

Levels, Patterns, Differentials and Trends of Male Fertility in Sub-Saharan Africa.

What Can We Learn from Demographic and Health Surveys?

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1. Introduction

Male fertility has been largely neglected in demographic research (Coleman, 2000; Greene and Biddlecom, 2000; Zhang, 2011). Although the role of men in fertility decisions and changes has received increased attention since 1990s (DeRose, and Ezeh, 2005; Greene and Biddlecom, 2000; Zulu, 1997), the patterns, levels, changes and determinants of male fertility have remained an understudied research area (Zhang, 2011). Various reasons have been described for explaining this lack of studies (Greene and Biddlecom, 2000; Zhang, 2011; Estee, 2004): the larger and less clearly defined age range of reproduction among males, the fact that males may be unaware of some of their progeny, data quality issues,... On the other hand, there are also good reasons why male fertility should be studied (Zhang, 2011). It includes methodological motivations, theoretical reasons, policy issues¹, etc.

Despite the relative lack of research in this field, several studies have provided empirical evidence on patterns, levels, differentials and trends of male fertility in a variety of contexts (Zhang, 2011; Estee, 2004; Brouard, 1977; Lognard, 2010). Research on African male fertility has however remained limited. Most studies have been conducted at the local level (Pison, 1986) or at the sub-national level (Donadjé, 1992). While the dearth of data has often been mentioned as a reason for the lack of studies on male fertility (Paget and Timaeus, 1994), data on male fertility sub-Saharan Africa has been largely untapped². As of September 2011, 95 men's surveys had been conducted in sub-Saharan

¹ For instance, the knowledge of age specific male fertility rates is useful in estimating adult mortality using orphanhood data (Page and Timaeus, 1994). Male fertility desires are also better interpreted when compared to actual fertility levels. For instance, men's ideal family is higher than women's in West Africa (Greene and Biddlecom, 2000). While this could be interpreted as a sign of greater resistance to fertility changes among males, a comparison of fertility desires to actual fertility leads to a more nuanced interpretation. Several theoretical approaches (a.. Caldwell's wealth flows theory) also posit that males are major decision makers in fertility behavior (and major beneficiaries of high fertility), and it suggests that some theories could be tested through males' point of view instead of (or in addition to) females' point of view.

² To our knowledge, only a few studies have used data on male fertility in DHS (Blanc and Gage, 2000; Ezeh, Serroussi and Raggars, 1996; Johnson and Gu, 2009; Macro international, 1997), but

Africa as part of the DHS (www.measuredhs.com)³, many of them with some questions on male fertility. Household questionnaires also contain valuable data for measuring male fertility. Although the data available on males are much less detailed than data from women birth histories (Blanc and Gage, 2000), it potentially allows measuring levels, patterns, differentials and trends in male fertility in a large number of countries.

The objective of this paper is to evaluate to what extent - and with which methods - the DHS data in sub-Saharan Africa can be used to measure levels, patterns, differential and trends of male fertility. In the first part of the paper, we will present the type of data that has been collected in DHS in sub-Saharan Africa and that can be used to measure male fertility. Next, we will present the three methods (two indirect methods and one direct method) used to compute recent age specific fertility rates from DHS data. In the third section, the three methods will be compared in a dozen of sub-Saharan African countries (countries with at least 2 DHS, including Ghana, Kenya, Senegal, Burkina Faso, Cameroon, Chad... – only a few of them included in preliminary results). Comparisons will focus on fertility levels (TFRs), patterns (age-specific fertility rates), differentials (ratios of TFRs across subgroups) and trends (comparisons of TFRS over time). These comparisons will allow us to evaluate if different methods/data lead to similar results, and to identify the major causes of differences across methods. Finally, guidelines for choosing the method(s) will be provided.

2. A brief review of research on patterns, levels, differentials and trends in male fertility

It is well established that the age pattern of male fertility is different from that of females. Even though the curve of age-specific male fertility rates looks similar to the curve of female rates, the age span is larger among males and the rates are typically lower at young ages and higher at higher ages (Paget and Timaeus, 1994). This was documented in several developed countries (Brouard, 1977; Lognard, 2010; Zhang, 2011) and developing countries (Zhang, 2011; Pison, 1986; Donadjé, 1992).

The intensity of fertility may also vary across gender. In *monogamous* societies, total fertility rates among males and females tend to be close to each other, even though they are not expected to be equal. Differences in age at childbearing (related to age at union) and differences in mortality explain that total fertility rates are often higher among males (Estee, 2004). In specific circumstances affecting gender balance (e.g. wars, high male or female migration), total fertility rates may be very different between males and females (Brouard, 1977). In *polygynous* societies, age-specific fertility rates and total fertility rates tend to be much higher among males than among females (Pison, 1986; Donadjé, 1992). For instance, Pison (1986) found a total fertility rate of 11.2 children among males and 6.7 among females among Bande Fulani in Senegal (Pison, 1986), and Donadjé (1992) a TFR around 10 among males in Southern Benin.

none of these have computed fertility rates. They either report mean number of children (or living children) by age, or distributions of males by number of children ever born

³ Excluding AIS and KAPsurveys, 86 men's surveys were conducted as part of Standard DHS.

Interestingly, fertility differentials and fertility trends may be also different among males than among females (Zhang, 2011), with different theoretical and policy implications. For instance, Zhang showed – in the US - that labor force participation had a much stronger effect on male than on female fertility, and that income had opposite effects. Fertility trends could also differ between males and females. It has been shown for instance in France that fertility changes did not occur at the same pace among males and females (Brouard, 1977). In a polygynous society, fertility changes could be more pronounced among males than among females when fertility changes are accompanied by changes in polygyny.

In brief, previous work indicates that the measurement of male fertility may offer interesting insights into the dynamics and determinants of fertility. This paper will be mainly methodological and descriptive, and is a step towards a systematic comparison of males' and females' fertility experiences.

3. Data & Methods

The data come from the Demographic and Health surveys conducted in sub-Saharan Africa. Three types of data available in DHS can be used to measure period male fertility rates. They come either from the men's survey or from the household survey.

- Date of birth of last child (men's survey)
- Number of children ever born (men's survey)
- Listing of children in the household, and father's line number (household survey).

Below, we briefly describe these data and how they can be used to compute age-specific fertility rates (and TFRs), and to measure fertility differentials and trends. The three methods we present have – to our knowledge – only been used to estimate female fertility. However, they can be used in a similar way to estimate male fertility, even though some specific issues need to be addressed.

1) Date of last birth (DLB)

The date of last birth was collected in a little less than half of men's surveys. It was frequently asked in the late 1990s, but has been collected in a limited number of surveys in the 2000s. In some cases, only the year of the last birth was recorded, while in others, both the month and year of the most recent birth were collected⁴. In a few countries (e.g. Burkina Faso), this question was asked in several consecutive surveys.

Such data allow computing fertility rates using the principle of backward recurrence times (Allison, 1985; Schmertmann, 1999). Under the assumption that the fertility rate is constant over a defined period of time (e.g. 3 years), fertility rates are simply computed as the ratio between the number of (last) births in an age group in that period and exposure. Exposure in each age group is measure as the sum of the duration (for each woman) spent in the age group between the date of the survey and the date of last

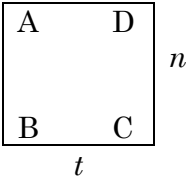
⁴ In some instances, the age of the youngest child is also available. While this could also be used to estimate fertility, it will not be used in this paper – as it was collected

birth, or the date of the start of the period if no birth occurred in the period (see Schmertmann, 1999). Fertility differentials can be estimated either by computing rates separately for different subpopulations, or with a Poisson regression including dummy variables for different categories of males. Theoretically, fertility trends can also be modeled by using a Poisson regression model, including age and time periods as independent (dummy variables) variables (Allison, 1985).

2) Number of children ever born and crisscross method (CC)

Data on the number of children ever born has been collected in approximately two thirds of men’s surveys in sub-Saharan Africa⁵. Although this type of data is crude – and refers to cohort fertility – it can be used to compute period age-specific fertility rates in a very simple way when two surveys are available. Schmertmann (2002) has shown that a period fertility rate between two exact ages (x and $x+n$) over a period of any length t (not necessarily five years) could be estimated with a simple formula (that he coined ‘crisscross’).

Figure 1 : Illustration of Lexis diagram and formula for estimating fertility rates with the crisscross approach (adapted from Schmertmann, 2002).



$$\left(\frac{1}{2n} + \frac{1}{2t}\right) \cdot (C - A) + \left(\frac{1}{2n} - \frac{1}{2t}\right) \cdot (B - D)$$

Where A, B, C and D are the mean number of children ever born at exact ages and dates defined by the corners of the Lexis diagram (Figure 1), t is the time between the two surveys, and n is the width of the age group.

The same method can also be used separately for different subpopulations, and – when three or more surveys are available - can be used to measure fertility trends.

3) Household data and own children method (OC)

Data collected in the household roster can also be used to estimate male fertility, using the own-children method (Cho, Retherford and Choe, 1986). The data needed to use the own children method are simple: the list of all children in each household and their age, as well as the list and ages of all adults (usually 15 and over). This is typically collected in most demographic surveys, and is available in all the DHS in sub-Saharan Africa. In addition, estimates of child survival and adult survival are also needed to estimate the number of births from the number of surviving children, and the number of fathers/mothers in the past. The basic principle of the own children method for male fertility is to match the surviving children with their father, and to tabulate children

⁵ In early men’s surveys, data were collected on the number of living children. Since approximately the mid 1990s, the question refers to number of children ever born.

according to their age and their father's age⁶. Unmatched children are then redistributed to fathers, and backward projection is used to estimate the number of births from the number of surviving children, and the number of fathers from the number of surviving fathers. To compute male fertility rates with the OC method, child survival can be estimated using female birth histories, or using model life tables.

Again, the method can be used to compute fertility differentials, although mortality estimates are needed in each category. Fertility trends can be computed from several consecutive surveys, or can also be estimated from a single survey over the last 15 years (Cho, Retherford and Choe, 1986).

Comparison of methods

These three methods can potentially be used to estimate fertility levels, patterns, differentials, and trends, and they *a priori* all have advantages and limitations. Some are easily used, are more flexible, or rely on data that are more readily available. For instance, the crisscross method (CC) is clearly the simplest approach: it relies on very simple data and very simple mathematics (Schmertmann, 2002). It has, however, a few limitations. For instance, two surveys with the same questions are necessary to estimate fertility rates for a single period, and at least three similar surveys are needed to measure fertility trends. The own-children (OC) method also has clear advantages: it relies on data that are very commonly available, and it potentially allows estimating fertility trends from a single survey. However, the OC method necessitates mortality estimates that may not be readily available, especially if one wants to estimate fertility differentials. The date of last birth method (DLB) is appealing because it is relatively simple to implement and relies on simple data, and can also be estimated with a regression model. However, such data are not available in many surveys, and the method also relies on the assumption of constant rates (for current fertility).

These three methods all rely on specific assumptions, and may also be affected by data quality problems (underreporting of births, displacements of births, etc.). For instance, the crisscross approach and the date of last birth approach both assume that men are aware of (and report) the births of their children. In contrast, this assumption is not necessary with the own children method, because unmatched children are redistributed among potential fathers. Underreporting of births may influence estimates in different ways with different methods. For instance, if underreporting of births is relatively stable over time, the crisscross method should be less affected than the other methods. On the other hand – variations in the underreporting of births over time may lead to negative rates – a result that is not possible with the two other methods. Birth displacements may also affect fertility estimates with the own-children method and the date of last birth method. Such issues will be discussed in detail in the full paper.

⁶ This can be done relatively in DHS, because the line number of the father (and mother) of each surviving child (aged less than 15) is collected in the household survey.

4. Preliminary results

This section presents a few preliminary results for some countries with varying levels of fertility and polygyny. The full paper will include a dozen sub-Saharan African countries, and detailed results on fertility patterns, levels, trends and differentials.

1) Levels and patterns of fertility

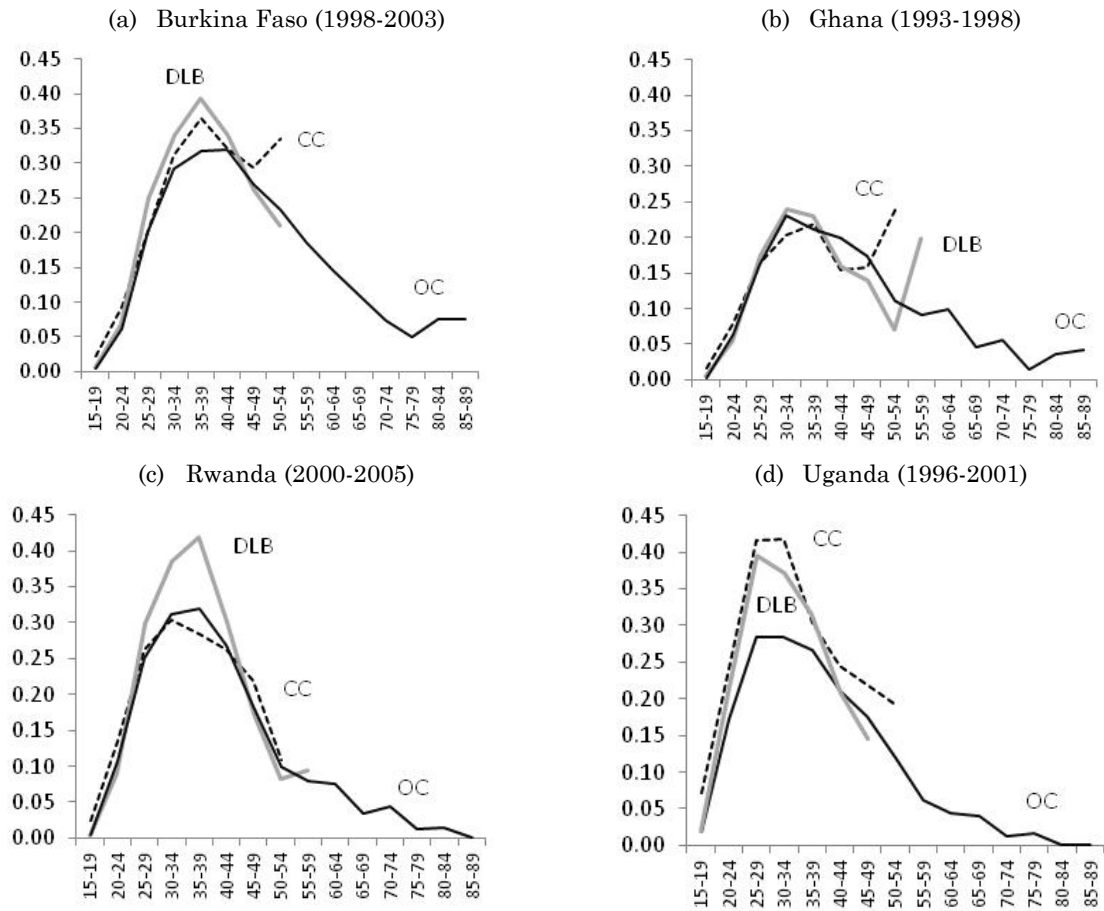
Figure 2 shows age-specific fertility rates estimated with the three methods (DLB, CC and OC) in four countries. Figure 3 compares total fertility rates (15-54) across methods in the four countries. Figure 4 compares total fertility rates between 15 and 79 in the four countries.

A few observations can be made:

- The OC method not only covers the largest age range, but also has the most regular curves. In contrast, the DLB and CC methods may behave erratically at higher ages.
- In Burkina Faso and Ghana, the rates from the three methods are fairly similar up to age 50. In Rwanda and Uganda, differences are more pronounced. In Rwanda, the DLB method gives much higher estimates between 25 and 44. In Uganda, the own children method (OC) leads to much smaller estimates.
- Difference in total fertility rates across methods are small in Ghana, 'reasonable' in Burkina Faso and Rwanda (around 1 child), and much larger in Uganda.
- Differences in TFRs across countries are relatively large. For instance, among men aged 15_79, it ranges from around 7 children to Ghana to more than 11 in Burkina Faso.

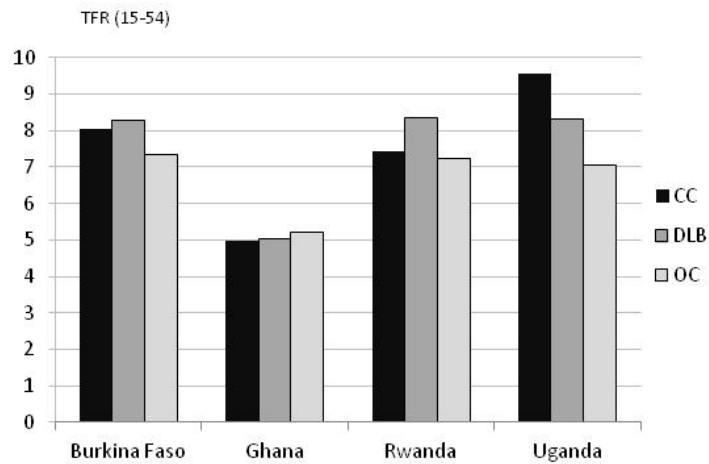
At this stage, no explanation is given for these large differences. However, they clearly suggest that – at least in some contexts – these methods may lead to very different results. These preliminary results also suggest that the differences across methods are not systematic, and may occur for various reasons. An in-depth analysis of the assumptions of these methods and their consequences in specific contexts, as well as data quality problems will be done to explain such differences.

Figure 2 : Age-specific fertility rates estimated with three methods in four sub-Saharan African countries (data source: DHS men's surveys and household surveys)



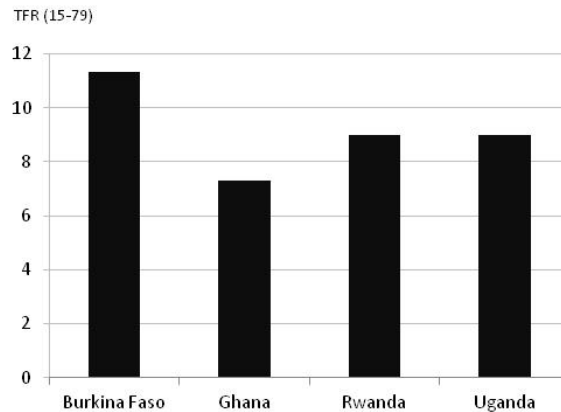
CC: Crisscross; DLB : Date of last birth; OC : Own children

Figure 3 : Total fertility rates (15-54) estimated with three methods in four sub-Saharan African countries (data source: DHS men's surveys and household surveys)



CC: Crisscross; DLB : Date of last birth; OC : Own children

Figure 4 : Total fertility rates (15-79) estimated with Own children in four sub-Saharan African countries (data source: DHS household surveys)

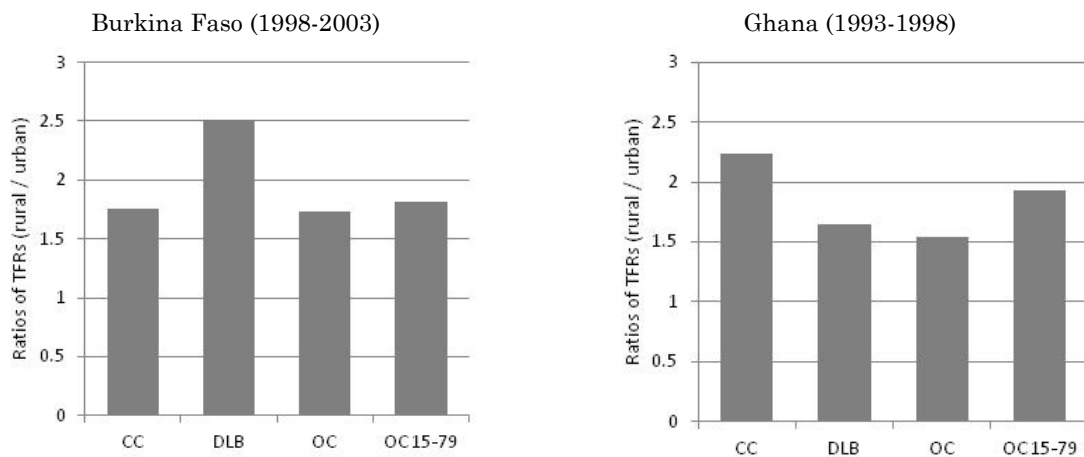


2) Fertility differentials

Results for rural-urban fertility differentials are presented for two countries (Burkina Faso and Ghana, Figure 5). Further results will include other countries, as well as differentials by level of education.

Again, different methods may lead to different results, and these two countries illustrate that differences across methods are probably not systematic. The DLB method leads to a rate ratio of 2.5 in Burkina Faso, compared to around 1.7 for the other methods. In contrast, in Ghana, the crisscross approach leads to the lowest urban TFR, and the largest rate ratio (around 2.2, compared to 1.5 for the DLB and OC methods on the same age range).

Figure 5: Ratios of TFRs (15-54) in rural and urban areas estimated with three methods in four sub-Saharan African countries (data source: DHS men’s surveys and household surveys)



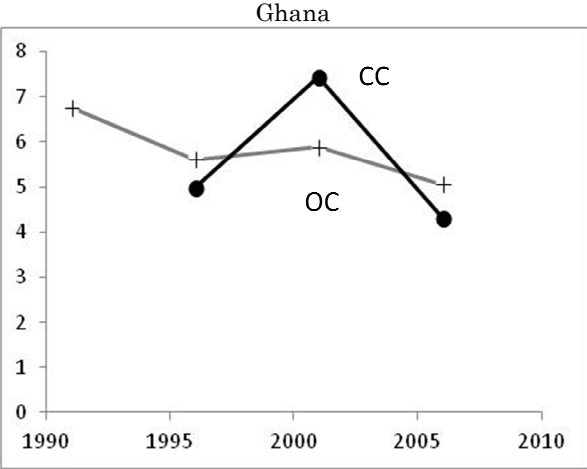
CC: Crisscross; DLB : Date of last birth; OC : Own children

3) Trends

Figure 6 shows trends in male TFR in Ghana estimated with two methods (own children and crisscross). This figure again clearly shows that different methods may lead to very

different trends. Although both methods indicate a fertility increase between the late 1990s and the early 2000s, the increase is much stronger with the CC method. This probably reflects differential omissions of births over time : larger omissions in the first survey for the CC method (1998) than in the second survey (2003) will lead to overestimated fertility rates between 1998 and 2003. The discrepancy between these two methods suggests that the CC method is not reliable for measuring fertility trends. It also indicates that fertility in the 1998 survey has probably been underestimated, and that the trend measured with the OC method may also be affected by data quality problems.

Figure 6: Trend of TFR (15-54) in Ghana with the own children method (OC) and crisscross method (CC) (data source: DHS men’s survey and household survey)



5. Preliminary discussion

Preliminary results suggest that DHS data can provide fairly good information on age patterns of fertility, and – to a lesser extent – reasonable orders of magnitude for total fertility rates. There are however clear differences across methods in some cases. Data on fertility differentials and on fertility trends also show that results may strongly vary across methods– reflecting differences in assumptions and data quality issues.

At this stage, the own children method seems the most promising approach. It allows estimating TFRs on a larger age range, the age-specific rates seem relatively smooth, and fertility trends might be less erratic than with other methods, as suggested by the Ghana example. Moreover, data are readily available and could be used to estimate fertility patterns, levels, trends, and differentials in most sub-Saharan African countries. Nevertheless, the OC estimates are probably also affected by data quality problems (underreporting of births, displacements of births) that also influence female fertility (Schoumaker, 2011), and need to be interpreted with caution.

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