, thus precluding consideration of how fertility intentions may have had an impact on the rates of condom use among married participants (Coughlin, 1990). Another factor that has been shown to greatly increase per-act transmission risk but has been largely overlooked in research with heterosexual populations including in this study is engaging in anal sex (Baggaley et al., 2013). Finally, as with other measures of health risk behaviour, there is always a concern that the study participants underreported their sexual behaviours out of concern for providing a more socially desirable response (Weinhardt, Forsyth, Carey, Jaworski, & Durant, 1998).

Conclusions

If the average number of days spent travelling in this study sample is typical of all truck drivers, then sexual liaisons while on the road seem an inevitable reality of the truck-driving profession that need to be addressed with more realistic and inventive approaches for truck drivers and for their long-term partners. Future inventions have the potential to build upon previous condom use peer education programmes by incorporating new approaches that better address the realities of truck drivers' sexual relationships. For example, educational and technological interventions, perhaps involving Skype or some other inexpensive video calling capabilities, aimed to assist truck drivers and their partners in dealing with both the emotional and physical strains that come with long-distance relationships (Marck, 1999; Ntozi et al., 2004; Romero-Daza, 1994; Thompson, 1983), may potentially decrease the occurrence of extramarital affairs.

While it has been shown women have a variety of reasons for choosing to have more than one sexual partner and/or not to use condoms (MacPhail & Campbell, 2001; Mahraj & Cleland, 2005; Cleland & Shah, 2006; Romero-Daza, 1994), female partners may be better able to protect themselves if provided with educational interventions aimed at enhancing the ability to negotiate condom use as well as elucidating the risks to them of their partners' sexual behaviours. Specifically, they need to receive counselling to help them avoid becoming lulled into a false sense of security when they have known their partner for a while. There may also soon be some validated concurrency reduction interventions to adapt for this population. Encouragingly results recently published of the first study designed to evaluate the feasibility and acceptability of an HIV prevention intervention focused on concurrent sexual partnerships showed clear evidence that the concurrency message was novel, but resonant to adult participants living in rural Nyanza province, Kenya (Knopf, Agot, Sidle, Naanyu, & Morris, 2014).

In addition, recent prevention studies involving the use of pre-exposure prophylaxis with antiretrovirals have shown significant promise (Abdool Karim et al., 2010; Cohen et al., 2011; Grant, 2010;) and long-term partners of truck drivers should be given consideration for these types of treatment for prevention strategies. In the meantime, aside from abstinence, 100% condom use with all sexual partners affords the greatest protection against HIV. Therefore, innovative interventions for long distance truck drivers should aim to adapt and expand Uganda's previous "zero-grazing" and current "get off the sexual networks" campaign (Stoneburner et al., 2004; Uganda Health Marketing Group, 2011) to sell the idea of maintaining condom use in relationships beyond the initial few months with all extramarital partners or a message of zero-unprotected acts as a way of protecting one's spouse from HIV infection.

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References

Abdool Karim, Q., Karim, S. S. A., Frohlich, J. A., Grobler, A. C., Baxter, C., Mansoor, L. E., et al., & the CAPRISA 004 Trial Group. (2010). Effectiveness and safety of tenofovir gel, an antiretroviral microbicide, for the prevention of HIV infection in women. *Science, 329*(5996), 1168–1174. http://dx.doi.org/10.1126/science.1193748

Anderson, J. E., Wilson, R., Doll, L., Jones, T. S., & Barker, P. (1999). Condom use and HIV risk behaviors among US adults: Data from a national survey. *Family Planning Perspectives, 31*(1), 24–28. http://dx.doi.org/10.2307/2991553

Baggaley, R. F., Dimitrov, D., Owen, B. N., Pickles, M., Butler, A. R., Masse, B., & Boily, M. C. (2013). Heterosexual anal intercourse: a neglected risk factor for HIV? *American Journal of Reproductive Immunology, 69*(S1), 95–105.

Bwayo, J., Plummer, F., Omari, M., Mutere, A., Moses, S., Ndinya-Achola, J., Velentgas, P., & Kreiss, J. (1994). Human immunodeficiency virus infection in long-distance truck drivers in east Africa. *Archives of Internal Medicine, 154*(12), 1391.

Cassels, S., Jenness, S. M., Biney, A. A., Ampofo, W. K., & Dodoo, F. N. (2014). Migration, sexual networks, and HIV in Agbogbloshie, Ghana. *Demogr Res*. Oct 10;31:861-888. Carey, M.P., Carey, K.B., Maisto, S.A., Gordon, C.M., & Weinhardt, L.S. (2001). Assessing sexual risk behaviour with the Timeline Followback (TLFB) approach: continued development and psychometric evaluation with psychiatric outpatients. *International Journal of STD & AIDS, 12*(6), 365.

Cleland, J., Ali, M. M., & Shah, I. (2006). Trends in protective behaviour among single vs. married young women in sub-Saharan Africa: The big picture. *Reproductive Health Matters, 14*(28), 17–22. http://dx.doi.org/10.1016/S0968-8080(06)28250-8

Cohen, M. S., Chen, Y. Q., McCauley, M., Gamble, T., Hosseinipour, M. C., Kumarasamy, N., et al., & the HPTN 052 Study Team. (2011). Prevention of HIV-1 infection with early antiretroviral therapy. *The New England Journal of Medicine, 365*(6), 493–505. http://dx.doi.org/10.1056/NEJMoa1105243

Coughlin, S. S. (1990). Recall bias in epidemiologic studies. *Journal of Clinical Epidemiology, 43*(1), 87–91. http://dx.doi.org/10.1016/0895-4356(90)90060-3

Eaton, J. W., Hallett, T.B,, & Garnett GP. (2011). Concurrent sexual partnerships and primary HIV infection: a critical interaction. *AIDS Behavior, 15*(4), 687–692.

Epstein, H., & Morris, M. (2011). Concurrent partnerships and HIV: An inconvenient truth. *Journal of the International AIDS Society, 14*(1), 13. http://dx.doi.org/10.1186/1758-2652-14-13

Epstein, H., Swidler, A., Gray, R., Reniers, G., Parker, W., Parkhurst, J., et al. (2010). Measuring concurrent partnerships. *Lancet, 375*(9729), 1869. http://dx.doi.org/10.1016/S0140-6736(10)60864-1

Fleming, P.J., Mulawa, M., Burke, H., Shattuck, D., Mndeme E, Attafuah, J., Mbwambo, J., & Guest, G. (2014). The role of relationship types on condom use among urban men with concurrent partners in Ghana and Tanzania. *AIDS Care*, *22,* 1–7.

Glynn, J. R., Dube, A., Kayuni, N., Floyd, S., Molesworth, A., Parrott, F., French, N., & Crampin, A. C. (2012). Measuring concurrency: an empirical study of different methods in a large population-based survey and evaluation of the UNAIDS guidelines. *AIDS*, *26*(8), 977–985.

Goodreau, S.M., Cassels, S., Kasprzyk, D., Montaño, D. E., Greek, A., & Morris, M. (2012). Concurrent partnerships, acute infection and HIV epidemic dynamics among young adults in Zimbabwe. *AIDS Behavior;16*(2):312–322.

Grant, R. M. (2010). Antiretroviral agents used by HIV-uninfected persons for prevention: Pre- and post-exposure prophylaxis. *Clinical Infectious Diseases, 50*(S3), S96–S101. http://dx.doi.org/10.1086/651479

Gray, R. H., Wawer, M. J., Brookmeyer, R., Sewankambo, N. K., Serwadda, D., Wabwire-Mangen, F., et al. (2001). Probability of HIV-1 transmission per coital act in monogamous, heterosexual, HIV-1-discordant couples in Rakai, Uganda. *Lancet, 357*(9263), 1149–1153. http://dx.doi.org/10.1016/S0140-6736(00)04331-2

Gysels, M., Pool, R., & Bwanika, K. (2001). Truck drivers, middlemen and commercial sex workers: AIDS and the mediation of sex in south west Uganda. *AIDS Care, 13*(3), 373–385. http://dx.doi.org/10.1080/09540120120044026

Hudson, C. P. (1996). AIDS in rural Africa: A paradigm for HIV-1 prevention. *International Journal of STD & AIDS, 7*(4), 236–243. http://dx.doi.org/10.1258/0956462961917906

Kajubi, P., Green, E. C., Hudes, E. S., Kamya, M. R., Ruark, A. H., & Hearst, N. (2011). Multiple sexual partnerships among poor urban dwellers in Kampala, Uganda. *Journal of Acquired Immune Deficiency Syndromes, 57*(2), 153–156. http://dx.doi.org/10.1097/QAI.0b013e318211b466

Kalichman, S. C., & Grebler, T. (2010). Reducing numbers of sex partners: do we really need special interventions for sexual concurrency? *AIDS and Behavior, 14*(5), 987–990. http://dx.doi.org/10.1007/s10461-010-9737-5

Knopf, A., Agot, K., Sidle, J., Naanyu, V., & Morris, M. (2014). 'This is the medicine': A Kenyan community responds to a sexual concurrency reduction intervention. *Soc Sci Med.108,* 175–184.

Kretzschmar, M., & Caraël, M. (2012). Is concurrency driving HIV transmission in sub-Saharan African sexual networks?: The significance of sexual partnership typology. *AIDS and Behavior, 16*(7):1746–1752.

Kretzschmar, M., & Morris, M. (1996). Measures of concurrency in networks and the spread of infectious disease. *Mathematical Biosciences, 133*(2), 165–195. http://dx.doi.org/10.1016/0025-5564(95)00093-3

Laukamm-Josten, U., Mwizarubi, B. K., Outwater, A., Mwaijonga, C. L., Valadez, J. J., Nyamwaya, D., et al. (2000). Preventing HIV infection through peer education and condom promotion among truck drivers and their sexual partners in Tanzania, 1990-1993. *AIDS Care, 12*(1), 27–40. http://dx.doi.org/10.1080/09540120047440

Lurie, M. N., & Rosenthal, S. (2010). Concurrent partnerships as a driver of the HIV epidemic in sub-Saharan Africa? The evidence is limited. *AIDS and Behavior, 14*(1), 17–24. http://dx.doi.org/10.1007/s10461-009-9583-5

Macaluso, M., Demand, M. J., Artz, L. M., & Hook, E. W., III. (2000). Partner type and condom use. *AIDS (London, England), 14*(5), 537–546. http://dx.doi.org/10.1097/00002030-200003310-00009

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. *Social Science & Medicine, 52*(11), 1613–1627. http://dx.doi.org/10.1016/S0277-9536(00)00272-0

Mahraj, P., & Cleland, J. (2005). Risk perception and condom use among married or cohabiting couples in KwaZulu-Natal, South Africa. *International Family Planning Perspectives, 31*(1).

Manning, W. D., Flanigan, C. M., Giordano, P. C., & Longmore, M. A. (2009). Relationship dynamics and consistency of condom use among adolescents. *Perspectives on Sexual and Reproductive Health, 41*(3), 181–190. http://dx.doi.org/10.1363/4118109

Marck, J. (1999). Long-distance truck drivers' sexual cultures and attempts to reduce HIV risk behaviour amongst them: a review of the African and Asian literature. In J. Caldwell, P. Caldwell, J. Anarfi, K. Awusabo-Asare, J. Ntozi, I. O. Orubuloye, et al. (Eds.), *Resistance to Behavioural Change to Reduce HIV/AIDS Infection in Predominantly Heterosexual Epidemics in Third World Countries* (pp. 91–100). Canberra, Australia: Health Transition Centre, National Centre for Epidemiology and Population Health, Australian National University.

Mbugua, G. G., Muthami, L. N., Mutura, C. W., Oogo, S. A., Waiyaki, P. G., Lindan, C. P., & Hearst, N. (1995). Epidemiology of HIV infection among long distance truck drivers in Kenya. *East African Medical Journal, 72*(8), 515.

Morris, C. N., & Ferguson, A. G. (2006). Sexual and treatment-seeking behaviour for sexually transmitted infection in long-distance transport workers of East Africa. *Sexually Transmitted Infections, 83*(3), 242–245. http://dx.doi.org/10.1136/sti.2006.024117

Morris, M. (2010). Barking up the wrong evidence tree. Comment on Lurie & Rosenthal,"Concurrent partnerships as a driver of the HIV epidemic in sub-Saharan Africa? The evidence is limited. *AIDS and Behavior, 14*(1), 31–33. http://dx.doi.org/10.1007/s10461-009-9639-6

Morris, M., & Kretzschmar, M. (1997). Concurrent partnerships and the spread of HIV. *AIDS (London, England), 11*(5), 641–648. http://dx.doi.org/10.1097/00002030-199705000-00012

Morris, M., Epstein, H., Wawer, M., & Jones, J. H. (2010). timing is everything: international variations in historical sexual partnership concurrency and HIV prevalence. *PLoS One, 5*(11), 1706–1728. http://dx.doi.org/10.1371/journal.pone.0014092

Morris, M., Wawer, M. J., Makumbi, F., Zavisca, J. R., & Sewankambo, N. (2000). Condom acceptance is higher among travelers in Uganda. *AIDS (London, England), 14*(6), 733–741. http://dx.doi.org/10.1097/00002030-200004140-00013

Ntozi, J. P. M., Mulindwa, I. N., Ahimbisibwe, F., Ayiga, N., & Odwee, J. (2004). Has the HIV/AIDS epidemic changed sexual behaviour of high risk groups in Uganda? *African Health Sciences, 3*(3), 107.

Oduwole, M., Jeminusi, O.A., Aderogba, O.I., & Okuboyejo, O.B. (2002). Influence of long distance truck drivers (LDTDs) HIV/ AIDS knowledge and attitude on the use of condoms. Poster presented at the XIV International AIDS Conference, Barcelona, Spain, 7-12 July 2002 (pp. Abstract no. ThPeD7686).

Opio, A., Mishra, V., Hong, R., Musinguzi, J., Kirungi, W., Cross, A., et al. (2008). Trends in HIV-related behaviors and knowledge in Uganda, 1989-2005: Evidence of a shift toward more risk-taking behaviors. *JAIDS Journal of Acquired Immune Deficiency Syndromes, 49*(3), 320–326. http://dx.doi.org/10.1097/QAI.0b013e3181893eb0

Orubuloye, I. O., Caldwell, P., & Caldwell, J. C. (1993). The role of high-risk occupations in the spread of AIDS: Truck drivers and itinerant market women in Nigeria. *International Family Planning Perspectives, 19*(2), 43–48. http://dx.doi.org/10.2307/2133418

Pickering, H., Okongo, M., Nnalusiba, B., Bwanika, K., & Whitworth, J. (1997). Sexual networks in Uganda: Casual and commercial sex in a trading town. *AIDS Care, 9*(2), 199–208. http://dx.doi.org/10.1080/09540129750125217

Pilcher, C. D., Tien, H. C., Eron, J. J., Jr., Vernazza, P. L., Leu, S. Y., Stewart, P. W., et al. (2004). Brief but efficient: Acute HIV infection and the sexual transmission of HIV. *The Journal of Infectious Diseases, 189*(10), 1785–1792. http://dx.doi.org/10.1086/386333

Pinkerton, S. D. (2008). Probability of HIV transmission during acute infection in Rakai, Uganda. *AIDS and Behavior, 12*(5), 677–684. http://dx.doi.org/10.1007/s10461-007-9329-1

Rakwar, J., Lavreys, L., Thompson, M. L., Jackson, D., Bwayo, J., Hassanali, S., et al. (1999). Cofactors for the acquisition of HIV-1 among heterosexual men: Prospective cohort study of trucking company workers in Kenya. *AIDS (London, England), 13*(5), 607–614. http://dx.doi.org/10.1097/00002030-199904010-00010

Ramjee, G., & Gouws, E. (2002). Prevalence of HIV among truck drivers visiting sex workers in KwaZulu-Natal, South Africa. *Sexually Transmitted Diseases, 29*(1), 44–49. http://dx.doi.org/10.1097/00007435-200201000-00008

Romero-Daza, N. (1994). Multiple sexual partners migrant labor and the makings for an epidemic: Knowledge and beliefs about AIDS among women in highland Lesotho. *Human Organization, 53*(2), 192–205.

Rosenberg ES, Rothenberg RB, Kleinbaum DG, Stephenson RB, Sullivan PS. (2014) Assessment of a new web-based sexual concurrency measurement tool for men who have sex with men. *J Med Internet Res*. Nov 10;16(11): Sawers L, Stillwaggon E. (2010) Concurrent sexual partnerships do not explain the HIV epidemics in Africa: a systematic review of the evidence. *J Int AIDS Soc*. Sep 13;13:34.

Slutkin, G., Okware, S., Naamara, W., Sutherland, D., Flanagan, D., Carael, M., et al. (2006). How Uganda reversed its HIV epidemic. *AIDS and Behavior, 10*(4), 351–360. http://dx.doi.org/10.1007/s10461-006-9118-2

Sobell, L. C., & Sobell, M. C. (1995). *Timeline followback users guide*. Toronto, Canada: Addiction Research Foundation.

Stoneburner, R. L., & Low-Beer, D. (2004). Population-level HIV declines and behavioral risk avoidance in Uganda. *Science, 304*(5671), 714–718. http://dx.doi.org/10.1126/science.1093166

Sunmola, A. M. (2005). Sexual practices, barriers to condom use and its consistent use among long distance truck drivers in Nigeria. *AIDS Care, 17*(2), 208–221. http://dx.doi.org/10.1080/09540120512331325699

Thompson, A. P. (1983). Extramarital sex: A review of the research literature. *Journal of Sex Research, 19*(1), 1–22. http://dx.doi.org/10.1080/00224498309551166

Uganda Bureau of Statistics and ICF International Inc. (2012). *Uganda Demographic and Health Survey 2011*..Kampala, Uganda: UBOS and Calverton. Maryland: ICF International Inc.

Uganda Bureau of Statistics and Macro International, Inc. (2007). *Uganda Demographic and Health Survey 2006*. Kampala, Uganda and Calverton, Maryland, USA: Uganda Bureau of Statistics and Macro International, Inc.

Uganda Health Marketing Group. (2011). *One love – Get off the sexual network campaign* Retrieved from: http://www.uhmg.org/content/one-love-get-sexual-network-campaign

Uganda Ministry of Health and ICF International. (2012). *2011 Uganda AIDS Indicator Survey*. Calverton, Maryland, USA: MOH and ICF International.

Ugandan AIDS Commission. (2012). *Global AIDS Response Progress Report*. Kampala: Ugandan AIDS Commission.

UNAIDS Reference Group on Estimates Modelling and Projections (2009). *Consultation on concurrent sexual partnerships: recommendations from a meeting held in Nairobi, Kenya* Retrieved June, 2012 from: http://www.epidem.org/publications.htm

Walden, V. M., Mwangulube, K., & Makhumula-Nkhoma, P. (1999). Measuring the impact of a behaviour change intervention for commercial sex workers and their potential clients in Malawi. *Health Education Research, 14*(4), 545–554. http://dx.doi.org/10.1093/her/14.4.545

Watts, C. H., & May, R. M. (1992). The influence of concurrent partnerships on the dynamics of HIV/AIDS. *Mathematical Biosciences, 108*(1), 89–104. http://dx.doi.org/10.1016/0025-5564(92)90006-I

Wawer, M. J., Gray, R. H., Sewankambo, N. K., Serwadda, D., Li, X., Laeyendecker, O., et al. (2005). Rates of HIV-1 transmission per coital act, by stage of HIV-1 infection, in Rakai, Uganda. *The Journal of Infectious Diseases, 191*(9), 1403–1409. http://dx.doi.org/10.1086/429411

Weinhardt, L., Forsyth, A., Carey, M., Jaworski, B., & Durant, L. (1998). Reliability and validity of self-report measures of HIV-related sexual behavior: Progress since 1990 and recommendations for research and practice. *Archives of Sexual Behavior, 27*(2), 155–180. http://dx.doi.org/10.1023/A:1018682530519

Weinhardt, L. S,, Carey, M. P., Maisto, S. A., Carey, K. B., Cohen, M. M., & Wickramasinghe, S. M. (1998). Reliability of the timeline follow-back sexual behavior interview. *Annals of Behavioral Medicine*, *20*(1), 25–30.

Westercamp, N., Mattson, C. L., Madonia, M., Moses, S., Agot, K., Ndinya-Achola, J. O., et al. (2010). Determinants of consistent condom use vary by partner type among young men in Kisumu, Kenya: A multi-level data analysis. *AIDS and Behavior, 14*(4), 949–959. http://dx.doi.org/10.1007/s10461-008-9458-1

Zeger, S. L., & Liang, K. Y. (1986). Longitudinal data analysis for discrete and continuous outcomes. *Biometrics, 42*(1), 121–130. http://dx.doi.org/10.2307/2531248