USAID
FROM THE AMERICAN PEOPLE

MEASURING CONCURRENT SEXUAL PARTNERSHIPS: EXPERIENCE OF THE MEASURE DHS PROJECT TO DATE

DHS METHODOLOGICAL REPORTS 7

FEBRUARY 2012

This publication was produced for review by the United States Agency for International Development. It was prepared by Joy D. Fishel, Ladys Ortiz, and Bernard Barrère of ICF International.

MEASURE DHS assists countries worldwide in the collection and use of data to monitor and evaluate population, health, and nutrition programs. Additional information about the MEASURE DHS project can be obtained by contacting ICF International, 11785 Beltsville Drive, Suite 300, Calverton, MD 20705 (telephone: 301-572-0200; fax: 301-572-0999; e-mail: reports@measuredhs.com; www.measuredhs.com).

The main objectives of the MEASURE DHS project are:

- to provide decision makers in survey countries with information useful for informed policy choices;
- to expand the international population and health database;
- to advance survey methodology; and
- to develop in participating countries the skills and resources necessary to conduct high-quality demographic and health surveys.

DHS Methodological Reports No. 7

Measuring Concurrent Sexual Partnerships: Experience of the MEASURE DHS Project to Date

Joy D. Fishel
Ladys Ortiz
Bernard Barrère

ICF International
Calverton, Maryland USA

February 2012

Corresponding author: Joy D. Fishel, International Health and Development Division, ICF International, 11785 Beltsville Drive, Suite 300, Calverton, MD 20705; Phone: 301-572-0200; Fax: 301-572-0999; Email: jfishel@icfi.com

Editor: Bryant Robey
Document Production: Yuan Gu

This report was written with support provided by the United States Agency for International Development (USAID) through the MEASURE DHS project (#GPO-C-08-00008-00). The views expressed are those of the authors and do not necessarily reflect the views of USAID or the United States Government.

Recommended citation:

Fishel, Joy D., Ladys Ortiz, and Bernard Barrère. 2012. *Measuring Concurrent Sexual Partnerships: Experience of the MEASURE DHS Project to Date*. DHS Methodological Reports No. 7. Calverton, Maryland, USA: ICF International.

Contents

Tables

Figures

Preface

The Demographic and Health Surveys (DHS) program has become one of the principal sources of international data on fertility, family planning, maternal and child health, nutrition, mortality, and HIV/AIDS. The quality of these data is of utmost importance to researchers worldwide.

Because survey methodology has a major impact on data quality, one of the objectives of the MEASURE DHS project is to advance the methodology and procedures used to carry out national-level surveys. This will improve the accuracy and depth of information relied on by policymakers and program managers in developing countries.

The topics in the *DHS Methodological Reports* series are selected by MEASURE DHS staff in consultation with the U.S. Agency for International Development. While data quality is a main topic of the reports, they also examine issues of sampling, questionnaire comparability, survey procedures, and methodological approaches.

This report summarizes recommendations for defining and measuring indicators on concurrent sexual partnerships that have been developed by the UNAIDS Reference Group on Estimates, Modeling and Projections. It explains the procedures used by MEASURE DHS to calculate the standard indicators, presents the data available at this time, and discusses some of the challenges and limitations to describing concurrency.

It is hoped that the *DHS Methodological Reports* series will be useful to researchers and survey specialists, particularly those engaged in work in developing countries.

Ann A. Way
Project Director

Acknowledgments

The authors would like to acknowledge the contributions of Trevor Croft, who participated in the development of protocols for processing concurrency data, and of Sunita Kishor and Ann Way, who reviewed the report and provided valuable feedback.

Executive Summary

In April 2009, the UNAIDS Reference Group on Estimates, Modeling and Projections convened a meeting in Nairobi, Kenya, to discuss the definition and measurement of concurrent sexual partnerships. Concurrent sexual partnerships, that is, those that overlap in time, have become a topic of increasing interest for understanding HIV epidemics. During this meeting, the Reference Group recommended three standard indicators for measuring the prevalence of concurrent sexual partnerships in population-based surveys. The standard indicators are: point prevalence of concurrent partnerships, cumulative prevalence of concurrent partnerships, and the proportion of multiple partnerships that are concurrent in the past year, in detail.

The purpose of the report is to summarize the Reference Group recommendations, to explain the specific procedures the MEASURE DHS project uses to calculate the standard indicators, to present the data on concurrency available at the present time, and to discuss some of the challenges and limitations.

It is possible to measure the three recommended indicators in Demographic and Health Surveys (DHS) and AIDS Indicator Surveys (AIS) with minor alterations of the standard questionnaires; however, there are challenges to collect accurate and complete data as well as limitations to their interpretation.

Five countries have collected and released data on concurrent sexual partnerships: Congo Brazzaville, Lesotho, Malawi, Mozambique, and Tanzania. Among women, the point prevalence of concurrency ranges from well under 1 percent in Malawi to 3 percent in Congo. Among men, point prevalence ranges from 4 percent in Malawi to 10 percent in Congo. Cumulative prevalence of concurrency ranges from less than 1 percent in Malawi to 5 percent in Congo and Lesotho among women, and from 7 percent in Malawi to 23 percent in Congo among men.

Challenges in data collection include possible underreporting of concurrency due either to a reluctance of respondents to reveal pre-marital or extra-marital sexual partners or to recall errors. Tabulation of the concurrency indicators is exceedingly complex, and requires some assumptions to be taken (see Section 3). Finally, although the data collected in DHS and AIS surveys can estimate the national prevalence of concurrent sexual partnerships, the data have limited value in analyzing the association between concurrency and HIV transmission. Low numbers of cases of women who report having concurrent sexual partners in DHS and AIS surveys, and the fact that the surveys use a cross-sectional, population-based design limits the analytical value of the concurrency data they collect (see Section 5).

1. Introduction

Concurrent sexual partnerships, that is, partnerships that overlap in time, have become a topic of increasing interest in the field of HIV/AIDS. A debate has developed over the premise that differences in levels of concurrent sexual partnerships help to explain why the HIV epidemic grew much more quickly in some countries than in others; however, the debate has been muddied by inconsistent definitions of concurrency and a lack of comparable data.

In April 2009, the UNAIDS Reference Group on Estimates, Modeling and Projections convened a meeting in Nairobi, Kenya, to discuss the definition and measurement of concurrent sexual partnerships. Through this meeting, the Working Group on Measuring Concurrent Sexual Partnerships generated a set of recommendations with respect to indicators for assessing the prevalence of concurrent partnerships and the questions that should be added to surveys to provide the data for measuring these concurrency indicators.

This report summarizes the Reference Group's recommendations, provides detail on how the MEASURE DHS Project collects and tabulates data to measure these indicators, and shows the results for the prevalence of concurrency in five Demographic and Health Surveys (DHS) and AIDS Indicator Surveys (AIS). The report also describes challenges and limitations in collecting data on concurrency, calculating the indicators, and interpreting the results.

2. Rationale and Definitions for Indicators of Concurrent Sexual Partnerships

2.1 Rationale

Mathematical modeling has shown that even small increases in concurrency can result in large increases in HIV transmission (Morris and Kretzchmar, 1997). The increase in risk of HIV transmission associated with concurrency is believed to occur through two different mechanisms: (1) by generating an interconnected sexual network, increasing the velocity with which HIV infection passes from one person to the next; and (2) by allowing HIV infection to travel both "forward" and "backward" among an individual's sexual partners (Ghys, 2009).

In serial monogamous partnerships, a newly infected individual cannot transmit the virus to another person until the current partnership dissolves and he or she acquires a new partner. In contrast, in concurrent partnerships the virus can spread quickly along the pathways of interconnected sexual networks. The period of high viremia and transmissibility that follows initial HIV infection amplifies the effect of concurrency on HIV transmission; having concurrent sexual partners makes it more likely that a newly infected individual will expose additional partners to infection during this time.

In addition, concurrency removes the "protective sequencing" of serial monogamy. In serial monogamous partnerships, HIV infection can only move "forward" through an individual's sexual partners. An individual's earlier partner is "protected" from acquiring the infection of a later partner. However, if an individual begins a second partnership while continuing the first partnership, then the first partner is at risk of acquiring an infection that the individual acquires from the second partner. In other words, HIV infection can move both "forward" and "backward" through an individual's sexual partners.

Although there is a theoretical link between concurrent sexual partnerships and the size and spread of HIV epidemics, few data are available to test for an empirical association. One of the challenges to generating a body of evidence on concurrency has been the lack of consensus on an operational definition and recommended data collection methodologies. In addition to providing evidence to support or refute an association between concurrency and HIV transmission, standardized indicators and data collection methodologies are also needed to facilitate evaluation of several emerging HIV prevention programs that aim to reduce the number of concurrent sexual partnerships.

2.2 Definitions

According to the UNAIDS Reference Group, concurrent sexual partnerships are defined as "overlapping sexual partnerships in which sexual intercourse with one partner occurs between two acts of intercourse with another partner."[1]

The Working Group on Measuring Concurrent Sexual Partnerships also recommended one primary and two alternate indicators:

- **Primary indicator: Point prevalence of concurrent partnerships**, defined as the proportion of women and men age 15-49 with more than one ongoing sexual partnership at the point in time six months before the interview.

- **Alternate indicator: Cumulative prevalence of concurrent partnerships**, defined as the proportion of women and men age 15-49 with overlapping sexual partnerships at any point in the past year.

[1] Ghys, 2009; UNAIDS, 2009; and UNAIDS, 2010.

- **Alternate indicator: Proportion of multiple partnerships that are concurrent in the past year**, defined as follows: Among women and men age 15-49 who had multiple sexual partnerships in the previous year, the proportion who had concurrent partnerships in the previous year.

The point prevalence of concurrent sexual partnerships, by virtue of requiring that partnerships start before and end after a given cutoff, excludes those that last only one day. It was chosen as the primary indicator because it emphasizes sustained overlapping sexual partnerships, which are theorized to have a stronger association with HIV transmission than concurrent sexual partnerships involving one long-term partnership and occasional one-time sexual encounters. The possibility of acquiring HIV through a single coital act with an HIV-positive individual is relatively low.[2] If an individual does not acquire an infection through a one-time sexual encounter, then their other concurrent sexual partners are not at increased risk of infection. An individual's risk of acquiring HIV from an HIV-positive partner is higher if their partnership is sustained over a period of time. The cumulative prevalence indicator, however, does include concurrent partnerships that consist of a longer-term partnership and a one-time sexual encounter.

The UNAIDS Reference Group recommendations took into account two other issues in defining concurrency:

(1) If one sexual partnership ends during the same month/week/day as another sexual partnership begins, the two partnerships should not be considered concurrent.

(2) The relationship of the sexual partner is not taken into account. Partnerships are treated the same if they are with a wife, a non-cohabiting long-term partner, a casual acquaintance, a sex worker, etc. One implication of this recommendation is that polygynous men who have overlapping sexual partnerships with their wives are considered to have concurrent partnerships.

The Reference Group also recommended a specific series of questions for measurement of these indicators:

- "When was the last time you had sexual intercourse with this person?"
  [Answer in days/weeks/months ago (and years for the most recent partner)]

- "When was the first time you had sexual intercourse with this person?"
  [Answer in days/weeks/months ago]

- "Are you still having sex with this person?"

[2] Three studies have estimated the chance of infection per coital act (of penile vaginal intercourse) at around 1 in 1,000: Gray et al., 2001; Wawer et al., 2005; and Hira et al., 1997.

3. Calculation of Indicators of Concurrent Sexual Partnerships in DHS and AIS Surveys

3.1 Data collection

The MEASURE DHS Project has incorporated the recommendations of the UNAIDS Reference Group on Estimates Modeling and Projections (with the exception of the question about whether the sexual partnership is ongoing) into the core DHS questionnaires and final report tabulation plan.[3] The rest of Section 3 provides detailed information on the indicator definitions and how they are tabulated in the DHS and AIS surveys. Data from surveys in five countries—three DHS and two AIS—are currently available and are presented in Section 4 of this report.

The standard DHS and AIS core questionnaires for women and men include a section on the respondent's sexual behavior in the past 12 months. Figure 1 shows the 12-month sexual history questions from the DHS core women's questionnaire; the men's version is nearly identical, except for the necessary modifications in coding categories and filters to adapt it for use with men.

In collecting the sexual history data, the surveys ask all respondents who have ever had sex when was the last time they had sexual intercourse. Respondents who reported having had sexual intercourse in the past 12 months are asked how long ago they last had sex, and how long ago they first had sex with each of their most recent three sexual partners in the past 12 months. Each of these questions is used in the calculation of both point and cumulative prevalence of concurrent sexual partnerships.

[3] The project did not include the question on whether the sexual partnership is ongoing because it requires the respondent to speculate about future events. It may be difficult for a respondent to know whether or not a partnership will continue into the future, especially for casual sexual partnerships. In addition, this question is not needed to calculate the recommended point and cumulative prevalence indicators.

Figure 1. Sexual history questions in the DHS core women's questionnaire

615	When was the last time you had sexual intercourse? IF LESS THAN 12 MONTHS, ANSWER MUST BE RECORDED IN DAYS, WEEKS OR MONTHS. IF 12 MONTHS (ONE YEAR) OR MORE, ANSWER MUST BE RECORDED IN YEARS.	DAYS AGO . . . . 1 WEEKS AGO . . . . 2 MONTHS AGO . . . . 3 YEARS AGO 4	→ 627

		LAST SEXUAL PARTNER	SECOND-TO-LAST SEXUAL PARTNER	THIRD-TO-LAST SEXUAL PARTNER
616	When was the last time you had sexual intercourse with this person?		DAYS AGO 1 WEEKS AGO 2 MONTHS AGO 3	DAYS AGO 1 WEEKS AGO 2 MONTHS AGO 3
617	The last time you had sexual intercourse (with this second/third person), was a condom used? **(2)**	YES . . . . 1 NO . . . . 2 (SKIP TO 619)	YES . . . . 1 NO . . . . 2 (SKIP TO 619)	YES . . . . 1 NO . . . . 2 (SKIP TO 619)
618	Was a condom used every time you had sexual intercourse with this person in the last 12 months?	YES . . . . 1 NO 2	YES . . . . 1 NO 2	YES . . . . 1 NO 2
619	What was your relationship to this person with whom you had sexual intercourse? IF BOYFRIEND: Were you living together as if married? IF YES, CIRCLE '2'. IF NO, CIRCLE '3'.	HUSBAND . . . . 1 LIVE-IN PARTNER . . . 2 BOYFRIEND NOT LIVING WITH RESPONDENT . . . 3 CASUAL ACQUAINTANCE . . . 4 CLIENT/PROSTITUTE 5 OTHER ____________ 6 (SPECIFY) (SKIP TO 622)	HUSBAND . . . . 1 LIVE-IN PARTNER . . . 2 BOYFRIEND NOT LIVING WITH RESPONDENT . . . 3 CASUAL ACQUAINTANCE . . . 4 CLIENT/PROSTITUTE 5 OTHER ____________ 6 (SPECIFY) (SKIP TO 622)	HUSBAND . . . . 1 LIVE-IN PARTNER . . . 2 BOYFRIEND NOT LIVING WITH RESPONDENT . . . 3 CASUAL ACQUAINTANCE . . . 4 CLIENT/PROSTITUTE 5 OTHER ____________ 6 (SPECIFY) (SKIP TO 622)
620	CHECK 609:	MARRIED ONLY ONCE / MARRIED MORE THAN ONCE (SKIP TO 622)	MARRIED ONLY ONCE / MARRIED MORE THAN ONCE (SKIP TO 622)	MARRIED ONLY ONCE / MARRIED MORE THAN ONCE (SKIP TO 622)
621	CHECK 613:	FIRST TIME WHEN STARTED LIVING WITH FIRST HUSBAND (SKIP TO 623) / OTHER	FIRST TIME WHEN STARTED LIVING WITH FIRST HUSBAND (SKIP TO 623) / OTHER	FIRST TIME WHEN STARTED LIVING WITH FIRST HUSBAND (SKIP TO 623) / OTHER
622	How long ago did you first have sexual intercourse with this (second/third) person?	DAYS AGO 1 WEEKS AGO 2 MONTHS AGO 3 YEARS AGO 4	DAYS AGO 1 WEEKS AGO 2 MONTHS AGO 3 YEARS AGO 4	DAYS AGO 1 WEEKS AGO 2 MONTHS AGO 3 YEARS AGO 4
623	How many times during the last 12 months did you have sexual intercourse with this person? IF NON-NUMERIC ANSWER, PROBE TO GET AN ESTIMATE. IF NUMBER OF TIMES IS 95 OR MORE, WRITE '95'.	NUMBER OF TIMES	NUMBER OF TIMES	NUMBER OF TIMES
624	How old is this person?	AGE OF PARTNER DON'T KNOW 98	AGE OF PARTNER DON'T KNOW 98	AGE OF PARTNER DON'T KNOW 98
625	Apart from (this person/these two people), have you had sexual intercourse with any other person in the last 12 months?	YES . . . . 1 (GO BACK TO 616 IN NEXT COLUMN) NO . . . . 2 (SKIP TO 627)	YES . . . . 1 (GO BACK TO 616 IN NEXT COLUMN) NO . . . . 2 (SKIP TO 627)	
626	In total, with how many different people have you had sexual intercourse in the last 12 months? IF NON-NUMERIC ANSWER, PROBE TO GET AN ESTIMATE. IF NUMBER OF PARTNERS IS 95 OR MORE, WRITE '95'.			NUMBER OF PARTNERS LAST 12 MONTHS . . . DON'T KNOW . . . 98

3.2 Preparing the data to generate variables on point and cumulative prevalence in DHS and AIS datasets

In DHS and AIS surveys, time since first/last sex is recorded in number of days, weeks, months or years before the survey. Each of these responses is first converted to a number of days, for ease of comparison. Because all responses are recorded in completed units, an adjustment of half the length of the unit is applied to each response.

e.g. "4 months ago" is treated as 4.5 months = (365 days/12 months) * 4.5 months = 137 days ago

e.g. "4 weeks ago" is treated as 4.5 weeks = (7 days/week) * 4.5 weeks = 31.5 days ago

3.3 Creation of recode variables and calculation of concurrency indicators

Creating the recode variable for point prevalence of concurrency

As mentioned above (see Definitions), point prevalence of concurrency is defined as having two or more sexual partnerships ongoing at the point in time six months before the survey. The cutoff of six months is converted to 182 days (6*(365/12)). A sexual partnership is considered to be ongoing six months before the survey if the time since first sex with the partner is greater than 182.5 days and the time since last sex with the partner is less than 182.5 days.[4]

The first step in creating the recode variable for point prevalence of concurrency is to tally the number of sexual partnerships that are ongoing at the point in time six months before the survey for each respondent who had more than one sexual partner in the past 12 months. The possible outcomes are 0, 1, 2, or 3, because the questionnaire collects time since first and last sex only for the last three sexual partners in the past 12 months. The recode variable for point prevalence of concurrent sexual partnerships is then defined as followed:

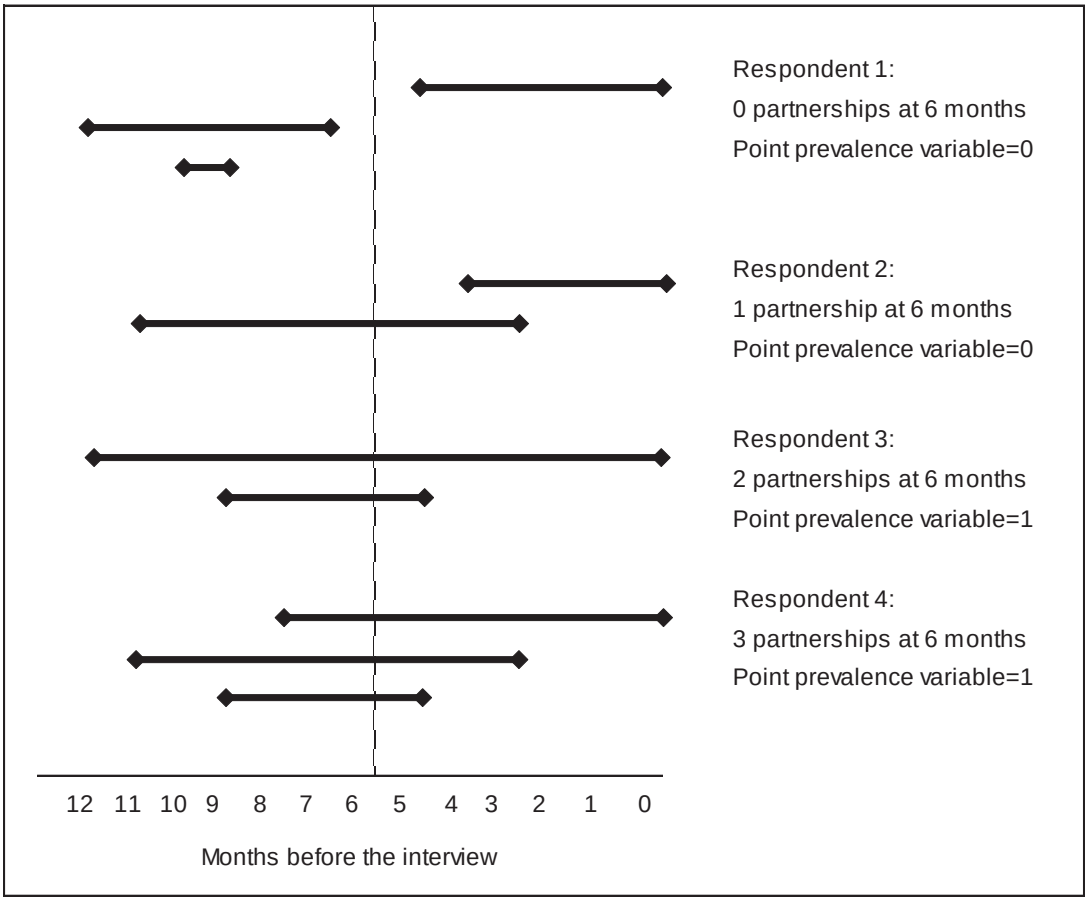
- Respondents who had multiple sexual partnerships in the past 12 months but who had no sexual partnerships or only one sexual partnership that met the criteria of beginning before the six-month cutoff and continuing after the six-month cutoff (i.e., those with a value of 0 or 1 on the tally variable described above) are assigned a value of 0. (Respondents 1 and 2 in Figure 2, below).

- Respondents who had two or three sexual partnerships in the past 12 months that began before the cutoff and continued after the cutoff (i.e., those with a value of 2 or 3 on the tally variable) are assigned a value of 1. (Respondents 3 and 4 in Figure 2).

- Respondents who had no sexual partners in the past 12 months or who had exactly one sexual partner during this time are assigned a value of 'not applicable' in CSPro. This gets translated into a value of 'system missing' in most analysis software.

[4] Due to the half-unit adjustment, responses for time since first/last sex cannot equal exactly 180 days.

Figure 2. Coding of the point prevalence recode variable



Calculating the indicator for point prevalence of concurrency using the recode variable

Using the recode variable for point prevalence of concurrency, the indicator is calculated by placing respondents with a value of 1 in the numerator, and all respondents (i.e., those with a value of 0, 1 and 'not applicable') in the denominator.

$$\text{Numerator: Number of respondents age 15-49 who had two or more sexual partnerships during the past 12 months in which the first sexual intercourse with a partner occurred prior to a cutoff of six months before the survey and the most recent sexual intercourse with the same partner occurred after a cutoff of six months before the survey}$$

$$\text{Denominator: All respondents age 15-49}$$

In other words, a person is counted as having point prevalence of concurrency if they have two or three sexual partnerships ongoing at the point in time six months before the survey. The point prevalence of concurrency indicator intentionally excludes partnerships lasting only one day. The relationship of each partner to the respondent is not taken into account in calculating point prevalence of concurrency.

Creating the recode variable for cumulative prevalence of concurrency

As mentioned above (see Definitions), cumulative prevalence of concurrency is defined as having any overlapping sexual partnerships in the 12 months preceding the survey. Overlapping sexual partnerships are those in which an individual has sexual intercourse with one partner between two acts of intercourse with another partner.

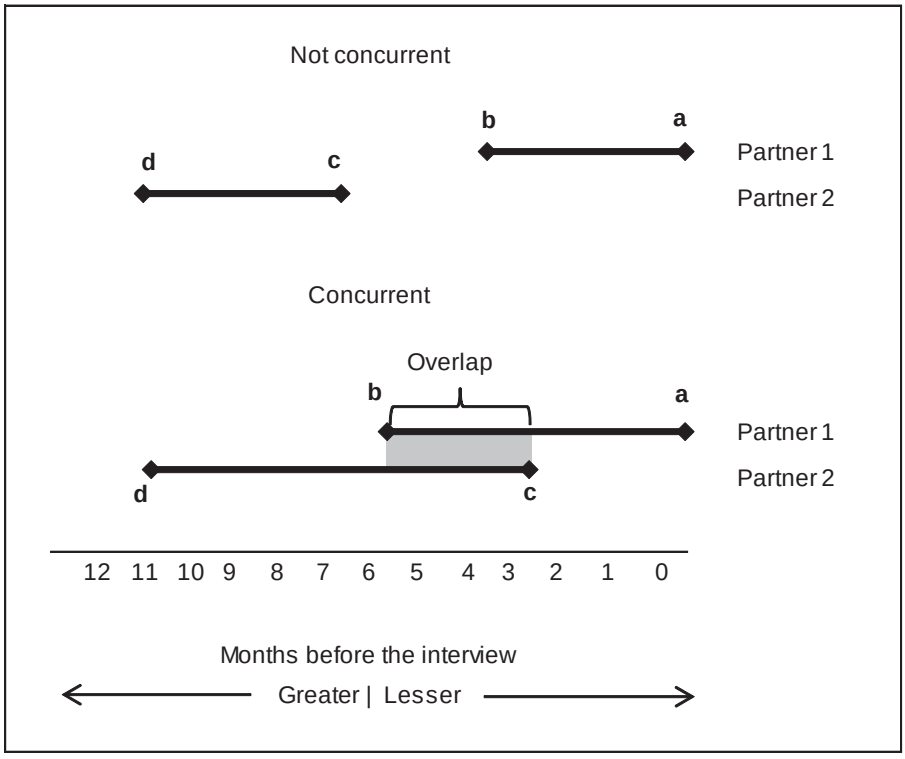
As in the recode variable for point prevalence, in the recode variable for cumulative prevalence respondents who did not have multiple sexual partners in the past 12 months are assigned a value of 'not applicable'. Next, all respondents with two or more sexual partners in the past 12 months are assigned a default value of 0, indicating no concurrent partnerships in the past 12 months. Each respondent is then checked to determine whether or not any of their partnerships are concurrent. Any respondent who is found to have concurrent partners, by satisfying one of the conditions described below, is recoded from 0 to 1, indicating concurrent sexual partnerships in the past 12 months.

As shown in Figure 1, the information on the last three sexual partners in the past 12 months is collected using a table with three columns, with the first column including information on the most recent sexual partner (the last person the respondent had sex with), the second column including information on the second-to-last sexual partner, and the third column including information on the third-to-last sexual partner. If a respondent has only two partners in the past 12 months, only one comparison is needed to check whether or not any two partners overlap (that is, a comparison between the most recent partner and the second-to-last partner). However, if a respondent has three or more sexual partners in the past 12 months, three comparisons must be made: between the most recent partner and the second-to-last partner, between the second-to-last partner and the third-to-last partner, and between the most recent partner and the third-to-last partner. If any two partnerships are concurrent according to the conditions below, then the respondent is assigned a value of 1 on the recode variable for cumulative prevalence of concurrent sexual partnerships.

In checking whether or not any two of the various combinations of sexual partnerships are concurrent, four data points are involved. Figure 3 illustrates how the information on time since first sex and time since last sex with the most recent partner and the time since first sex and time since last sex for the second-to-the last partner are checked for concurrency.

1. Last sex with the most recent partner - call this 'a'
2. First sex with the most recent partner - call this 'b'
3. Last sex with the second-to-the last partner - call this 'c'
4. First sex with the second-to-the last partner - call this 'd'

Figure 3. Concurrent and non-concurrent partners



For the vast majority of respondents in the five surveys analyzed, any two sexual partnerships can be correctly classified as concurrent or not concurrent simply by determining whether the first sex with the first partner in the pair being checked for concurrency (data point 'b') occurred before or after the last sex with second partner in the pair (data point 'c'). As Figure 3 shows, if data point 'b' is after data point 'c' the partnerships are not concurrent; if data point 'b' is before data point 'c' the partnerships are concurrent. However, two data quality issues affecting a small percentage of partnerships may prevent this simple check from working correctly for every pair of partners: (1) partners being recorded out of order on the questionnaire; and (2) missing data.

Although sexual partners are supposed to be recorded in the three columns in the questionnaire in order, from most recent to least recent according to the time since last sex with each partner, it is possible for the timing of last sex for a supposedly earlier partner to be reported as later than the timing of last sex with the supposed later partner. In this situation, we assume that the data for time since last sex is correct, and the partners are out of order in the questionnaire. To ensure that the cumulative prevalence variable correctly classifies partnerships as concurrent or not, we employ a logic for checking partnerships that is equally effective whether the partners are in order or out of order. The logic is also designed to minimize the impact of missing data on the indicator calculation. In many (but not all) pairs of partnerships, it is possible to correctly classify the partnerships as concurrent or not concurrent even when one of the four data points is missing. The logic used to classify partnerships performs multiple checks on each pair of partners, so that a lack of information on any specific data point does not prevent correct classification of the partnerships when sufficient information is available to make a conclusion.

The following logic rules are used to classify any two partnerships as concurrent or not concurrent (see Figure 4):

Condition 1: If b>c and b<d, then the partners are concurrent

Condition 2: If a>c and a<d, then the partners are concurrent

Condition 3: If a<d and b>d, then the partners are concurrent

Condition 4: If a<c and b>c, then the partners are concurrent

Condition 5: If a is missing and b>d, then assume that the partners are in order, and the two partners are considered concurrent by condition 3

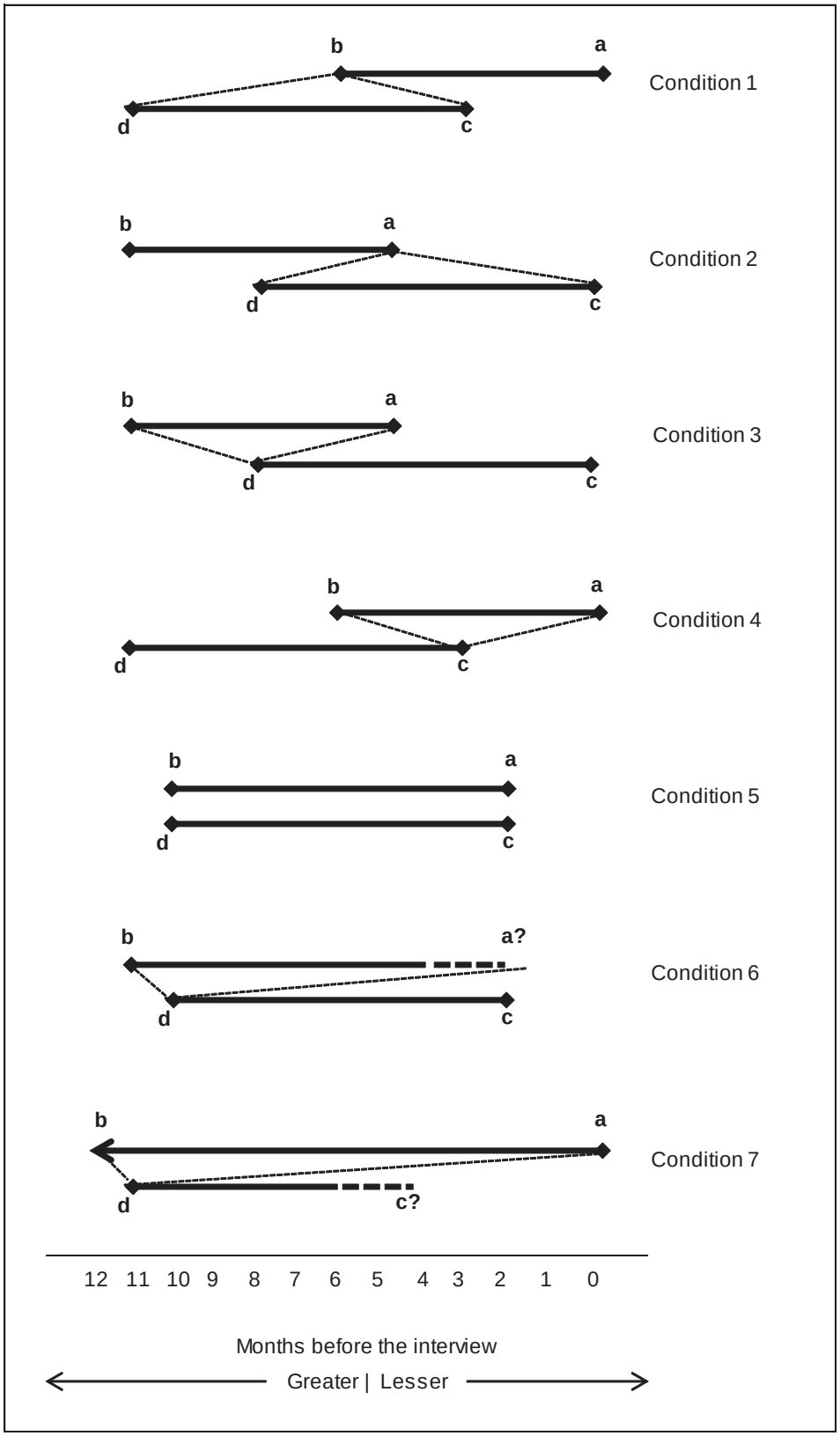
Condition 6: If c is missing and b≥12 months, then the two partners are concurrent

Condition 7: If a=c and b=d and a is not equal to b, then the partners are concurrent

The date of first/last sex is recorded in time before the interview, so a larger number signifies an earlier event, while a smaller number signifies a later event.

For the purpose of illustrating the basic mechanics of the seven conditions, Figure 4 is simplified and does not show all possible configurations of partnerships. For example, Condition 1 would also classify two partnerships as concurrent if ‘a’ occurred at the same time as ‘c’, if ‘a’ occurred in between ‘b’ and ‘c’, or if ‘a’ and ‘b’ had the same value, as in a one-time casual encounter.

Figure 4. Logic to tabulate cumulative prevalence of concurrent sexual partnerships



If at least one of these seven conditions is true, then the respondent is recoded from 0 to 1 on the cumulative prevalence of concurrency recode variable. The program to calculate the variable first compares the most recent and second-to-last partners. If none of the seven conditions is satisfied for that pair of partners, the program then loops through and compares the second-to-last partner and third-to-last partners. If none of the conditions is satisfied, the program then compares the most recent partner and the third-to-last partner. If at least one condition is found to be true in any of the three comparisons, the respondent is recoded from 0 to 1 on the cumulative prevalence of concurrency variable.

If none of the conditions is true for any pair of partners, then the respondent maintains the default value of 0 on the cumulative concurrency variable. Respondents with a value of 0 on the cumulative prevalence of concurrency variable include two groups: (1) respondents whose information confirms that none of their partners in the past 12 months were concurrent; and (2) respondents whose information is insufficient to determine whether or not any of their partners were concurrent.[5]

In summary, for the recode variable on cumulative prevalence of concurrency, a respondent is given a value of 1 if any two of their last three sexual partnerships in the past 12 months satisfy at least one of the seven conditions specified above. All other respondents who had multiple partners in the past 12 months retain a default value of 0. Respondents who did not have sex in the past 12 months and those who had exactly one sexual partner are assigned a value of 'not applicable'.

Calculating the indicator for cumulative prevalence of concurrency using the recode variable

Using the recode variable for cumulative prevalence of concurrency, the indicator is calculated by placing respondents with a value of 1 in the numerator, and placing all respondents (i.e., those with a value of 0, 1 and 'not applicable') in the denominator. The relationship of each partner to the respondent is not taken into account in calculating point prevalence of concurrency.

$$\text{Numerator: } \frac{\text{Number of respondents age 15-49 who had two or more overlapping sexual partners in the past 12 months (as determined by satisfying at least one of the seven conditions outlined above)}}{\text{Denominator: All respondents age 15-49}}$$

Calculation of point and cumulative prevalence of concurrency, further detail

The following steps are taken to clean the data collected for time since first sex (TFS) and time since last sex (TLS) before any of the calculations on concurrency are made:

- If TLS (with any sexual partner in the past 12 months) is reported earlier than TFS with the same partner, then the two values are reversed.
- If TFS (with any sexual partner in the past 12 months) is missing and TLS with the same partner is valid, and the number of times the respondent had sex with this partner is 1, then TFS is set equal to TLS.
- If TLS (with any sexual partner in the past 12 months) is missing and TFS with the same partner is valid, and the number of times the respondent had sex with this partner is 1, then TLS is set equal to TFS.

[5] Information on the proportion of cases that lack sufficient information is provided in Table 4, for each of the five countries examined.

- If the TFS (for any partner in the past 12 months) has code ‘4’ for the unit, indicating ‘years ago’, and the number of years is missing, then set time since first sex for this partner equal to 1 year. This allows the application to establish that first sex with this partner occurred before last sex with any other partner in the sexual history table, because last sex with any partner must have occurred within the past 12 months in order for the partner to be recorded in this section of the questionnaire.

4. Results

4.1 Point and cumulative prevalence of concurrent sexual partnerships

DHS or AIS data on concurrent sexual partnerships are currently available from five countries (Congo Brazzaville, Lesotho, Malawi, Mozambique and Tanzania)[6] and are presented in Table 1. In the five countries, data were collected from nationally representative samples, varying widely in size, from 5,674 women in Mozambique to 23,020 in Malawi, and from 2,527 men in Tanzania to 6,818 in Malawi.

Table 1 first presents the proportion of women and men who reported multiple partners in the past 12 months. In Malawi, about one in ten men reported two or more sexual partners; in Lesotho, Tanzania and Mozambique, this proportion is twice as high; and in Congo one in three men reported multiple partners. Among women, these proportions are much lower: less than 1 percent of women reported multiple partners in Malawi, about 3 percent in Mozambique and Tanzania, 6 percent in Lesotho, and 7 percent in Congo.

In each country, both the point and cumulative concurrency prevalence measures are markedly higher for men than women. Among women, point prevalence ranges from 0.1 percent in Malawi to 3 percent in Congo. Cumulative prevalence ranges from 0.3 percent in Malawi to 5 percent in Congo and Lesotho. Among men, point prevalence ranges from 4 percent in Malawi to 10 percent in Congo. Cumulative prevalence ranges from 7 percent in Malawi to 23 percent in Congo. Cumulative prevalence of concurrent sexual partners appears to be about twice as high as point prevalence, for both women and men in all countries.

[6] Congo AIS 2009 (Centre National de la Statistique et des Études Économiques and ICF Macro, 2009); Lesotho DHS 2009 (Ministry of Health and Social Welfare and ICF Macro, 2010); Malawi DHS 2010, (National Statistical Office and ICF Macro, 2011); Mozambique AIS 2009 (INS, INE, and ICF Macro, 2010); and Tanzania DHS 2010 (National Bureau of Statistics and ICF Macro, 2011).

Table 1. Point prevalence and cumulative prevalence of concurrent sexual partnerships

Percentage of all respondents age 15-49 who had overlapping sexual partnerships six months before the survey (point prevalence[1]), and percentage of all respondents age 15-49 who had any overlapping sexual partnerships during the 12 months before the survey (cumulative prevalence[2]), and among respondents age 15-49 who had multiple sexual partners during the past 12 months, percentage who had concurrent sexual partnerships

	Among all respondents age 15-49				Among respondents who had multiple partners during the 12 months before the survey	
Background characteristic	Percentage with 2+ partners in the past 12 months	Point prevalence of concurrent sexual partners[1]	Cumulative prevalence of concurrent sexual partners[2]	Number	Percentage who had concurrent sexual partners[2]	Number
CONGO 2009						
Women	**6.9**	**2.6**	**5.2**	**6,550**	**77.0**	**446**
Not in union	12.1	3.9	8.5	2,658	72.0	315
In Union	3.4	1.6	3.0	3,892	89.1	131
Men	**28.6**	**9.9**	**22.6**	**5,863**	**79.5**	**1,667**
Not in union	23.1	4.5	14.8	2,855	64.2	658
In Union	33.8	15.0	30.0	3,008	89.5	1,009
Polygynous	91.7	69.7	86.2	192	94.0	176
Non-polygynous	29.7	11.0	26.0	2,795	88.4	822
LESOTHO 2009						
Women	**6.4**	**2.4**	**5.2**	**7,624**	**81.6**	**488**
Not in union	5.2	1.3	3.6	3,575	69.0	186
In Union	7.5	3.3	6.7	4,049	89.5	302
Men	**21.9**	**7.7**	**16.2**	**3,008**	**74.0**	**659**
Not in union	21.0	4.9	13.2	1,839	62.9	385
In Union	23.4	12.0	21.0	1,169	89.7	274
Polygynous	*	*	*	17	*	5
Non-polygynous	23.4	11.9	20.9	1,152	89.5	269
MALAWI 2010						
Women	**0.7**	**0.1**	**0.3**	**23,020**	**45.8**	**151**
Not in union	1.0	0.2	0.4	7,492	39.7	73
In Union	0.5	0.1	0.3	15,528	51.5	78
Men	**9.2**	**3.8**	**7.2**	**6,818**	**78.5**	**627**
Not in union	6.7	0.7	3.9	2,923	58.3	195
In Union	11.1	6.0	9.7	3,895	87.7	432
Polygynous	68.8	54.7	63.8	295	92.7	203
Non-polygynous	6.3	2.0	5.3	3,592	83.2	227
MOZAMBIQUE 2009						
Women	**3.0**	**0.8**	**2.1**	**5,674**	**70.3**	**169**
Not in union	5.9	1.5	3.7	1,516	63.3	90
In Union	1.9	0.5	1.5	4,157	78.2	79
Men	**19.8**	**9.0**	**16.0**	**4,168**	**80.7**	**824**
Not in union	15.1	3.8	9.2	1,458	60.8	220
In Union	22.3	11.8	19.6	2,710	87.9	604
Polygynous	73.9	52.4	71.1	311	96.3	230
Non-polygynous	15.6	6.5	12.9	2,377	83.0	370
TANZANIA 2010						
Women	**3.5**	**1.1**	**2.1**	**10,139**	**59.8**	**357**
Not in union	5.0	1.0	2.3	3,727	47.4	185
In Union	2.7	1.1	2.0	6,412	73.2	173
Men	**20.7**	**7.8**	**15.4**	**2,527**	**74.5**	**523**
Not in union	12.3	2.1	5.7	1,210	46.5	149
In Union	28.3	13.1	24.3	1,317	85.6	373
Polygynous	85.5	63.9	80.6	128	94.3	109
Non-polygynous	22.2	7.7	18.2	1,189	82.1	264

Notes: Two sexual partners are considered to be concurrent if the date of the most recent sexual intercourse with the earlier partner is after the date of the first sexual intercourse with the later partner. Information on type of union is missing for 21 men in Congo, 8 men in Malawi, and 21 men in Mozambique.

[1] The percentage of respondents who had two (or more) sexual partners that were concurrent at the point in time six months before the survey

[2] The percentage of respondents who had two (or more) sexual partners that were concurrent anytime during the 12 months preceding the survey

The countries rank in more or less the same order for prevalence of concurrency, regardless of whether one looks at the point prevalence indicator or the cumulative prevalence indicator. However, concurrency among men is not consistently correlated with concurrency among women across the countries. Malawi has the lowest levels of concurrency for both women and men, Congo has the highest levels among men and women, and Mozambique and Tanzania fall in the middle. In Lesotho, however, the level of concurrency among women is similar to the higher level in Congo while among men, the level of concurrency is similar to the moderate levels in Tanzania and Mozambique.

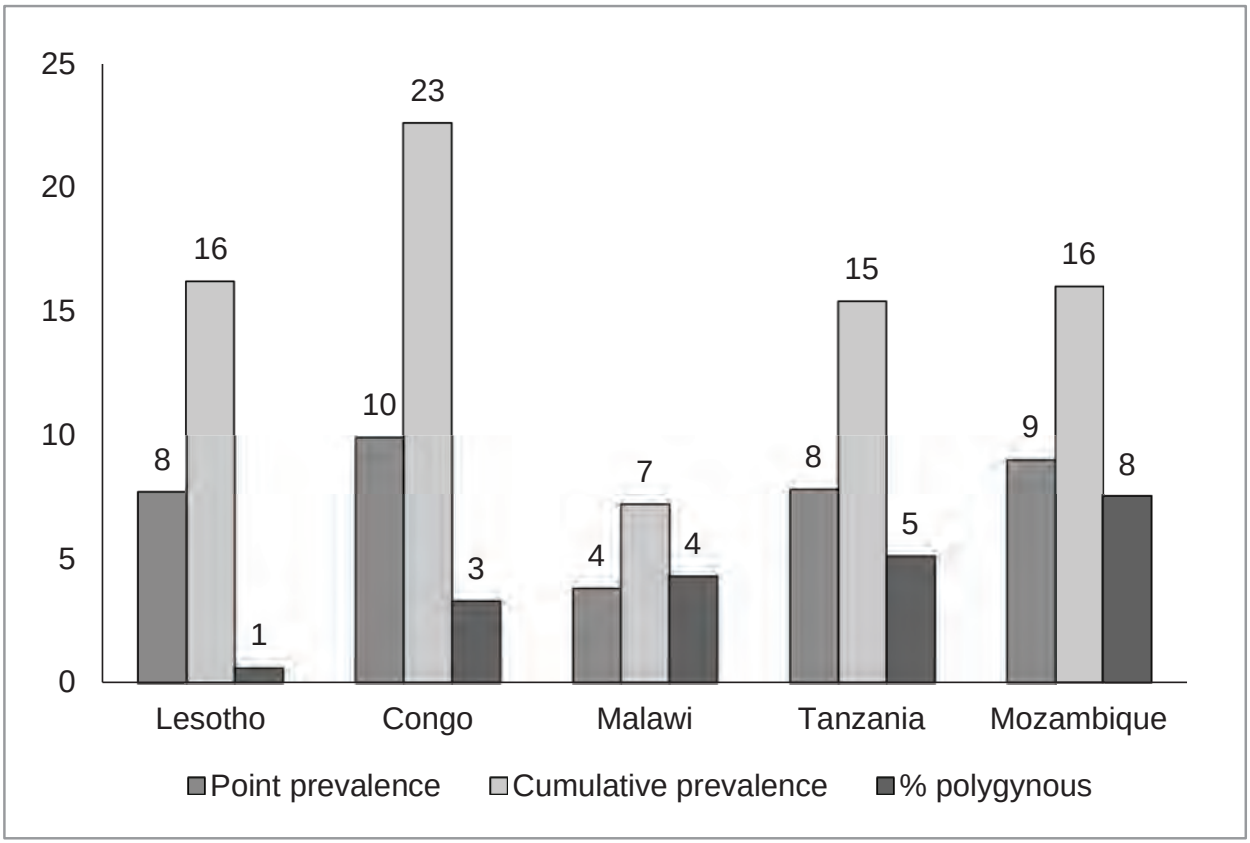
Considering current marital status, in Congo and Mozambique women who are not in union are more likely to have concurrent sexual partners (by either definition), but in Lesotho they are less likely to have concurrent partners, and in Malawi and Tanzania they are roughly equally likely to have concurrent sexual partners compared with women in union.

Given that the definitions of point and cumulative prevalence of concurrency include multiple wives as concurrent partners, it is not surprising that polygynous men are most likely to report concurrent sexual partnerships in the past 12 months. Men with one wife are more likely than men who are not in union to have had concurrent sexual partnerships in the past 12 months but are less likely than polygynous men to have had concurrent sexual partnerships (by either the point or cumulative indicator). It is also interesting to note that the percent of men in polygynous union who report having concurrent sexual partnerships in the past 12 months is low in some countries (64 percent in Malawi and 71 percent in Mozambique, versus 86 percent in Congo, according to the cumulative prevalence indicator).

However, the prevalence of concurrency is not directly associated with the prevalence of polygyny in these five countries, which all have relatively low levels of polygyny. Figure 5 shows the percentage of all men age 15-49 with more than one wife/partner. Malawi, with 4 percent of men currently married to more than one woman, has a cumulative prevalence of concurrent sexual partnerships of 7 percent. In contrast, Congo, with 3 percent of men currently in polygynous union, has a cumulative prevalence of concurrent sexual partnerships of 23 percent. In another set of countries with higher levels of polygyny, a stronger relationship between polygyny and concurrency may be observed.

Table 1 also shows the second UNAIDS-recommended alternate indicator: the proportion of multiple partnerships that are concurrent in the past year. In considering these results, note that relatively small numbers of respondents, especially women, report having multiple partners. Among women and men age 15-49 who had multiple sexual partnerships in the previous year, the proportions that had concurrent partnerships in the previous year is high in all five countries—among women from 46 percent in Malawi to 82 percent in Lesotho, and among men from 74 percent in Lesotho to 81 percent in Mozambique. As might be expected, among women with multiple partners in the past 12 months, in each of the five countries the percentage that had concurrent partners is higher among women in union than those who are not in union. Among men with multiple partners in the past 12 months, the percentage that had concurrent partners is highest among men in polygynous union, followed by men with one wife and then men who are not in union.

Figure 5. Concurrency and polygyny among men age 15-49



4.2 Concurrent sexual partnerships and HIV status in individuals

Table 2 shows HIV prevalence by number of sexual partners in the past 12 months, and whether or not the individual had concurrent partnerships in the past 12 months according to both point prevalence and cumulative prevalence definitions. Concurrency and HIV prevalence are available for only four of the countries because the 2010 Tanzania DHS did not include HIV testing. One limitation to these data is that although the sexual behavior data applies to the past 12 months, there is no information on when HIV+ individuals became infected. Obviously, sexual behavior in the past 12 months cannot have a causal relationship with HIV infection that was acquired more than 12 months ago.

For men in all countries, HIV prevalence increases with the number of sexual partners in the past 12 months. For women, by contrast, there is no consistent pattern across countries. In Lesotho, Malawi and Mozambique, women with multiple partners in the past 12 months have the highest HIV prevalence. In Congo, however, women with no sexual partners in the past 12 months have the highest HIV prevalence. In Congo, Malawi and Mozambique, women with no sexual partners in the past 12 months have higher HIV prevalence than those with one sexual partner during this time.

Table 2. HIV prevalence by sexual behavior

Percentage HIV-positive among women and men age 15-49 who ever had sex and were tested for HIV, by sexual behavior characteristics

Sexual behavior characteristic	Women		Men	
	Percentage HIV-positive	Number	Percentage HIV-positive	Number
CONGO 2009				
Number of sexual partners in last 12 months				
0	5.7	506	1.0	248
1	3.9	5,070	2.1	3,332
2+	4.3	440	2.4	1,613
Missing	*	2	*	3
Concurrent sexual partners at 6 months before the survey[1]				
Multiple, concurrent	2.4	168	3.3	558
Multiple, non-concurrent	5.5	272	1.9	1,055
Concurrent sexual partners anytime in past 12 months[1]				
Multiple, concurrent	3.5	339	2.2	1,283
Multiple, non-concurrent	7.0	101	3.1	331
Total age 15-49	4.1	6,019	2.1	5,196
LESOTHO 2009				
Number of sexual partners in last 12 months				
0	28.4	418	12.6	287
1	29.8	2,514	20.2	1,488
2+	39.4	261	23.8	651
Missing	(49.3)	46	(16.4)	41
Concurrent sexual partners at 6 months before the survey[1]				
Multiple, concurrent	42.5	95	29.9	229
Multiple, non-concurrent	37.6	165	20.4	422
Concurrent sexual partners anytime in past 12 months[1]				
Multiple, concurrent	38.2	215	26.6	480
Multiple, non-concurrent	(45.1)	45	15.8	171
Total age 15-49	30.7	3,239	20.2	2,468
MALAWI 2010				
Number of sexual partners in last 12 months				
0	24.7	831	4.9	783
1	12.7	5,262	9.7	4,137
2+	31.8	64	11.8	614
Missing	*	8	*	7
Concurrent sexual partners at 6 months before the survey[1]				
Multiple, concurrent	*	13	10.9	248
Multiple, non-concurrent	(25.5)	51	12.4	366
Concurrent sexual partners anytime in past 12 months[1]				
Multiple, concurrent	*	26	12.1	482
Multiple, non-concurrent	(26.6)	38	10.5	132
Total age 15-49	14.5	6,166	9.3	5,541
MOZAMBIQUE 2009				
Number of sexual partners in last 12 months				
0	15.6	663	7.9	187
1	12.9	4,175	9.6	2,538
2+	23.1	164	11.1	777
Missing	nc	0	*	2
Concurrent sexual partners at 6 months before the survey[1]				
Multiple, concurrent	(30.4)	41	10.6	351
Multiple, non-concurrent	20.7	123	11.5	426
Concurrent sexual partners anytime in past 12 months[1]				
Multiple, concurrent	21.3	115	10.5	627
Multiple, non-concurrent	27.4	49	13.7	149
Total age 15-49	13.6	5,003	9.8	3,503

Note: Figures in parentheses are based on 25-49 unweighted cases; an asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed. nc = No cases

[1] Restricted to those respondents with 2+ partners in the past 12 months

There is no theoretical basis for an association between an individual's own HIV status and whether or not his or her sexual partnerships are concurrent, and Table 2 shows no consistent pattern between an individual's HIV status and whether his/her multiple partners in the past 12 months were concurrent or sequential. The point and cumulative prevalence indicators do not always have the same direction of association with HIV status—across countries, within a country, or between women and men in the same country.

Out of 16 comparisons of individuals with concurrent partners versus individuals with multiple non-concurrent partners (for point and cumulative prevalence indicators for men and women in four countries), 5 comparisons show higher HIV prevalence among those who had concurrent partners, 9 show higher HIV prevalence among those with multiple partners that were not concurrent, and 2 lack a sufficient number of cases on which to draw a conclusion. Several of these differences are likely to be within sampling error.

4.3 Concurrent sexual partnerships and HIV status in couples

If having concurrent sexual partnerships affects partners' risk of HIV infection, it seems plausible that the data on couples available from DHS and AIS surveys would be useful in analyzing this association. Table 3 presents HIV prevalence according to the two indicators of concurrency, for cohabiting couples for whom an HIV test result was available.

There are several limitations to using couples data for this type of analysis. These limitations include having information on HIV status for only the cohabiting partner rather than all sexual partners, and not knowing whether the concurrency behavior or the HIV infection came first. These limitations are described in greater detail in Section 5 (see "Challenges in interpretation"). They make it difficult to determine what the expected relationship should be between concurrency and HIV status.

Even if there were a clear expected association, the results in Table 3 show that in the four countries the number of cases in which women had concurrent sexual partners (by either definition) is too small to analyze. Thus, the only robust comparison to make is between couples in which neither member had concurrent partnerships and couples in which the man had concurrent partnerships and the woman did not. In both Congo and Lesotho, couples in which the man had concurrent sexual partners and the woman did not are less likely to have both partners be HIV-negative and more likely to have both partners be HIV-positive compared with couples in which neither partner had concurrent sexual partnerships. In Malawi and Mozambique, couples' HIV status does not differ much by whether or not the members in the couple had concurrent partners.

Table 3. HIV prevalence among couples

Percent distribution of couples living in the same household, both of whom were tested for HIV, by the HIV status, according to concurrent sexual partnership

Concurrency	Both HIV-positive	Man HIV-positive, woman HIV-negative	Woman HIV-positive, man HIV-negative	Both HIV-negative	Total	Number
CONGO 2009						
Concurrent sexual partners at 6 months before the survey						
Both no	0.8	1.8	2.3	95.1	100.0	1,885
Man yes, woman no	2.0	1.4	5.7	90.9	100.0	361
Woman yes, man no	*	*	*	*	100.0	23
Both yes	*	*	*	*	100.0	6
Concurrent sexual partner in past 12 months						
Both no	0.9	1.8	2.3	94.9	100.0	1,534
Man yes, woman no	1.2	1.4	4.0	93.3	100.0	695
Woman yes, man no	(3.8)	(8.6)	(4.9)	(82.7)	100.0	22
Both yes	*	*	*	*	100.0	24
Total	1.0	1.8	2.9	94.3	100.0	2,275
LESOTHO 2009						
Concurrent sexual partners at 6 months before the survey						
Both no	18.5	8.9	7.3	65.3	100.0	729
Man yes, woman no	22.2	13.0	8.4	56.4	100.0	90
Woman yes, man no	*	*	*	*	100.0	16
Both yes	*	*	*	*	100.0	8
Concurrent sexual partner in past 12 months						
Both no	18.1	8.8	7.0	66.0	100.0	642
Man yes, woman no	21.6	11.0	9.6	57.9	100.0	148
Woman yes, man no	(18.6)	(12.2)	(13.1)	(56.1)	100.0	38
Both yes	*	*	*	*	100.0	15
Total	18.9	9.5	7.6	64.0	100.0	843
MALAWI 2010						
Concurrent sexual partners at 6 months before the survey						
Both no	6.4	4.6	3.6	85.4	100.0	3,208
Man yes, woman no	5.2	5.5	4.8	84.5	100.0	245
Woman yes, man no	*	*	*	*	100.0	4
Both yes	*	*	*	*	100.0	4
Concurrent sexual partner in past 12 months						
Both no	6.3	4.4	3.7	85.6	100.0	3,060
Man yes, woman no	6.1	7.0	3.7	83.2	100.0	387
Woman yes, man no	*	*	*	*	100.0	10
Both yes	*	*	*	*	100.0	4
Total	6.3	4.7	3.8	85.3	100.0	3,462
MOZAMBIQUE 2009						
Concurrent sexual partners at 6 months before the survey						
Both no	4.9	5.1	5.2	84.7	100.0	2,267
Man yes, woman no	4.5	4.7	4.5	86.4	100.0	374
Woman yes, man no	*	*	*	*	100.0	4
Both yes	*	*	*	*	100.0	3
Concurrent sexual partner in past 12 months						
Both no	4.6	5.0	5.1	85.3	100.0	2,057
Man yes, woman no	5.7	4.9	4.9	84.5	100.0	559
Woman yes, man no	(10.3)	(17.2)	(10.5)	(62.0)	100.0	21
Both yes	*	*	*	*	100.0	11
Total	4.9	5.1	5.2	84.9	100.0	2,648

Note: Table based on couples for which a valid HIV test result (positive or negative) is available for both partners. Figures in parentheses are based on 25-49 unweighted cases; an asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed.

5. Challenges in Collecting, Tabulating, and Interpreting Indicators on Concurrent Sexual Partnerships

5.1 Challenges in collection

There are several challenges in collecting the data needed to tabulate point and cumulative prevalence indicators. As mentioned, the data come from six questions about time since the respondent first and last had sexual intercourse with their sexual partners. Accurate classification of an individual's concurrency status requires information for all of the partners to be internally consistent and externally valid. It is very difficult to assess the external validity of respondents' answers. It is also a challenge to get internally consistent responses on up to six questions asking for information that is both sensitive to report and difficult to remember.

Specific sources of bias or error include:

- **Normative response bias:** In many societies, having sexual partners before or outside of marriage is not an acceptable behavior, especially for women. Paid sex is also stigmatized. Respondents may choose not to report 'socially undesirable' sexual partners, which would lead to an underestimation of multiple partnerships and consequently of concurrency.

- **Recall error:** It may be difficult for respondents to accurately recall when they first had sex and last had sex with all of their sexual partners, especially for respondents with many partners. Interviewers are trained in how to probe respondents who say that they cannot remember. Nonetheless, some respondents will be unable (or in some cases unwilling) to report the needed information. In thinking about the care that is needed to obtain optimal information on the questions used to calculate concurrency, it is also important to keep in mind that these questions come from only one page of a very long and complex individual questionnaire.

5.2 Challenges in tabulation

Challenges in collecting data for the questions used to measure concurrency introduce two key issues in the process of tabulating the indicators: (1) the possibility of partners being recorded out of order; and (2) missing data. Problems in remembering time since first/last sex or preferential reporting of the spouse in the first column, even when he/she is not the last sexual partner, can result in partners being recorded out of order on the questionnaire. If the interviewer does not correct this error at the time of the interview, correct calculation of the cumulative prevalence indicator requires either that the partners be reversed during the data cleaning stage or that the logic used to tabulate the indicator accommodate the possibility that partners may be recorded out of order. Conditions 2 and 3 shown in Figure 3 are included in the logic for cumulative prevalence of concurrency specifically to check for overlap in partners that are recorded out of order. However all conditions include an additional layer of complexity (two logic statements instead of one) to allow for correct classification of partnerships regardless of the order in which they are recorded in the questionnaire.

The possibility of having missing data on any of the six questions also affects the logic that must be used to tabulate the cumulative prevalence indicator. Additional conditions must be included in order to catch all cases that can be identified as concurrent even when some of the questions have missing responses. There is redundancy in Conditions 1-4 (shown in Figure 4) in that the same pair of overlapping partners will satisfy two of the conditions when all four data points are present (that is, a, b, c, and d). The redundancy is required because each condition (except condition 5) is designed to work even if a specific data point is missing:

- Condition 1 still works when data point 'a' is missing and the partners are in order

- Condition 2 still works when data point 'b' is missing and the partners are out of order

- Condition 3 still works when data point 'c' is missing and the partners are out of order

- Condition 4 still works when data point ‘d’ is missing and the partners are in order

- Conditions 6 and 7 capture overlapping sexual partnerships in special cases when data points ‘a’ and ‘c’ are missing, respectively

5.3 Challenges in interpretation

There are several challenges in interpreting the concurrency data collected in DHS and AIS surveys. First, missing data and imprecise recording of timing of events (i.e., in completed units) prevent accurate classification of the concurrency status of some respondents. Second, low reported prevalence of concurrency, especially among women, limits the possibility of analyzing characteristics of respondents with concurrent partners. Third, the research design of cross-sectional population-based surveys such as the DHS and AIS is not appropriate to addressing many of the most salient questions regarding concurrency and the spread of HIV.

Missing data and imprecise recording of timing. In many cases, missing data makes it impossible to classify two sexual partners as overlapping or not. For point prevalence of concurrency, missing data on first or last sex for a given partner sometimes makes it impossible to determine whether or not that partnership straddles the six-month cutoff. Such a partnership is treated as if it does not straddle the six-month cutoff. Thus, in some cases the missing data could result in an underestimation of concurrent partnerships.

Missing data can also result in underestimation of the cumulative prevalence of concurrency. When time since last sex with the prior partner or time since first sex with the later partner is missing, it is impossible to determine whether or not the partners overlapped.

Moreover, in cases where one partnership ended during the same day/week/month that another started, whether the earlier partnership ended before or after the later partnership started is ambiguous. As recommended by the UNAIDS Reference Group, such partnerships are classified as not concurrent; however, this assumption results in some underestimation of concurrency. This challenge is not easy to address: more precise accounting of time is not necessarily more accurate, and a directed question such as “Did you first have sex with [later partner] before or after you last had sex with [earlier partner]” is difficult for the respondent to understand and may be prone to normative response bias.

Table 4 shows respondents for whom it cannot be determined whether or not they had concurrent sexual partnerships (according to the cumulative prevalence indicator) as a percentage of all respondents, and as a percentage of respondents who had multiple partnerships in the past 12 months. It appears that missing data and imprecision in the start and stop dates of partnerships do not have a large impact on the overall estimates of point and cumulative prevalence of concurrency. In each of the five countries, the number of cases with missing data or in which two partnerships end and begin during the same unit of time is low. Such cases account for well under 1 percent of women in each of the five countries, less than 1 percent of men in Tanzania, Lesotho and Malawi, and less than 2 percent of men in Congo and Mozambique.

Although the impact of missing data on the point prevalence indicator has not been assessed, we anticipate these issues in tabulation would have a similar impact on point prevalence of concurrency as on cumulative prevalence.

In sum, respondents with undetermined concurrency status do not appear to have a strong impact on the point and cumulative prevalence indicators. For these indicators, the denominator includes all women and men interviewed. However, respondents with undetermined concurrency status have a more notable impact on the third concurrency indicator: proportion of multiple partnerships that are concurrent in the past year. The denominator in this indicator is restricted to individuals who had multiple partners in the past 12 months. In each of the five countries, concurrency status was uncertain for less than 7 percent of women and men with multiple partners, with the exception of women in Malawi. In Malawi, there are 18 women whose concurrency status (cumulative prevalence) could not be determined. As shown in Table 4, these 18 women make up only 0.1 percent of all women but make up 14 percent of women with multiple partners, because the percentage of women with multiple partners in Malawi is low.

Table 4. Completeness of data

Among all women and men, the percentage for whom concurrency status could not be determined from the available data; and among women and men with multiple partners in the past 12 months, the percentage for whom concurrency status could not be determined from the available data (unweighted)

	Women				Men			
	Among all women		Among women with 2+ partners in the past 12 months		Among all men		Among men with 2+ partners in the past 12 months	
Country	% with concurrency status unknown	Number of women	% with concurrency status unknown	Number of women	% with concurrency status unknown	Number of men	% with concurrency status unknown	Number of men
Congo	0.3	6,550	5.7	388	1.5	5,863	5.1	1,763
Lesotho	0.2	7,624	3.2	496	0.7	3,317	3.4	707
Malawi	0.1	23,020	13.5	133	0.5	7,175	5.6	692
Mozambique	0.1	6,413	4.9	183	1.4	4,799	6.8	971
Tanzania	0.2	10,139	6.9	291	0.8	2,527	4.4	474

Notes: Concurrency status is unknown for the cumulative prevalence indicator. Data for women for age 15-49 in Congo, Lesotho, Malawi and Tanzania, and age 15-64 in Mozambique. Data for men are for age 15-49 in Congo and Tanzania, age 15-54 in Malawi, age 15-59 in Lesotho and age 15-64 in Mozambique. In this table, respondents with concurrency status unknown include those with one partnership beginning at the same time that another ends and those for whom missing data made it impossible to determine whether or not any of the respondents' partners were concurrent.

Low reported prevalence. Low prevalence of reported concurrency is another factor that can impede analysis to identify factors associated with concurrency or to test for an association between HIV prevalence and concurrency. In Malawi, Mozambique and Tanzania, point prevalence is at or below 1 percent of the general population of women age 15-49. In Malawi, with a sample of over 20,000 women, there are only around 20 women classified as having concurrent sexual partnerships according to the point prevalence indicator. In Mozambique, with a sample of over 5,000 women, fewer than 50 women have concurrent partners according to the point prevalence indicator, and in Tanzania, with a sample of over 10,000 women, only around 100 women have concurrent sexual partners according to the point prevalence indicator. As Table 3 shows, low reported prevalence of concurrency among women and relatively low HIV prevalence in some countries results in low numbers of cases in much of the table.

Research design. The final challenge to data interpretation is related to a mismatch between the research design employed in DHS and AIS surveys and the kind of research design that is best suited for answering questions about the association between concurrency and HIV transmission. This mismatch introduces limitations particularly in interpreting couples data.

First, in testing the theoretical association between concurrency status of one member of a couple and the HIV status of the other member in the couple, it is important to know the order in which an individual and his or her partners became infected with HIV, but this information is not available from cross-sectional surveys. Consider for a moment John and Jane, a married couple. John began a concurrent partnership with Carol after he married Jane. At the time of the survey, all three are HIV-positive. Whether or not Jane's HIV status has anything to do with John's concurrent sexual partnership depends on which of John's two partners was the source of his HIV infection. If Carol was infected first, and she transmitted the virus to John who then transmitted the infection to Jane, then John's concurrent sexual partnership caused Jane's infection. However, if Jane was infected first (i.e., before John), then Jane's HIV status is unrelated to whether or not John had any concurrent sexual partnerships. In the data files, it is impossible to distinguish between those couples in which a concurrent sexual partnership introduced a 'backward path' for infection (i.e. from Carol to Jane) and thus posed additional risk for HIV transmission, and those couples in which a concurrent sexual partnership did not introduce a backward path. This limitation dilutes the association at the aggregate level between an individual's practice of concurrency and his or her principle partner's HIV status. It also presents a serious challenge for any research using couples as the unit of analysis.

Second, DHS and AIS surveys cannot link sexual partners who live in separate households. In terms of the example above, the data can only link John with Jane. If Carol lives in a separate household, then she is most likely not in the

survey sample, but even if her household is included in the sample it is still impossible to link her with John. In order to make a meaningful association between concurrency and partners' status, it is necessary to have the status of all of the partners. Assume that John ends his sexual partnership with Jane before beginning his sexual partnership with Carol. If Jane is the partner who infects John, then Carol is at increased risk of acquiring HIV. But if John acquires HIV from Carol, then Jane is at no increased risk of infection. On the other hand, if John has concurrent sexual partnerships with Jane and Carol, then Carol is still at risk if John is infected by Jane, just as she would be in the case of sequential relationships, but now Jane would be at risk of acquiring HIV if John is infected by Carol. For HIV-positive individuals, fewer of their sexual partners on average will be HIV-positive if none of their partnerships are concurrent than if any of their partnerships are concurrent, but it is necessary to have the HIV-status of all of the partners in order to see this association.

6. Conclusions

The indicators on point and cumulative prevalence of concurrent sexual partnerships were designed by the Working Group on Measuring Concurrent Sexual Partnerships, an ad hoc working group of the UNAIDS Reference Group on Estimates, Modeling and Projections. From the experience to date of the MEASURE DHS project with these indicators, we can conclude the following:

1. Although the DHS and AIS questionnaires could be fairly easily modified to ask for the information needed to measure the recommended concurrency indicators, there are challenges to collect accurate data.

The standard questionnaires required little adjustment to be able to provide the data needed to measure the three recommended indicators. Exactly the same questions are required to measure both point and cumulative prevalence indicators. However, there are challenges to collecting complete and correct data. Recall error, normative response bias, and the general sensitivity of asking about these kinds of sexual behaviors all impact data quality. Due to the nature of the data collection challenges, adding additional or more detailed questions is unlikely to greatly improve data quality.

2. It is possible but challenging to calculate the three recommended indicators from the data collected in DHS and AIS surveys.

Both point and cumulative prevalence of concurrency require complex calculations and a number of assumptions to be made. As illustrated in Section 3, the logic required to calculate the point prevalence indicator of concurrent sexual partnerships is somewhat simpler than the logic required to calculate the cumulative prevalence indicator. The data quality issues mentioned in conclusion 1 above, in addition to others detailed in Section 3, markedly complicate the process of calculating both indicators.

3. DHS findings to date do not support recommending any one indicator over the others.

The three indicators measure different aspects of concurrent sexual partnerships and have different interpretations. Point prevalence emphasizes long-term overlapping sexual partnerships, cumulative prevalence measures the total magnitude of overlapping sexual partnerships, and the final indicator provides information on the proportion of multiple partnerships that are concurrent. The UNAIDS Reference Group concluded that it is important to know all three of these things. The Reference Group made the point prevalence indicator the primary indicator because concurrency theory suggests that this may be the indicator most closely linked to HIV transmission; however, the empirical data remain inconclusive. In addition, point prevalence of concurrent sexual partners is always lower than cumulative prevalence, and there are often too few cases to allow further analysis.

4. Data on both point prevalence and cumulative prevalence of concurrency are of limited analytical value in cross-sectional population-based surveys such as the DHS and AIS.

Although data collected in DHS and AIS surveys can be used to calculate levels of concurrency, there are numerous limitations to how much the surveys can contribute to the body of evidence on the theorized association between concurrency and transmission of HIV. At the national level, DHS and AIS surveys can measure the association between prevalence of concurrent sexual partnerships and prevalence of HIV, but knowing the extent of this association is not very meaningful, as a stronger association is expected between HIV incidence and concurrency. At the level of respondents and their sexual partners, DHS and AIS surveys cannot be used to map sexual networks, and the DHS and AIS surveys do not have information on the HIV status or timing of infection of all of the respondent's sexual partners. Moreover, the small numbers of women reporting concurrent sexual partnerships prevent drawing robust conclusions about concurrency and HIV in couples.

References

Centre National de la Statistique et des Études Économiques (CNSEE) et ICF Macro. 2009. *Enquête de Séroprévalence et sur les Indicateurs du Sida – Congo 2009.* Calverton, Maryland, USA : CNSEE et ICF Macro.

Ghys, P., for the UNAIDS Reference Group on Estimates, Modeling and Projections: Working Group on Measuring Concurrent Sexual Partnerships. 2009. Recommended Definition, Measures, and Research on Concurrent Sexual Partnerships and HIV Transmission. A presentation given at the UNAIDS Monitoring and Evaluation Reference Group Meeting: Prague, 17-19 November, 2009.

Gray, R.H., M.J. Wawer, R. Brookmeyer, N.K. Sewankambo, D. Serwadda, F. Wabwire-Mangen, T. Lutalo, X. Li, T. vanCott, T.C. Quinn, and the Rakai Project Team. 2001. Probability of HVI-1 transmission per coital act in monogamous, heterosexual, HIV-1-discordant couples in Rakai, Uganda. *The Lancet* 357: 1149-1153.

Hira, S.K., P.J. Feldblum, J. Kamanga, G. Mukelabai, S.S. Weir, and J.C. Weir. 1997. Condom and Nonoxynol-9 use and the incidence of HIV infection in serodiscordant couples in Zambia. *International Journal of STD and AIDS* 8: 243-250.

Instituto Nacional de Saúde (INS), Instituto Nacional de Estatística (INE), e ICF Macro. 2010. *Inquérito Nacional de Prevalência, Riscos Comportamentais e Informação sobre o HIV e SIDA em Moçambique 2009*. Calverton, Maryland, EUA: INS, INE e ICF Macro.

Ministry of Health and Social Welfare and ICF Macro. 2010. *Lesotho Demographic and Health Survey 2009*. Calverton, Maryland, USA: MOHSW and ICF Macro.

Morris, M. and M. Kretzschmar. Concurrent partnerships and the spread of HIV. 1997. *AIDS* 11: 641-48.

National Bureau of Statistics (NBS) and ICF Macro. 2011. *Tanzania Demographic and Health Survey. 2010.* Dar es Salaam, Tanzania: NBS and ICF Macro.

National Statistical Office (NSO) and ICF Macro. 2011. *Malawi Demographic and Health Survey 2010.* Zomba, Malawi, and Calverton, Maryland, USA: NSO and ICF Macro.

UNAIDS. 2009. Consultation on concurrent sexual partnerships: recommendations from a meeting of the UNAIDS Reference Group on Estimates, Modeling and Projections: Nairobi, Kenya, April 20–21, 2009.

UNAIDS Reference Group on Estimates, Modeling and Projections: Working Group on Measuring Concurrent Sexual Partnerships. 2010. HIV: Consensus indicators are needed for concurrency. *The Lancet* 375:621-22.

Wawer, M.J., R.H. Gray, N.K. Sewankambo, D. Serwadda, X. Li, F. Nalugoda, F. Wabwire-Mangen, M.P. Meehan, and T.C. Quinn. 2005. Rates of HIV-1 transmission per coital act, by stage of HIV-1 infection in Rakai, Uganda. *Journal of Infectious Diseases* 191: 1403-1409.

DHS Methodological Reports Series

1. Institute for Resource Development. 1998. **An Assessment of DHS-I Data Quality.**

2. Macro International Inc. 1993. **An Assessment of the Quality of Health Data in DHS-I Surveys.**

3. Aliaga, Alfredo and Pradip K. Muhuri. 1994. **Methods of Estimating Contraceptive Prevalence Rates for Small Areas: Applications in the Dominican Republic and Kenya.**

4. Landers, Alynne and Melissa McNiff. 1994. **Comparability of Questionnaires.**

5. Pullum, Thomas W. 2006. **An Assessment of Age and Date Reporting in the DHS Surveys, 1985-2003.**

6. Pullum, Thomas W. 2008. **An Assessment of the Quality of Data on Health and Nutrition in the DHS Surveys, 1993-2003.**

7. Fishel, Joy D., Ladys Ortiz and Bernard Barrère. 2012. **Measuring Concurrent Sexual Partnerships: Experience of the MEASURE DHS Project to Date.**