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COITUS, THE PROXIMATE DETERMINANT OF CONCEPTION: INTER-COUNTRY VARIANCE IN SUB-SAHARAN AFRICA

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Summary. There is a general consensus in the literature that fertility differences between populations can be accounted for by differences in just four key proximate determinants: nuptiality, the postpartum non-susceptible period, contraception and abortion. Natural fecundibility is generally assumed to be constant between populations. This paper puts the theoretical and empirical case for a re-evaluation of that assumption, drawing on the under-utilized data on sexual activity collected in the Demographic Health Surveys (DHSs). Using data for married women in nine African countries, the analysis finds substantial population level differences in mean monthly coital frequency, which, if accurate, suggest an important demographic effect. There is a clear regional patterning to these differences, with levels of activity considerably lower among women in the West African populations included in the study than those from East and southern Africa. For West Africa in particular the data indicate the normality of exceptionally long periods of very infrequent or no intercourse by married women outside the period of postpartum abstinence. The findings challenge prevailing presumptions concerning susceptibility to pregnancy in marriage on which statistics for unmet need for family planning are derived. While doubts are raised over the precision of the sexual activity data used, the paper argues for the need for a greater effort to operationalize the 'proximate determinant of conception', not only for more accurate fertility modelling, but also as a planning tool for a more sensitive provision of family planning services in Africa.

Introduction

'. . . from the behavioural perspective, coitus is the proximate cause of conception, the difference between some coitus and no coitus is the difference between some probability of conception and none.' (Udry, 1993, p. 85.)

While the nature and diversity of sexual behaviour has long been a prominent theme in anthropological work on sub-Saharan societies (see, for example, Molnos, 1972/3), it arguably remains a neglected concern among demographers seeking to explain and model the diversity of fertility experience across the sub-region.

This may partly reflect the methodological difficulties of collecting and incorporating data on sexual activity directly into fertility analysis, but also the assumption that any variance in rates of coital activity are probably insufficient to affect significantly differences in either period or cohort levels of fertility. Bongaarts (1978) argues that the great majority of difference in Total Fertility Rates (TFRs) can be explained empirically through just four variables: the proportion married, the duration of postpartum non-susceptibility, the use of contraception and the use of induced abortion. Crucially, the first two factors determine the extent to which women are in unions and susceptible to *any* sexual activity, and the second two the prospects of sex leading to a birth. The characteristics and diversity of sexual behaviour itself (such as in its timing and frequency) within those periods is rarely considered. Rather it is the practice (or non-practice) of family planning behaviour (including abortion) that generally occupies the interest of population analysts and policy makers.

In this context, efforts to incorporate coitus into the conceptualization and measurement of 'exposure' status have rarely gone beyond the absolutism of Udry's statement (cited above), with most methodologies typically employing dichotomous variables to determine (usually by proxy and by default rather than by direct information) whether women are exposed or not exposed to 'any' intercourse. Rarely does sexual activity receive more specific concern in the current policy-driven research climate. In the wake of the HIV/AIDS epidemic there has been a considerable research effort into patterns of sexual networking and sexual behaviours in sub-Saharan Africa (for example, the Research Programme on Aids in Uganda by the Medical Research Council, Pickering, 1994). However, the application of this research has so far remained focused within the public health field. There is currently little indication of any heightened interest in the importance of differences in sexual behaviour by fertility analysts (except perhaps, indirectly, concerning the ways AIDS mortality, and the fear of AIDS, may be impacting on the fertility process; for example Gregson, 1994). Using the under-utilized statistics on sexual behaviour collected in the Demographic Health Surveys (DHSs), this paper investigates the nature and variance of exposure to sexual intercourse in the sub-Saharan region.

Sexual activity and fertility: a review of the theory

The impact of variance in the level of sexual activity on fertility is best conceptualized in terms of its effect of raising or lowering a woman's fecundability, generally defined as the monthly probability of a recognizable conception. Elaborating on Udry's observations cited earlier, the determinants of a 'successful' conception are, in the absence of contraception, as follows (Bongaarts & Potter, 1983):

(i) ovulation in a 28-day cycle;
(ii) insemination during the fertile period (mid-cycle);
(iii) a successful fertilization resulting from (ii);
(iv) a recognizable conception resulting from (iii).

Using Bongaarts and Potter's notation, if the probability of these four events occurring is $p1$, $p2$, $p3$ and $p4$, fecundability (f) is calculated as:

$$f = p1 \times p2 \times p3 \times p4$$

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With the direct measurement of individual fecundability being extremely difficult, efforts to quantify it have rested on mathematical modelling of the key components identified in Bongaarts and Potter's equation.

Modelling fecundability

The classic convexity of the age-specific fertility schedule in 'natural' fertility regimes has long pointed to a strong and consistent association between age of woman and fecundability, which rises sharply from menarche to peak in the early twenties, declining thereafter until menopause (Henry, 1961; Hobcraft, 1987). In addition to this overall age effect it is apparent that fecundability remains variable between women in the same population (Weinstein *et al*., 1990). However, the extent to which these observations reflect differences in the level of sexual activity ($p2$) or physiological factors ($p1$, $p3$ and $p4$) is unclear. Empirical studies have consistently found both to be age dependent.

Whether measured by actual age (male of female) or years spent in union, levels of sexual activity are observed to decline over time (Udry, Deven & Coleman, 1982). Establishing the precise association between age and the physiological components of fecundability has been more difficult. However, it is fairly clear that the prospect of an ovulatory cycle ($p1$) is strongly age dependent. As well as the obvious age effect on the probability that a women will be post-menarche and pre-menopausal, women in the first years post-menarche and at later ages running up to the onset of menopause are more likely to experience longer and more variable ovarian cycles than at other ages, and also cycles that are non-ovulatory (Lenten *et al*., 1984). The value of $p1$ may additionally be affected by an individual's nutritional status (chronic under-nourishment may induce temporary periods of amenorrhoea: see Watkins & Menken (1985) on sub-fecundity among famine victims) and by psychological factors (periods of stress may induce anovulatory cycles). Assuming no use of contraception, $p3$ appears close to 1, although variation in the quality and quantity of sperm, the viability of ova and chance factors introduce some variance. The value of $p4$ appears to be around 0·5 for most populations, but at the individual level the prospect of early embryonic loss is found to be strongly age dependent, increasing fairly consistently after age 25 (Weinstein, Wood & Ming-Cheng, 1994).

Despite their obvious importance, modelling of fecundability has generally failed to incorporate age-related changes in sexual behaviour and female physiology. Addressing this shortcoming, Weinstein *et al*. (1990, 1994) model the decline in fecundability with age under two separate conditions. In the first, they allow female physiology to vary with age while assuming 'constant exposure' to intercourse (set at the expected value for a wife aged 25); in the latter case, the rate of coitus is allowed to vary while female physiology is held constant at the level expected in a wife aged 25. Based on the models, the authors conclude that declining fecundability after age 25 is largely a function of physiological changes rather than declining coital frequency, and especially so after age 35. Initially this is due almost entirely to the increasing prospects of embryonic loss with age, though after age 40 the irregularity of cycles and increased likelihood of anovulatory cycles becomes important.

One aspect of sexual behaviour that may be a factor in the decline of fecundability by age, and also help explain the apparent extent of variation in fecundability between

women of the same age, is couple-to-couple variation in coital frequency. The typical assumption of 'constant exposure' masks this, yet an increase in the variance of coitus (especially in the proportion of women actually abstaining from sex) will logically increase heterogeneity in fecundability (as measured by longer mean waiting times to conception). Weinstein *et al.* (1994) consider this by modelling the effect on waiting times of three contrasting levels of couple-to-couple variation in coital rates (constant exposure; a Poisson variation introducing random variation; and systematic heterogeneity, based on an empirical distribution). While increasing variability did increase model estimates of waiting times, the effect was well short of the heterogeneity observed in real populations, leading the authors to again conclude that heterogeneity in fecundability is due primarily to individual level differences in the physiological determinants (probably in the form of cycle irregularity and differential levels of intra-uterine mortality).

However, it should be stressed that the conclusion that variable rates of coital activity are relatively unimportant in explaining variability in fecundability relates to patterns *within* populations. As the authors themselves comment, differences in coital rates recorded between populations 'may have a substantial demographic impact' (Weinstein *et al.*, 1990, p. 226). Indeed, despite their variability at the individual level, given that determinants $p1$, $p3$ and $p4$ are biologically determined, it may be concluded that differences at the population level are likely to be minimal and that the great majority of inter-population variance in fecundability is likely to be delivered through differences in patterns of coital activity, on which the paper now focuses.

Throughout this paper there is an implicit assumption that, in relation to fecundability, all relevant variance in sexual behaviour is captured by measurement of coital frequency. This is a requirement of the data and not a rejection of the potential for other aspects of coitus, notably its timing (with a 'fertile period' approximately only 2 days in each monthly cycle, the timing of coitus is clearly crucial to the probability of conception), to be influential in the reproductive experience. While such factors are generally overlooked in the demographic literature, Parkes (1976), writing from a biological perspective, considers ways in which the form of sex might affect the probability of conception. While his concern is with the more obscure medical and behavioural controversies (such as the impact of seasonal temperature fluctuation on sexual behaviour and the impact of female orgasm on the probability of conception), it is reasonable to suppose that more substantial differences in the practice of sex, perhaps including forms of withdrawal or non-penetration, may be important demographic determinants at the individual and even the population level. On this point there is a clear opportunity for greater input to demographic analysis from anthropological literature, which contains considerable information on the social and cultural norms of sexual behaviour (e.g. Molnos, 1972/3). Despite their reservations, by assuming coitus follows a random pattern it is possible to establish a fairly strong statistical relationship between coital frequency and conception probabilities.

Figure 1 illustrates one such sequence, based on an equation by Bongaarts and Potter. While this is a simulated model, it appears to correlate quite well with observed values from a range of empirical studies (Bongaarts & Potter, 1983). One feature is particularly striking. While increasing mean coital frequency typically raises fecundability, the relationship is not linear. Variance at low frequencies (less than 10 per cycle) generally appears more important than at high frequencies (Udry, 1993), a

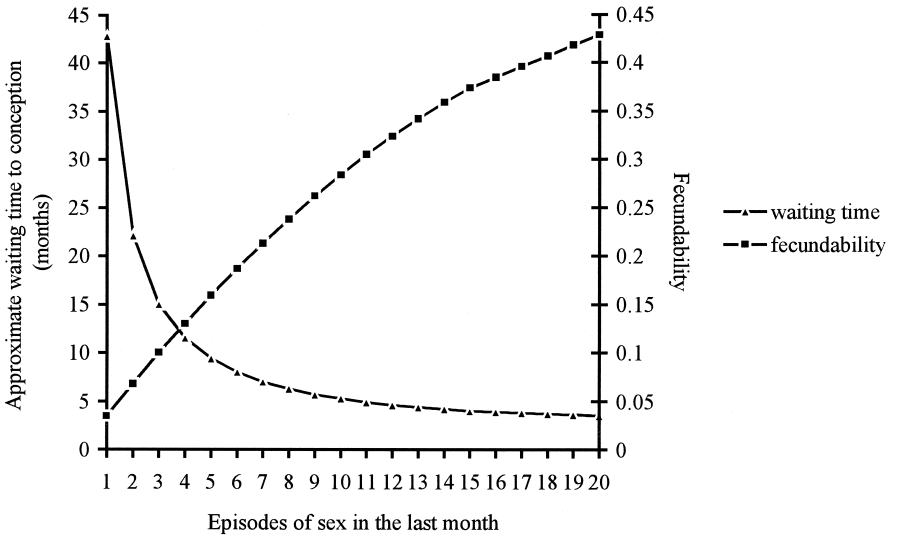

Fig. 1. Fecundability and waiting time to conception for different levels of coital frequency (model estimates after Bongaarts & Potter). Source: Table 2.3, Bongaarts & Potter (1983, p. 34).

finding emphasized in Potter & Millman's (1985) review of existing models. In Bongaarts and Potter's model, moving from a mean of one coital act a month to two doubles fecundability and reduces the expected waiting time to conception from just over three and a half years to less than two.

The impact of variation in coital frequencies on fecundability is thus determined not only by the degree of variance but the frequencies over which it occurs.

Issues of data

The analysis uses data from nine of the African Demographic Health Surveys (DHSs) conducted between 1989 and 1994, selected to provide an inter-regional as well as inter-country comparative base (three from West, East and southern Africa). The data on sexual activity used in this analysis are based on two key recall questions in the woman's individual questionnaire: one on the recent frequency of sex (episodes of sex in the last 4 weeks) and one asking the duration of time since the last episode of sex. Doubts over the quality of DHS data on sexual activity have recently been expressed by Thomas & Mercer (1995). Using data from the 1988 Zimbabwe DHS they calculate a total fecundity rate of 11·3 children, well below the lower range estimated by Bongaarts (1978). Using coital frequency data for other sub-Saharan DHSs (Ghana, Uganda and Kenya) they estimate the discrepancy would be even greater. 'Equally puzzling' (p. 187), they note that the coital frequency data show a uniformity by age which is incompatible with the standard age-specific natural marital fertility rate (ASNMFR) schedules calculated by Coale & Trussell (1974). On this basis they reject the data as 'extremely unreliable'. This view may be supported by more widespread concerns over the accuracy of recall data in macro surveys, particularly in sub-Saharan

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Table 1. Mean reported number of days since last episode of sex by reported coital frequency

Coital frequency[a]	Mean number of days since last episode of sex								
	BK	NG	GH	KE	UG	RW	ZW	ZM	NM
1	12·6	14·1	11·6	11·3	10·1	9·7	10·3	11·6	9·7
2	10·4	9·5	8·7	7·7	7·5	6·4	8·2	8·0	7·0
3	8·5	7·9	7·1	6·0	5·5	4·3	7·2	6·2	5·5
4	7·7	6·4	6·4	5·0	4·7	3·7	5·9	5·4	5·6
5	6·7	5·5	5·0	4·0	4·6	3·1	5·1	4·5	5·5
6	6·9	5·2	5·3	3·9	3·6	2·9	4·4	4·8	3·6
7	4·3	6·4	5·3	4·4	4·1	2·8	5·1	4·2	3·2
8+	6·1	4·4	4·5	2·7	2·6	1·8	2·6	3·1	2·6

[a]Episodes of sex in the last 4 weeks.
BK = Burkina Faso; NG = Nigeria; GH = Ghana; KE = Kenya; UG = Uganda; RW = Rwanda; ZW = Zimbabwe; ZM = Zambia; NM = Namibia.

Africa (Arnold, 1991; Caldwell, 1985). Such concerns may be especially valid for sexual activity where, compounding the obvious difficulties of direct recall (Udry, 1993), strong psychological and social pressures may result in answers that reflect perceptions of what is normative rather than actual behaviour.

However, while the extent of such distortions is difficult to estimate, conventional checks for data quality are fairly encouraging. First, despite much emphasis in the literature on the difficulties of gaining participation on sexual matters, particularly in a DHS-type survey (Caldwell, 1985), response rates for the relevant questions are very high in all the study countries (exceeding 99% in all cases). Although high levels of participation are of course no measure of the quality of response, it does ensure that the analysis is not biased by selective sampling. Second, frequency distributions for responses to the question on coital frequency show relatively little of the heaping observed in other studies, where it is widely assumed that respondents simply recall episodes for the last week and then multiply by the number of weeks in the recall period (Hobcraft, 1987; Blanc & Rutenburg, 1991). Only Burundi shows real evidence of this pattern among the African data sets (not used in this analysis). The question on recency reveals considerably more heaping, though this relates to the fact that the choice of unit of measurement was left to the respondent, and with many answering in weeks there is notable peaking on 7 day multiples (when the data are all converted into days).

A final check on the internal consistency of respondents' answers was made by observing the association between reported coital frequency and coital recency (Knodel & Chayovan, 1991). On the assumption that the higher the coital frequency the more recent the last episode of sex should be, any deviation in the negative relationship between the two would be an indication of inconsistent answering on one or both questions. This was tested for all nine countries, and a strong and broadly consistent negative association between coital frequency and mean number of days since last episode of sex was found in all cases (Table 1). However, use of means does hide the

extent of variance and there are a number of individual cases where the answers to the two questions appear inconsistent (this is particularly notable in the Zambia data set).

While the high response rate, limited evidence of heaping and generally good internal consistency in the data are encouraging, it is important to stress that these data sets are based on a very small window of observation. On the reasonable assumption that sexual activity is rarely consistent over a woman's reproductive life (within as well as between periods in and out of union), behaviour in any given 4 weeks may present a very misleading picture of longer term norms (for example, where relationships are subject to frequent or periodic separations). Such concerns reflect a fundamental weakness of all period data, and the demographic significance of any apparent differences in levels of sexual activity therefore needs to be assessed with caution, particularly at the individual level of analysis.

Finally, while the standardization of sexual activity into 'episodes' provides a helpful means of comparative analysis, it is important to question whether the reality of sexual practices and local terminologies easily translates into a common unit measure – nowhere does the DHS define what an 'episode' of sex comprises, and consequently there is no guarantee (even assuming internal consistency within national data sets) that like is being compared with like. Further definitional problems are encountered when attempting to use these data to operationalize concepts of sexual exposure. Any attempt to distinguish the sexually active from the inactive raises the question 'when does sexual activity become so infrequent as to warrant the term ''sexually inactive''?' The defining of inactivity as 'no episodes of sex in the previous 4 weeks' (as used here) relates principally to the data constraints imposed by the 4 week window on sexual behaviour used in the DHS. It does not imply a temporal definition for sexual abstinence. The crucial quality of abstinence is probably the deliberate motivation to withhold from sex rather than any specific duration of time of non-exposure. With the DHS providing no information on the motivations behind sexual behaviour, this analysis therefore avoids use of concepts of abstinence (except in the case of postpartum abstinence, the duration of which can be specifically derived from the DHS) with the referred term 'sexual inactivity' defined and interpreted simply as a measure of recent non-participation in sex. The use of a 4-week window does, however, coincide with the duration of a woman's monthly cycle, and consequently facilitates application to models of fecundability.

Lifetime sexual activity

Sexual exposure and marriage

While the suppression of a woman's fertility potential is primarily seen in terms of regulatory behaviour to prevent coitus translating into a birth, in all societies a significant proportion of a woman's reproductive years may be spent in a state of non-exposure to sexual relations themselves. In some populations this period will be a close function of patterns of formal marriage and captured effectively via a general index of nuptiality (as used by Bongaarts in his proximate determinants model of fertility, 1978). However, the empirical relationship between formal marriage and sexual relations may not hold for many sub-Saharan societies (Caldwell, Orubuloye & Caldwell, 1992; Blanc & Rutenburg, 1991). Since this association is the basis of any

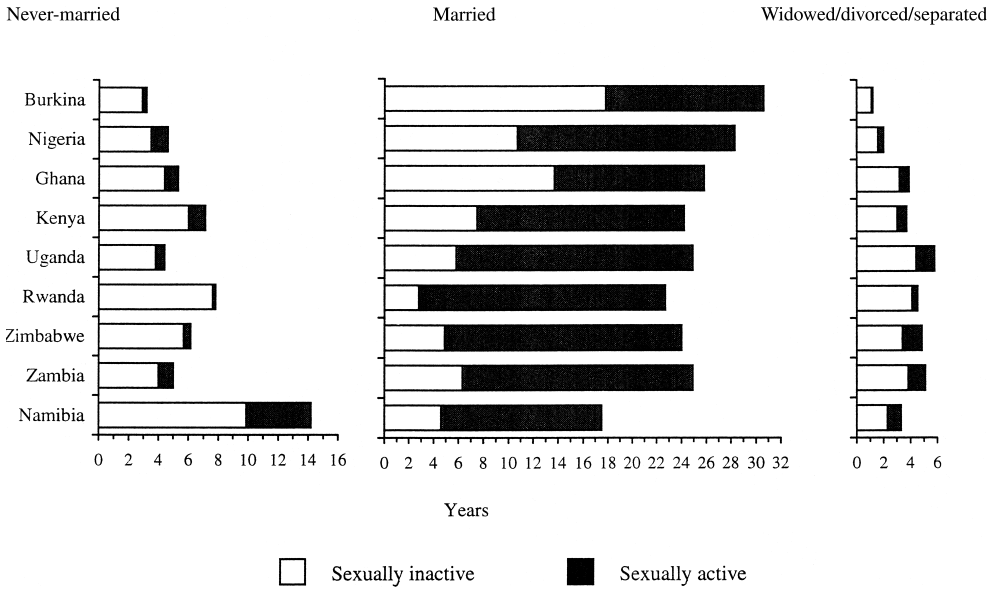

Fig. 2. Lifetime sexual activity by marital status, calculated for synthetic cohorts (women aged 15–49).

methodology that uses marriage as a proxy for sexual exposure, it forms an important preliminary focus for empirical analysis.

Figure 2 shows, for synthetic cohorts, the expected breakdown of the reproductive years (defined here as ages 15–49) according to marital status and sexual activity status, for each of the study populations. This is calculated using a methodology similar to that followed by Blanc & Rutenburg (1991). For each five-year age group, women are divided up according to marital status and activity status. The resulting proportions are then summed across age groups, multiplied by five, and divided by 100 to give an estimate of the number of years that a women would expect to spend in each particular state (assuming the age-specific rates remained valid over her reproductive lifetime).

On the bases of these estimations, the association between marital status and sexual exposure is far from clear. Sexual intercourse is not restricted to the currently married, and nor, conversely, is time spent in marriage always a proxy for sexual activity. Crucially, the nature of the relationship appears to differ *between* countries.

It is probably true that in all societies entry into marital union implies entry into a sexual relationship (though possibly delayed as in the case of societies practising childhood marriage). In this context, evidence of substantial and varying amounts of sexual inactivity among the currently married in Fig. 2 may be more unexpected than the evidence of sexual activity among the never and previously married (divorced, separated and widowed).

Levels of sexual inactivity are highest in the West African populations. For example, in Burkina Faso, which records the highest proportion of reproductive years spent married, almost 60% of that period is apparently spent sexually inactive (on the 4-week criterion), with Ghana and Nigeria all recording over 30%. By contrast, women

Table 2. Coital frequency (episodes in previous 4 weeks), all married women

	Episodes of sex in the last 4 weeks						Mean monthly coital frequency		
	0 (%)	1 (%)	2 (%)	3 (%)	4–7 (%)	8+ (%)	All married women	Non-abstainers	Sexually active[a]
West									
Burkina	57·8	8·3	11·3	7·5	10·8	4·3	1·5	2·4	3·7
Nigeria	36·9	6·2	12·8	11·7	23·3	9·1	2·8	3·6	4·4
Ghana	45·2	12·5	15·3	10·7	13·5	2·8	1·6	2·1	3·0
East									
Kenya	28·8	13·0	15·7	12·2	19·9	10·4	3·1	3·3	4·4
Uganda	21·4	6·0	11·2	9·0	22·6	29·8	5·7	6·1	7·2
Rwanda	10·7	8·0	13·1	12·8	22·9	32·4	7·3	7·4	8·1
Southern									
Zimbabwe	20·5	8·3	8·4	8·9	19·9	34·1	6·3	6·8	7·9
Zambia	25·5	7·7	10·7	10·0	19·9	26·2	5·6	6·4	7·5
Namibia	25·5	14·0	16·7	9·5	12·7	11·7	3·4	3·7	4·6
All	32·0	8·9	12·6	10·3	19·4	16·8	3·6	4·3	5·3

[a]At least one episode of sex in the last 4 weeks.

in the six populations from southern and East Africa record notably lower levels of inactivity. In Uganda and Rwanda, for example, women are sexually active for over 80% of the married period. Viewed in combination with the patterns of sexual activity observed outside marital union, these findings suggest that, while women in all countries in the study experience long overall periods of sexual inactivity during the reproductive years, its timing and link with relationship status varies considerably between the study populations. Thus at one extreme, sexual inactivity among women in Rwanda appears to relate to a particularly effective sanctioning of sexual exposure prior to marriage, with marriage itself associated with fairly continuous exposure. In West Africa, by contrast, long periods of inactivity relate principally to behaviour within marriage.

Current levels of sexual activity

Because of the wide inter-country variation in the proportion currently married, subsequent analysis is focused on currently married women only to improve comparability of the data sets. Table 2 shows the recent experience of reported marital sexual activity for the nine study countries (frequency distributions of sexual episodes and mean monthly coital frequency).

The data show substantial variance in the mean monthly coital frequencies, with a strong regional patterning. A key factor in the notably lower rates recorded in West Africa appears to be the very high proportion of women who recorded no sexual activity at all over the recall period (more than half of the married women in Burkina

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Fig. 3. The contribution of postpartum abstinence to overall levels of sexual inactivity (married women).

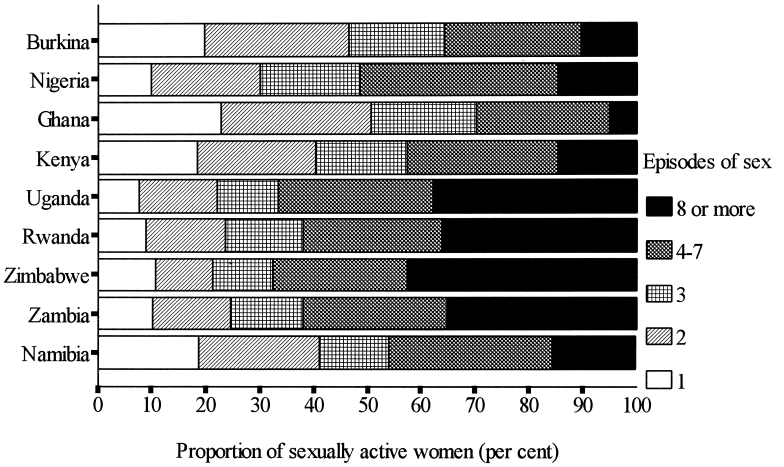

Fig. 4. Frequency of coital episodes for all sexually active married women.

Faso). This in turn may partially be explained by differentials in the practice of postpartum sexual abstinence which, while having undergone considerable erosion over much of the sub-Saharan region (Schoenmaeckers *et al.*, 1981), remains strong in West Africa (Fig. 3). Postpartum abstinence accounts for at least 50% of current sexual inactivity in West Africa compared with 30% or less for the East African populations.

However, while removing postpartum abstainers substantially reduces the proportion of married women classified as currently sexually inactive, the impact on country differentials in mean coital frequency remains modest, and the regional pattern persists (Table 2). Differences persist even if the analysis focuses only on those women who are currently sexually active (mean monthly frequencies of sexually active women in West Africa remain only around two-thirds of the levels recorded in southern and East Africa). Figure 4 shows that in West Africa, the great majority of sexually active

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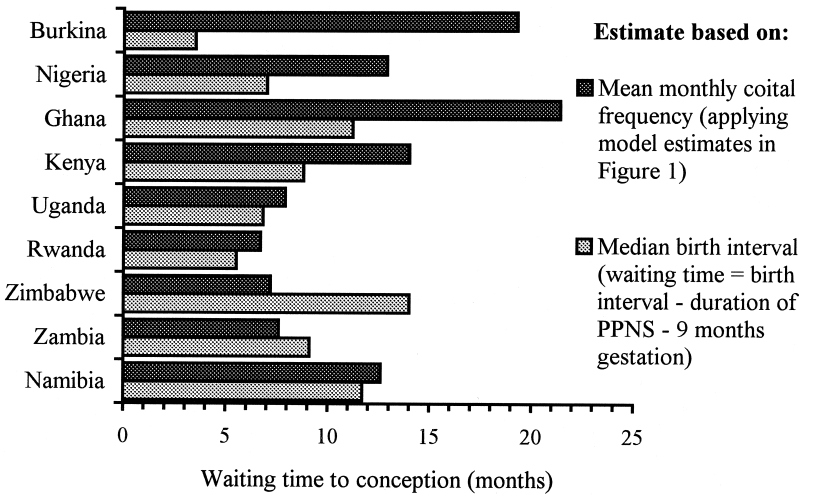

Fig. 5. Estimates of waiting time to conception (excluding period of postpartum non-susceptibility).

women record fewer than four episodes of sex in the previous 4 weeks (the mode is just one episode). Fewer than one in ten record 'high' activity (eight episodes of sex or more) compared with a third in Rwanda, Uganda and Zimbabwe.

Based on the strict application of the Bongaarts and Potter schedule, and in the absence of contraception, these country differentials would imply substantial differences in mean waiting times to conception for women returning to fecundity at the cessation of their non-susceptible period (Fig. 5). These range from 6 months in Rwanda to nearly 2 years in Burkina Faso. However, these country differentials are not repeated if waiting times are calculated directly from actual fertility experience (median birth intervals). After taking account of differences in the length of the postpartum non-susceptible period, the distribution of mean waiting times is actually reversed, being relatively longer in the southern and East African countries (Fig. 5). Clearly, this may partly be explained by differences in the level of contraceptive use (higher in southern and East Africa). But the key observation is that in terms of the Bongaarts and Potter model, the rate of coital activity recorded in the West African populations of Burkina Faso and Ghana (and to a lesser extent Nigeria and Ghana) appears far too low to deliver the tempo of childbearing apparently experienced.

The contradiction may indicate that the coital frequency data are inaccurate, or that the model makes unrealistic assumptions about the relationship between coital frequency and fecundability in these societies. Clearly it could be a combination of the two.

As already discussed there are a number of factors relating to the measurement of sexual behaviour in a snap-shot survey such as the DHS that raise doubts over the likely reliability of the data. However, there remains no clear explanation of why, given a standard questionnaire, women in certain countries (notably Burkina Faso and Nigeria), but not others, should consistently and on-mass understate their sexual activity in DHS surveys. Thus, notwithstanding that the contradictions in Fig. 5 raise substantial doubts about the precision of the sexual activity data, the differences

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between country means of coital frequency remain striking. Seen in the context of a strong internal consistency in reported behaviour, it is hard to avoid the conclusion that coitus is indeed variable between countries, if overstated by the DHS data.

Turning to the applicability of the Bongaarts and Potter schedule, it has already been hypothesized that aspects of coitus other than its frequency may be important in determining the probability of conception. It was noted earlier that Bongaarts's model was based on the assumption of random timing of coitus through the 28-day cycle. If sex were being deliberately targeted to fall within (or outside) the 'fertile period' mid-cycle, this could dramatically modify the relationship between frequency and fecundability, and, in the case of West Africa, help explain how relatively high fertility could be associated with very low reported frequencies of coitus. This is clearly an important area for further research.

The current failure to incorporate 'the proximate determinant of conception' more directly into contemporary fertility analysis probably owes much to Bongaarts's empirically supported observation that nearly all observed fertility differentials are explained by the so-called key determinants (nuptiality, postpartum susceptibility, contraception and abortion). However, this need not imply that sexual activity operates as a constant in determining fertility experience.

The assumption, implicit in Bongaarts's model, that determinants other than the four key ones operate a 'constant' suppression on fecundibility relates to their 'net' effect, and is not based on individual measurement. Therefore, it is possible that the impact of variance in coitus on overall fertility is being masked by compensatory movement in other unmeasured determinants. This may notably include abortion which, despite being one of Bongaarts's key determinants, is rarely measured in African surveys, and generally assumed to be zero in efforts to operationalize the proximate determinants model. As already argued, that assumption is almost certainly unsafe, though evidence is lacking to determine whether the practice shows any marked regional differences. To summarize the broader point, similar levels of total fertility (as derived from measurement of the key determinants) may be being delivered via quite different sexual regimes, between women and over time.

Whatever the ultimate impact on lifetime fertility differentials, in terms of improving short-term measures of current status susceptibility to pregnancy, the case for greater quantification and operationalization of coital behaviour (the key behavioural determinant of natural fecundibility) remains strong, particularly since, in conjunction with contraceptive data and stated fertility intentions, natural susceptibility is the key component used to derive measures of family planning 'need' and 'unmet need' currently given such prominence in policy literature. Increasingly sophisticated criteria have been employed to narrow down the susceptible population in these calculations. Indeed, latest attempts to measure unmet need (Westoff & Bankole, 1995) directly incorporate the data collected on sexual activity by restricting the base to women who have had sex in the last 4 weeks. Nevertheless, this still assumes that once defined in this way, women experience a standard level of sexual activity and risk. The findings of this analysis dispute this. Even after excluding all sexually inactive women, mean coital frequencies tend to be notably higher in East and southern Africa than in West Africa (Table 2).

In assuming a simple dichotomy between the susceptible and the non-susceptible, current approaches to measuring susceptibility generally offer little scope (at either a

conceptual or methodological level) for accommodating the varying 'degrees of risk' implied by these figures. A possible exception is the approach taken by Hobcraft & Little (1984) in their development of fertility exposure analysis. In essence, this attempts to measure a woman's exposure status over a defined period of time, applying a more rigorous and sensitive set of exclusion criteria. The original paper outlines eighteen of these 'exposure states': four states of pregnancy; six states of absence from sexual relations; five states of postpartum infecundity; a state of contraception (by method); a state of sterility; a residual state.

By recognizing that exposure to pregnancy is a complex function of different biological and behavioural factors, and that these vary in their respective impact over time, exposure analysis allows much greater fluidity in the modelling of risk over time, and in this respect is a major advance on previous measures of risk derived from crude application of the proximate determinants framework. However, it still relies on identifying states of infecundity and there is still no explicit incorporation of coital frequency as a positive variable in the risk of pregnancy (though it can be included as a stratified variable), despite Hobcraft's own assertion that it is: 'Probably the major source of apparent heterogeneity in fecundability and thus worthy of explicit treatment,' (Hobcraft, 1987, p. 804).

In the policy and programme field, the conclusion that current measures of susceptibility miss important variance among the susceptible casts doubts over the accuracy of widely used indices of contraceptive need and unmet need, since these are derived from susceptibility measures. This may be exacerbated if the process of contraceptive uptake involves a measure of self-selection, by which contraceptors tend to experience above-average coital frequencies (it is reasonable to assume that women with very low coital frequencies will perceive less likelihood of conception, and so less need for contraception). The pool of non-users in a population may thus contain a significant proportion of women in that range of coital frequency associated with very low fecundability rates. Analysis of DHS data for Burkinan Faso revealed that among currently married women with an unmet need, 10% of those not intending to use contraception gave infrequent sex as the main reason (Westoff & Bankole, 1995, Table 6.2, p. 16). Their inclusion in the denominator for calculation of contraceptive need and unmet need may inspire misleading interpretations of the so-called KAP (knowledge, attitudes and practice) gap.

Certainly from a demographic perspective, women practising very infrequent sex represent a substantially different risk-scenario to those practising higher frequencies. While programme officials, and the women themselves, might reasonably argue that having any unprotected sex, however infrequent, warrants their inclusion, there are clear implications for method choice. The oral contraceptive, for example, which must be taken every day and which may involve some deterimental side-effects, may be inappropriate for a women having sex less than once a month, even if only from the perspective of efficient use of resources.

Conclusion

This investigation has demonstrated substantial variance in three key aspects of sexual activity: the proportion of the reproductive years spent sexually active; the level of sexual activity outside marriage; and, the focus of this paper, the level of sexual activity

inside marriage. These differences are displayed within populations, but it is the finding of quite substantial country and regional level differences that raises the most important methodological questions over the way coitus is incorporated into fertility analysis.

Some of the variance can be explained by different levels of postpartum abstinence, but the persistence of differentials after controlling for this practice suggests a need for more direct measurement of coitus in modelling the proximate determinants. Clearly the temporal variability of coital behaviour at the individual level would make its more direct inclusion in a Bongaarts-type model very problematic. A more facilitating modelling framework might be the fertility exposure framework developed by Hobcraft & Little (1984). Since this explicitly recognizes the dynamic nature of postpartum susceptibility in its methodology, different levels of coital frequency could readily be incorporated in the index of variables employed. However, this methodology would require more sophisticated measurement of the unfolding sequence of individual behaviour than is currently available from the narrow 4-week snap-shot of sexual behaviour provided by DHS surveys. Further advancement in this area may require the adoption of more costly longitudinal data collection methods, which could provide continuous individual level data on the determinants of fecundability as they unfold over time.

Finally, it is argued that a greater effort to operationalize the 'proximate determinant of conception' is warranted, not only for more accurate fertility modelling, but as a planning tool for a more informed provision of family planning services. It is well established that most demand for family planning in Africa is driven by the desire to 'space' rather than 'stop'. This means that programmes may already expect an intermittent pattern of lifetime use, based on reversible methods and regular discontinuations as women seek to become pregnant again. The finding that African women (particularly in West Africa) may, in addition, spend substantial periods of their married reproductive lives not participating in sexual activity is likely to introduce further discontinuities in the nature of demand. Even among the sexually active, women practising sex once a month are likely to have very different family planning needs to those practising sex more than once a week, particularly with regards to method choice.

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