

## **Interview Length in Demographic and Health Surveys: Trends, Patterns, and Implication for Data Quality**

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### **Abstract**

The Demographic and Health Surveys (DHS) Program is a major, critical data source for population and health in less developed countries. Its scope and questionnaire has expanded in order to respond to data needs, which are expected to continue to grow. With this expansion, concerns around interview length and its potential implications on data quality have been raised. However, few studies examined interview length and data quality, particularly in face-to-face interviews. Using 20 surveys conducted in four select countries in sub-Saharan Africa, this study aims to: estimate trends of interview length; assess differentials in interview length by individual characteristics; and assess associations between interview length and select data quality indicators. Results confirm increasing interview length across countries, but at varying rates. Consistent with questionnaire design, multivariate results indicate that a woman's reproductive and relationship histories are strong predictors of extended interview lengths. Finally, positive associations were found between interview length and select indicators on inconsistent reporting, which have implications on future questionnaire development, field implementation, as well as research using DHS data.

**Keywords** Demographic and Health Surveys, Interview length, Data quality, sub-Saharan Africa

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## Background

Begun in 1984 by the United States Agency for International Development (USAID), The Demographic and Health Surveys (DHS) Program has provided technical assistance for the implementation of more than 300 surveys in more than 90 countries. DHS serves as a key population, health, and nutrition data source for less developed countries as well as the global health and development community. The surveys are typically conducted every five years, and each survey utilizes the standard DHS core questionnaires—household, women’s and oftentimes men’s—to ensure comparability across countries and over time.

To meet existing and emerging data needs while maintaining comparability, The DHS Program’s standard<sup>i</sup> DHS core questionnaires are revised periodically—roughly every five years—which correspond with Phases of the program. As health data needs have grown, The DHS Program has responded, resulting in the expansion of the survey. For example, the initial number of questions in the core women’s questionnaire was 205 during Phase 1 (approximately 1984-1989). The number of questions peaked at 439 during Phase 5 (the 2004-2009 period), and was thereafter reduced to 351 as a result of the Phase 6 core questionnaire revision (2009-2014 period).<sup>ii</sup> In addition, to meet country-specific data needs, biomarker data collection has increased, and various optional question modules (e.g., domestic violence, maternal mortality, and out-of-pocket health expenditure) have been developed and implemented. Thanks to its efforts to meet data needs while maintaining quality and comparability, The DHS Program has remained a key data source for health policy and programming at both global and country levels. The breadth, depth, and longevity of DHS data allow for robust analyses, and DHS data use in peer-reviewed research has increased exponentially over time (Fabic, Choi, and Bird 2012).

As questions and biomarkers have been added, the interview length has increased concomitantly. For example, during Phase 1 of The DHS Program, which was characterized by the shortest questionnaire, the overwhelming majority of all women interviewed spent less than 45 minutes participating. During Phase 5, which was characterized by the longest questionnaire, only 30% of all women interviewed spent fewer than 45 minutes answering the survey (ICF Macro 2009).<sup>iii</sup> Concerns about interview fatigue, potentially resulting in data quality issues, led to a deliberate effort to shorten the core questionnaires during the Phase 6 revision, which took place in 2009.

The impact of survey length on data quality has long been a source of concern for survey researchers. A number of studies focused on telephone and mail-in surveys have evaluated the relationship between survey length and response rate, respondent fatigue, and random and systematic errors in reporting (Berdie 1973; Herzog and Bachman 1981). Other non-quality related issues pertaining to survey length—namely respondent burden—have also been sources of concern (Burchell and Marsh 1992; Bradburn, 1978; Sharp and Frankel 1983). Meanwhile, The DHS Program has and continues to undertake rigorous and systematic assessments of data

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<sup>i</sup> The DHS Program includes a range of both population-based and facility-based surveys such as the DHS,, AIDS Indicator Survey, Malaria Indicator Survey, and Service Provision Assessment. This paper focuses on the DHS.

<sup>ii</sup> These are conservative counts. For example, questions on child nutrition, which include 20 or more items and are asked of multiple children, are counted as one question.

<sup>iii</sup> In spite of lengthy interviews with no direct compensation and sensitive questions, the survey response rate has typically been very high. On average, the eligible women response rate is 95.6% (n=191 surveys since 1993, median=96%, SD=2.6%, range: 85.3% to 100%) (ICF International, 2012a).

quality via methodology reports (Institute for Resource Development 1990, Macro International Inc. 1993, Curtis 1995, Gage 1995, Stanton et al. 1997, Pullum 2006, Pullum 2008, Johnson et al. 2009), though none has focused specifically on the relationship between interview length and data quality, as well as standard data quality assessment in each survey.<sup>iv</sup>

Given that the DHS core questionnaires have been revised five times over the past 30 years, there is much to learn from historical trends of interview length and its potential relationship with data quality in DHS. To date, however, no published study has reviewed such issues systematically. Our study aims to begin to fill that gap. Specifically, using DHS data from four sub-Saharan African countries, our study objectives are to (1) estimate trends of interview length, (2) assess differentials in interview length by individual characteristics, and (3) assess associations between select data quality indicators and interview length.

## Data

The study data come from a series of DHS conducted in four Anglophone countries in sub-Saharan Africa—Ghana, Kenya, Uganda, and Zimbabwe—that conducted their first DHS using the Phase 1 core questionnaires and have completed three or more DHS since then. We purposely selected these countries to assess long-term trends of interview length, and focused on sub-Saharan Africa given the region’s continued utilization of and support for DHS. The study is limited to the women’s interview data since the start and end times of the household interviews were not systematically collected by The DHS Program.<sup>v</sup> Appendix 1 lists the 20 surveys and respective number of sampled women.

As in all DHS, data were collected via face-to-face interviews, which were conducted by a same-sex interviewer.<sup>vi</sup> The household interview was conducted first, collecting basic background characteristics for the household and each household member from one adult household member. During the interview, all 15-49 year old women in sampled households—some of whom participated in the household interview—were identified and eligible to participate in the women’s interview. During the women’s interview, information was collected regarding a woman’s fertility – including complete birth history, contraceptive use, and fertility preference; her health and the health of her children– including antenatal and delivery care utilization, infant feeding practices, immunization coverage, and treatment of childhood illness, hereafter referred to as maternal and child health (MCH); marriage; sexual behavior; and characteristics of the woman’s husband/partner. MCH questions were asked for selected index pregnancies or births (typically those within the last five years before the survey), and could constitute a substantial portion of the interview for women with index pregnancies or births. The index pregnancies/births varied slightly over time as indicated in Appendix 1. In each survey, questionnaires were translated into major local languages.

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<sup>iv</sup> In each survey’s final report includes a standard appendix chapter on data quality assessment, focusing on a set of selected data quality indicators.

<sup>v</sup> Though the Men’s interview is increasingly included in many DHS – especially in countries affected by the HIV/AIDS epidemic, it is not part of the standard DHS. Therefore, men are excluded from our sample. Among the 20 study surveys in four countries, 16 surveys included men’s interview.

<sup>vi</sup> For additional information on DHS methodology, including interviewer training, supervision, data quality monitoring, and the like, see: <http://dhsprogram.com/What-We-Do/Survey-Types/DHS-Methodology.cfm>

Across the 20 surveys, a total of 134,275 women were interviewed. After adjusting for missing and inconsistent data on interview length (discussed in detail below) our analysis sample consisted of 117,716 women. Missing data on other variables were rare (n=14) and employing listwise deletion yielded a final analytic sample of 117,702 women (Appendix 2).

## Measures

### *Interview Length*

In accordance with our analytic strategy (discussed below), this research treats interview length as both a dependent and independent variable. Therefore, we use two measures of interview length. As a dependent variable, the length of women's interview was calculated in minutes based on the start and end time of the interview (Objectives 1 and 2). To assess associations between data quality and interview length (Objective 3), interview length is used as an independent variable and represented by a binary measure marking interviews that took 45 minutes or longer to complete. This categorization was based on exploratory analyses of the distribution of interview lengths.

On average across the surveys, interview length could be calculated on 89% of the respondents; it could not be calculated on the remaining 11% of the respondents because multiple visits were required to complete these interviews (9.4%) or interview duration was inconsistent or incomplete in recording (1.1%) (see Appendix 2). Among the cases for which length was calculated (n=120,102), we excluded extreme, highly unlikely outliers, which we defined as cases for which the interview length was shorter than the lowest 1 percentile or longer than the highest 1 percentile of the distribution in each survey.

### *Respondent Characteristics*

In order to assess differential interview length (Objective 2), we constructed three variables that are expected to affect the interview length given design of the questionnaire. The first is parity, which categorized into 0, 1 to 3, 4 to 6, and 7 or more children. Higher parity would be positively associated with interview length because it would increase time to complete birth history. The second measure is the number of living children under age five. This is a three-category variable that measures 0, 1, and two or more children. The number of living children under age five would be positively associated with interview length because the mother has to answer the MCH questions for each child. Our third measure of interest is marital status, and a binary variable was used to categorize women who are currently married or cohabiting (yes vs. no). Currently married or cohabiting women would spend more time answering questions regarding marriage and husband or partner's background characteristics.

In addition to the above variables, we also constructed an education variable that is expected to affect interview length *and* data quality, categorized into three mutually exclusive categories: never attended school; attended some primary school; or attended some primary or higher (following country-specific definition of education levels). More educated women may have better comprehension of survey questions (Krosnick and Alwin 1987; Narayan and Krosnick 1996; for a notable exception, see Holbrook, Cho, and Johnson 2006), and we expect education to be negatively associated with interview length. Finally, we created three additional

background characteristic variables: 1) residential area (urban vs. rural), 2) household wealth (categorized into quintiles), and 3) current age in 5-year categories.

### *Data quality*

To assess data quality (Objective 3), we selected four binary indicators representing inconsistent or incomplete responses to serve as our dependent variables for the analyses. Among various data quality indicators,<sup>vii</sup> we hypothesize that inconsistency or incomplete responses – especially towards end of the questionnaire – are positively associated with interview length. DHS recode files contain several flag variables that show inconsistent or implausible responses, compared to computed values based on other related information collected during the interview.

The first measure is an inconsistency in reported time since last menstrual period (LMP) (yes vs. no). It refers to a case where reported LMP was not consistent with related information such as time since last birth and postpartum amenorrhea. This measure is available for all women. The second measure is available for women who ever had sexual intercourse and identifies an inconsistency in reported age at first sexual intercourse (yes vs. no), which happens when reported age at first sexual debut is inconsistent with related information such as current age, age at first birth, and age at marriage. The third data quality measure is inconsistency in reported time since last sexual intercourse (yes vs. no). It refers to a case where reported age at first sexual intercourse was not consistent with related information such as time since last birth, duration of postpartum abstinence, and sexual activity in the last four weeks. This measure is also available only among women who ever had sexual intercourse. Our fourth data quality indicator is a binary measure of incomplete response for husband or partner's education (yes vs. no). It refers to a case when the respondent did not report *both* her husband/partner's highest level attended *and* years attended. This final measure is only available for women who are married or cohabiting with a partner.

In checking internal consistency across related information, it is impossible to affirmatively identify which information is correct. For example, inconsistent age at first sexual intercourse can be due to incorrectly reporting any of the following: age at first sexual intercourse, current age, age at first birth, and age at marriage. Thus, an inconsistency measure in this study refers to inconsistency in a set of related responses, not necessarily an incorrect response to a particular question. Nevertheless, we speculate reporting of major demographic events (e.g., birth, marriage) may be more valid than response to a sensitive question (e.g., sexual activity). Detailed explanation of the three inconsistency variables is provided in Appendix 3.

### **Analysis**

Our analysis unfolds in three stages to correspond with our research objectives. We start by assessing trends in interview length (Objective 1) through the use of descriptive analyses. These

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<sup>vii</sup> Data quality can be examined using various indicators, including but not limited to: response rate, age transfer of eligible respondents, digit preference in reporting continuous variables, missing values, and inconsistency in responses. Digit preference and age transfer can be assessed only at an aggregated level, and were not included in our analysis because we were interested in studying individual-level associations. Further, age transfer of eligible respondents would happen in the household interview, and age transfer for index pregnancies/births for the MCH section would happen relatively early in the women's interview, meaning these measures may be less responsive to interview length.

analysis were conducted to explore changes in the interview length over time within each country.

To explore our second objective of assessing differential interview lengths, all analyses were conducted for each survey separately. In this stage we first conducted descriptive analyses of the interview length and the three categories of independent variables: those expected to affect length given the questionnaire design (parity, births in the last five years, and marital status); those expected to affect interview length due to comprehension (education); and background characteristics. Then, we conducted t-tests to assess unadjusted associations between interview length and each of the independent variables. Thereafter, we conducted multivariate analyses using a linear regression model in order to estimate adjusted associations between interview length and the main independent variables.

Examining associations between interview length and data quality (Objective 3) requires great caution, especially using observation data. Further, attempts to study the association across countries or over time will be limited by unobserved but critical survey-specific factors that impact quality, such as survey field management, training, supervision, inclusion of biomarkers, and inclusion of country/survey-specific questions. Thus, we approach our third objective using only the latest survey data from each country, examining within survey differentials in survey length and data quality.

All analyses for our third objective were conducted separately for each of the four quality indicators and by country. First, we conducted chi-test to examine differential distribution of data quality by interview length (categorized into  $<$  vs.  $\geq$  45 minutes). We then conducted multivariate analyses using logistic regression models in order to estimate associations between data quality and interview length, adjusting for characteristics of interviewees that are known to be related with data quality, including education (Krosnick and Alwin 1987; Narayan and Krosnick 1996) and key socio-demographic background characteristics. We did not include the parity, births in the last five years, and marital status variables in the model because, while they are undeniably related with interview length as a result of the questionnaire's design, they are not expected to independently be associated with data quality.

Finally, it should be noted that analyses for all of the three objectives were un-adjusted for sampling weights, since our study focuses on findings among the survey participants. All multivariate analysis models were adjusted for inter-interviewer clustering.

## **Results**

### Interview length trends (Objective 1)

Figure 1 and Table 1 present interview length by survey and country. Interview length increased over time in all countries with the exception of Uganda and Zimbabwe. As expected, the shortest questionnaire—Phase 1—produced the shortest average survey interview duration with the average length of interview ranging from 30 minutes in Kenya DHS 1989 to 44 minutes in Ghana DHS 1988. Meanwhile, the longest questionnaire—Phase 5—resulted in the longest average interview duration across each of the five countries, ranging from 47 minutes in

Zimbabwe DHS 2005-06 to 74 minutes in Uganda DHS 2006. Within each country, comparing average survey length between the Phase 1 and Phase 5 surveys, women spent more than twice as long answering the Phase 5 survey in Kenya, Uganda, and Ghana, and 44 percent longer in Zimbabwe.

--Figure 1 and Table 1 about here--

In Uganda and Zimbabwe, interview length decreased in the most recent surveys (15.6 minutes in Uganda and 1.4 minutes in Zimbabwe). This can partially be explained by the reduction in core questionnaire length between Phases 5 and 6. Given the large differential in the amount of reduction in time between Uganda and Zimbabwe, it is clear that other factors beyond core questionnaire length were at play, including, for example, incorporation of country-specific survey questions and/or optional modules.

#### Differential interview length (Objective 2)

Appendix 4 contains a descriptive overview of the background characteristics of the survey respondents over time in each of the four countries. From these data we see marked socio-demographic shifts in key variables in our analysis. In Ghana, for example, marriage patterns shifted over the 20-year span between the earliest and latest surveys. Fewer than 60 percent of women in the sample were currently married in 2008 compared with 71 percent in 1988. More women ever attended secondary school (53 percent in 2008 vs. 7 percent in 1988). Additionally, women had fewer children (mean parity 2.4 in 2008 vs. 3.2 in 1988) and fewer women had births in the five years preceding the survey (44 percent in 2008 vs. 61 percent in 1988). These trends are largely the same across Kenya, Uganda, and Zimbabwe, albeit with a few important differences—most notably the high originating levels of education among Zimbabwean women.

Table 2 presents results of multivariate linear regression that analyzed the most recent survey data in each country (complete results across all surveys are not presented but largely consistent with those in the latest surveys). Across all four countries and all 20 surveys, interview length, as expected, was significantly associated with characteristics that would have increased the number of questions a given woman was asked to answer (i.e., parity, births in the last five years, and marital status), adjusted for education, age, and other background characteristics. A one-child increase in parity was associated with increased interview length by about one to three minutes. Women who had one or more birth in the last five years spent about 11 to 17 minutes more during their interviews than women who did not have a birth in the past five years. Currently married or in union women spent about five to eight minutes more than unmarried women.

---Table 2 about here---

#### Interview length and data quality (Objective 3)

Table 3 shows data quality indicators in the most recent survey in each country. Averaging across all four countries (unweighted), 6 percent of women had inconsistent responses for reporting time since the LMP, 17 percent for reporting age at first sexual intercourse, and 14

percent for reporting time since the last sexual intercourse. In all countries, inconsistency in reporting time since the LMP was less common than the latter two inconsistency measures. The latter two are derived from questions that are asked later in the interview compared to the reporting time since LMP measure, indicating the potential impact of interview fatigue on data quality, in addition to other potential explanations such as the sensitivity nature of questions related to sexual activity. Meanwhile, percent of incomplete responses for husband or partner's education averaged 4 percent across the four countries, despite being asked later than the sexual activity questions. This may indicate that data quality on basic demographic characteristics may not suffer substantially from interview fatigue.

---Table 3 about here---

Figure 2 presents unadjusted positive associations between the three inconsistent response and interview length variables classified into <45, 45-60, and  $\geq 60$  minutes. In all countries, interview length was associated with each of the three inconsistent reporting indicators (chi-square test  $p$ -value<0.05, results not shown). Also, in most countries and indicators, the percent inconsistency increased as interview length increased, potentially suggesting a linear dose response relationship. Meanwhile, relative to other two inconsistency measures, women were asked to report their LMP fairly early in the survey; the positive association between interview length and inconsistency in reporting time since LMP suggests potential confounding factors in this unadjusted association. Incomplete response in husband/partner's education was not associated with interview length.

---Figure 2 about here---

After controlling for background characteristics, women whose interview lasted 45 minutes or longer had higher odds of inconsistent reporting compared to their counterparts. Figure 3 plots the odds ratios of inconsistent or incomplete reporting by interview length, controlling for all other covariates (full results from the multivariate logistic regression analyses are presented in Appendix 5). From this figure, we see that longer interview length (i.e.,  $\geq 45$  minutes) was statistically significantly associated with reporting inconsistency in time since LMP across all countries, age at first sex in all but Ghana, and time since last sex in all countries except Zimbabwe. Despite the LMP questions appearing earlier in the interview, differential odds by interview length is higher in time since LMP than those of the latter two inconsistency measures.<sup>viii</sup> In no country did we find evidence that longer interviews were associated with greater odds of providing incomplete responses for a husband's/partner's education.

---Figure 3 about here---

## Discussion

To our knowledge, this is the first quantitative study to measure the relationship between survey length and data quality in DHS or face-to-face interviews. Results indicate that women who have higher parity, who gave births five years before the survey, or who are married are more

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<sup>viii</sup> Note that all data quality indicators are binary, facilitating the comparison of the magnitude of coefficients.



likely to have longer interviews, adjusted for other background factors. We also found that women who spent 45 minutes or longer on a given survey are more likely to have inconsistent reporting in three selected measures, compared to their counterparts, even after controlling for respondent background characteristics. Important points of discussion related to the three objectives are elaborated herein.

*Interview length trends (Objective 1):* The number of survey questions has grown in each DHS Phase, save for the reduction from Phase 5 to Phase 6. Trends in interview length have followed suit. In Uganda and Zimbabwe, while the average interview length decreased in the latest survey, corresponding with the reduction in the number of questions in the core questionnaire, there was a large difference in the amount of reduction in interview time between the two countries. We reviewed women's questionnaires in the latest two surveys in both countries. In all four surveys, the questionnaire included same optional modules following the core questionnaire (i.e., domestic violence, and adult and maternal mortality). However, the total number of pages, though a very crude measure for the number of questions, decreased slightly in Uganda (from 66 in 2006 to 59 in 2011), while it increased in Zimbabwe (from 61 in 2005-06 to 67 in 2010-11).<sup>ix</sup> This example may indicate that core questionnaire length is not the only factor impacting interview length; the addition of country specific questions throughout the questionnaire as well as optional modules also have great influence.

*Differentials in interview length (Objective 2):* As expected, women with a birth in the index period, women with higher parity, and women who are in union had longer interview duration, compared to their counterparts. This largely reflects the design of the survey. However, education was not associated with interview length controlling for other factors. One likely explanation for this finding is that the relationship between education and interview length is attenuated—in addition to better comprehending survey questions, more educated women may also be younger and/or have lower parity, which would affect the number of questions they answer.

As the DHS has changed over time, so too have socio-demographic characteristics of the survey respondents (see Appendix 4). Given the associations between individual characteristics and interview length previously described, changes in respondent's characteristics over time—particularly delay of marriage and lower fertility—could have resulted in decreased interview length in each country had the survey questionnaire remained the same. The fact that we do not observe a reduction in average interview length over time, however, further demonstrates how the increased length of the questionnaire has contributed to longer women's interviews.

*Interview length and data quality (Objective 3):* It is important to note that highly personal questions related to sexual behavior are fraught with issues of reporting accuracy (Blanc and Rutenberg 1990; Gage 1995; Mensch, Hewett, and Erulkar 2003) irrespective of questionnaire length. Nevertheless, all three inconsistency measures—time of LMP, age at first sex, and time since last sex—were positively associated with interview length exceeding 45 minutes, even after adjusting for background characteristics. Significant and strong association between

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<sup>ix</sup> The number of pages of the English version questionnaire. Zimbabwe 2011 DHS employed computer assisted personal interview (CAPI) approach using tablets, and the rest three surveys were conducted using paper questionnaires.

interview length and inconsistent reporting of LMP was rather unexpected given that data on LMP is collected relatively early in the survey. It likely suggests unobserved characteristics of women that might have affected both interview length and inconsistent reporting for LMP. For example, women who have young children may have a longer interview and also have an irregular menstrual cycle (related to breastfeeding and postpartum period), which can result in inconsistency.

The other notable point is the lack of association between interview length and incomplete response to partner's education. Also, importantly, compared to the inconsistency measures, incomplete response to partner's education was relatively rare, occurring in only 3.5 percent on average of across surveys. We speculate, because again it is not an especially intimate topic and education is a relatively constant background characteristic, respondents are more likely to provide answers to these questions. Additionally, it is possible that completeness is a less sensitive measure to interview length, compared to consistency across related multiple responses. In a subset of women who participated in both household and women's interviews, consistency in reporting partner's education can be assessed by comparing responses in the household interview and women's interview. Such further analyses using less sensitive topics may provide further information for better interpretation of the results on the association between interview length and data quality.

## Implications

Results from our study have a number of implications for both researchers who use DHS data and The DHS Program itself. Our study demonstrates a clear positive association between interview length and a host of data inconsistencies in a number of settings. This suggests that researchers studying sensitive topics—particularly those related to reproductive health and sexual behavior—should consider accounting for interview length in their research. At minimum researchers would be well advised to conduct exploratory analysis assessing the effect that interview length has on their findings.

As revisions to the core questionnaire are considered at the global level, and country-specific additions contemplated at local levels, we offer a few suggestions to The DHS Program and its partners as well. First, we encourage both global and in-country stakeholders (e.g., governments, donors, foundations, and research institutions) to limit the number of questions and keep interview length at a reasonable level, as the study results clearly show a negative impact of lengthy interview on data quality. Second, we encourage The DHS Program and implementing agencies in each country to address interview fatigue and its data quality implications during training and supervision of fieldworkers. Qualitative research may be necessary to better understand survey fatigue among interviewers and respondents, and provide formative basis for interventions to address it. Finally, as use of computer-assisted personal interviewing (CAPI) increases, it may provide opportunities for more robust assessment of time spent on survey questions, sections, biomarkers, and modules. In surveys included in our study, only Zimbabwe DHS 2011 employed CAPI technology, but to date, 10 standard DHS have been administered using CAPI since 2009. Such use of CAPI may provide opportunities to collect interview time data more systematically and accurately and allow for more robust assessments of time spent on survey questions, sections, biomarkers, and modules.

## Study limitations

Studying the association between survey length and data quality is fraught with challenges, some of which limited our ability to fully flesh out the relationship. First and foremost, we did not attempt to assess variations in data quality and interview length between surveys as the many confounding factors stymied such an analysis. With changed length of the core questionnaire, it is an understandable question to ask whether data quality has changed as well. However, questionnaire length and interview fatigue is one of critical factors determining data quality. Even within a country, there can be survey field management challenges that are different across surveys, in spite of standardized implementation manuals. Further, as shown in the example of Uganda and Zimbabwe, inclusion of country specific questions, modules, and biomarkers can be substantial and vary across surveys.

Second, there were a number of important factors that we could not incorporate into our model, including interviewer characteristics, household survey interview length, and language of interview and the questionnaire. Because DHS heretofore does not collect information on interviewer characteristics, we were unable to assess interviewer effects on interview length and data quality.<sup>x</sup> Similarly, because The DHS Program has not systematically collected data on household survey interview length, we were able to study the impact of the length of only the women's core questionnaire on survey quality. It is important to note that some respondents to the women's core questionnaire are also the respondents to the household questionnaire, which means that the total time these women spent answering survey questions is even longer than that reported in Table 1. In our analytic sample, the percent of women who participated in both household and women's interviews ranged from 38% in Ghana DHS 2008 to 59% in Kenya DHS 2008 (unweighted average across four surveys: 49%). This additional time spent could further negatively impact survey data quality. Thus, we speculate that the positive association between interview length and data quality uncovered in our analysis to be a conservative assessment.

Another important characteristics not included in our model is language. In each survey, questionnaires were translated into major local languages. Appendix 6 presents the number of languages that questionnaires were translated into, used in interview, and used by women in the latest surveys. No survey collected information on the usual language spoken by the interviewers, since DHS field teams are arranged in a way that interviewers will work in areas where their language is spoken.<sup>xi</sup> The difference between the number of questionnaire language and the number of interview language (ranging from 1 in Ghana DHS 2008 to 4 in Uganda DHS 2011) suggests potential non-standard questionnaire translation, which happens when there is a discrepancy between the language of the questionnaire and the respondent's language. In such cases, it is the responsibility of the interviewer to translate the questionnaire during the interview. Though interviewers are trained to maintain the meaning of the question when they rephrase or

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<sup>x</sup> The DHS Program is in the process of developing and implementing an interviewer questionnaire to collect basic background characteristics of interviewers in a systematic way. The DHS Program plans to make that interviewer data available to the public.

<sup>xi</sup> Detailed information on interview language is available in the DHS interviewer's manual (ICF International 2012b)

interpret it into another language (ICF International 2012b), non-standard questionnaire translation has been shown to impact multivariate analyses (Weinreb and Sana 2009). This practice also likely affects the time it takes to conduct an interview as well as other factors related to data quality. In the four surveys analyzed in our study, preliminary analyses suggests that measurement of non-standard questionnaire translation would be limited since the language of the questionnaire and the language of the interview were comparably measured and collected across countries, thus excluded from the multivariate analysis model.

Third, with regard to our data quality variables, it is also important to note that highly personal questions related to sexual behavior are fraught with issues of reporting accuracy irrespective of questionnaire length. Further analyses will measure consistency in information that are less sensitive, for example education, and it may provide further information for better interpretation of the results.

Finally, we are limited by the observational data that we used, which allow us to identify associations, but not causality. Nevertheless results of our study can be used to generate hypotheses in experimental studies testing the impact on data quality of various field implementation factors.

## **Conclusion**

The DHS Program is constantly evolving to meet emerging data needs, while high data quality remains to be a top priority. Increased questionnaire and interview length is only one result of this dynamic. Nevertheless, it is an extremely important component, especially as data needs continue to grow and pressures to add to the survey mount. Using data from four select countries, our study demonstrates trends in increasing interview length from the inception of the DHS. Using the latest survey in each country, we also presented positive association between inconsistent reporting and interview length 45 minutes or longer. Balancing data needs and data quality will continue to be a challenge and a priority for The DHS Program. We are hopeful that our study facilitates the important work of the world's foremost population, health, and nutrition data source as well as informs researchers on how to better leverage the data for their purposes.

Figure 1. Interview lengths trends by core questionnaire phase

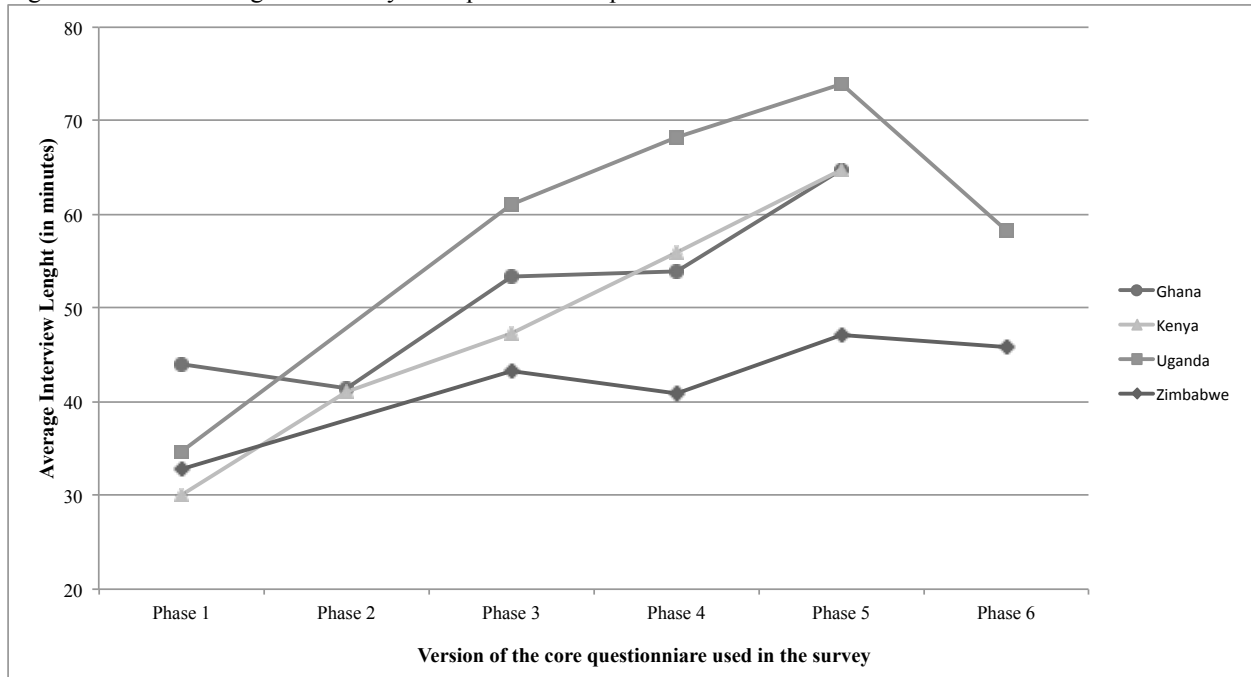


Table 1. Interview lengths in minutes by country and survey

Survey	Questionnaire used in the survey	Analytic Sample Size	Mean	SD	Minimum	Maximum
<b>Ghana</b>						
1988	Phase 1	4028	44.1	19.0	7	120
1993-94	Phase 2	4006	41.4	17.2	12	124
1998	Phase 3	4236	53.3	23.8	15	150
2003	Phase 4	5002	53.9	22.9	15	143
2008	Phase 5	4152	64.8	29.4	19	177
<b>Kenya</b>						
1988-89	Phase 1	6495	30.0	15.0	7	127
1993	Phase 2	6104	41.0	19.2	10	125
1998	Phase 3	6677	47.4	18.5	15	122
2003	Phase 4	6739	55.9	22.4	17	140
2008-09	Phase 5	7373	64.7	28.2	17	185
<b>Uganda</b>						
1988-89	Phase 1	4338	34.7	17.3	6	101
1995	Phase 3	6373	61.1	24.5	19	165
2000-01	Phase 4	6595	68.2	28.8	20	175
2006	Phase 5	7594	74.0	29.2	21	173
2011	Phase 6	7769	58.4	26.9	15	159
<b>Zimbabwe</b>						
1988-89	Phase 1	3594	32.8	15.6	7	89
1994	Phase 3	5045	43.3	18.8	13	132
1999	Phase 4	5197	40.8	16.1	12	104
2005-06	Phase 5	7921	47.2	21.8	14	145
2010-11	Phase 6	8464	45.8	22.6	11	143

All estimates are un-weighted average. SD: Standard deviations.

Table 2. Associations between interview length and individual characteristics in the latest survey by country: multivariate linear regression analysis

	Ghana 2008 Coef.	Kenya 2008-09 Coef.	Uganda 2011 Coef.	Zimbabwe 2010-11 Coef.
Parity (number)	1.2 *	1.9 **	2.3 **	2.5 **
Births in past 5 years				
No†				
Yes	16.1 **	15.8 **	16.5 **	15.0 **
Currently married				
No†				
Yes	4.6 **	5.4 **	5.5 **	7.5 **
Highest education level attended				
None†				
Primary	1.3	-1.4	3.1	-1.5
Secondary+	1.9	-3.7	1.2	-2.1
Wealth quintiles				
Lowest	7.8 *	-1.0	0.9	-0.9
Second lowest	0.4	0.8	-0.7	-0.8
Middle†				
Second highest	-2.8	-0.4	-0.2	1.1
Highest	-2.4	-2.1	-2.0	-0.1
Residential area				
Rural†				
Urban	2.2	0.0	0.5	4.6 **
Age groups, in years				
15-19	-5.4 **	-6.4 **	-5.4 **	-5.7 **
20-24†				
25-29	1.0	0.1	-0.4	2.1 **
30-34	4.2 *	0.2	-1.1	2.6 **
35-39	0.1	-1.8	-2.9 *	2.8 **
45-49	2.5	-1.7	-4.4 **	1.2
35-39	2.0	-3.5	-3.6 *	0.3
45-49	48.9 **	52.9 **	38.2 **	29.1 **
Number of women	4152	7373	7769	8464

† Reference category

\* p-value<0.5, \*\* p-value<0.01

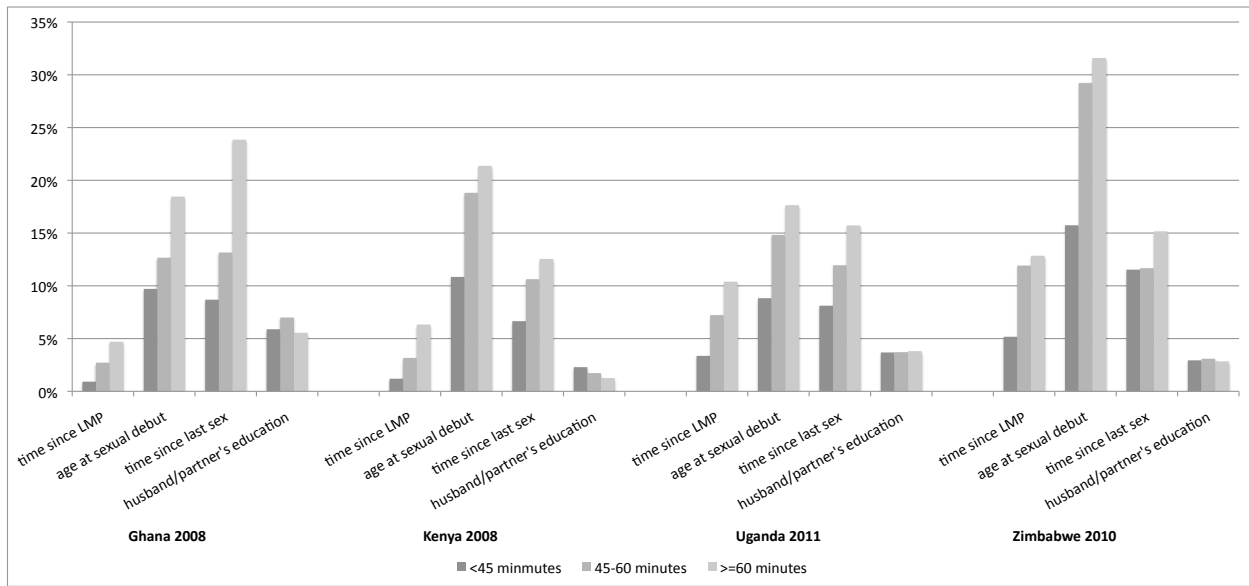
Table 3. Select data quality indicators by the most recent survey in each country

Survey	inconsistency in time since last menstrual period		inconsistency in age at sexual debut		inconsistency in time of last sex		incomplete response for husband/partner's education	
	n	%	n	%	n	%	n	%
Ghana 2008	4152	3.2	4152	14.8	3506	18.1	2844	5.9
Kenya 2009	7373	4.4	7373	18.2	6239	11.1	5280	1.5
Uganda 2011	7769	7.3	7769	14.0	6708	12.8	5910	3.8
Zimbabwe 2010	8464	8.5	8464	22.6	6998	12.6	6373	2.9
Average, unweighted		5.8		17.4		13.6		3.5

Note: See Appendix 3 for the definition of inconsistency variables.

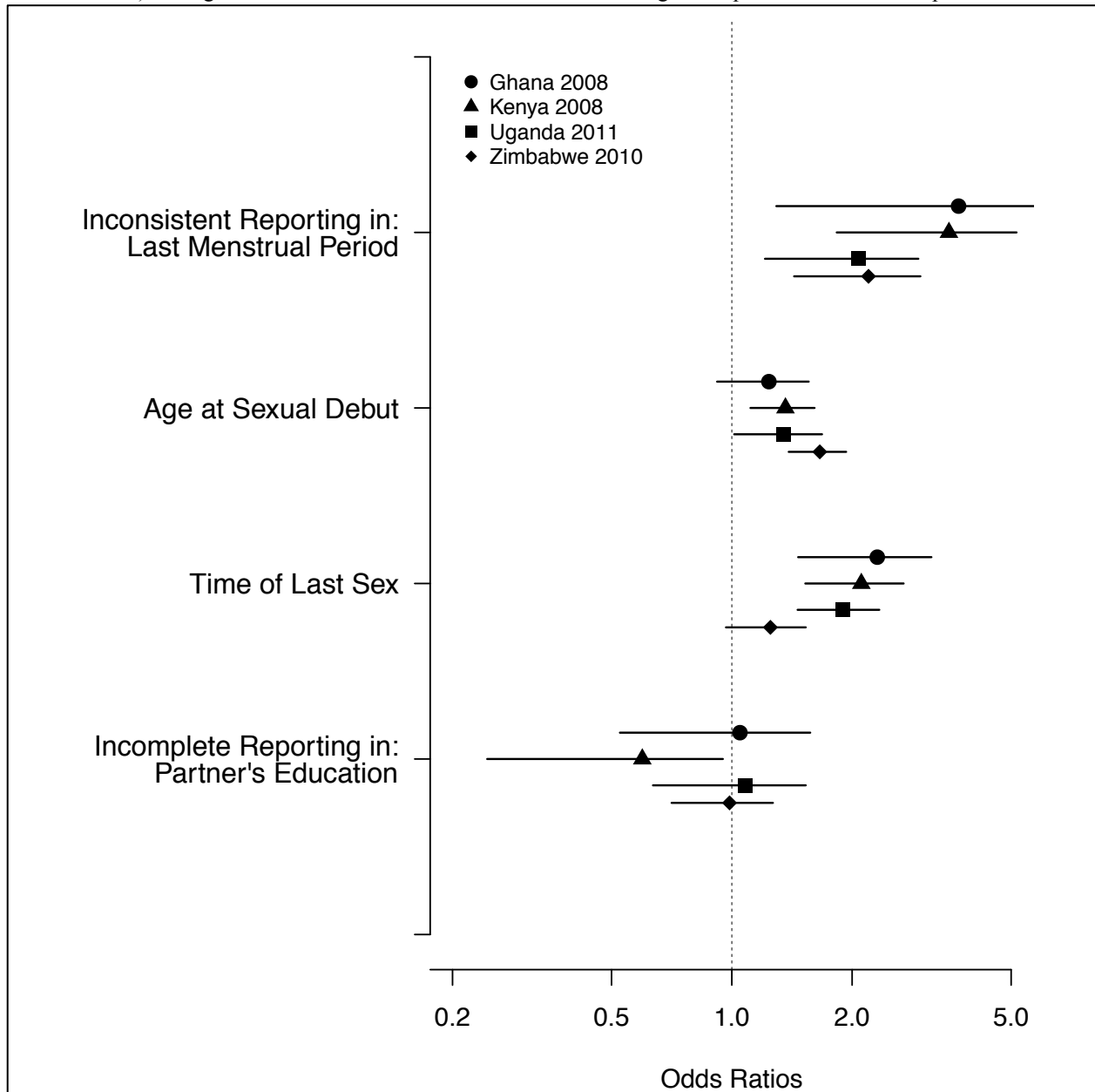


Figure 2. Data quality indicators\* by interview length and country



\*% inconsistency in responses for time since LMP (LMP), age at sexual debut, and time since last sex and % incomplete responses for husband/partner's education. Three inconsistency indicators are statistically significantly associated with the interview length categories in all five countries (chi-square test, p-value<0.5).

Figure 3. Adjusted\* odds ratio of inconsistent or incomplete reporting (with 95% confidence interval in the horizontal line) among those whose interview lasted 45 minutes or longer compared to their counterpart



\*Multivariate logistic regression model, controlling for age, education, residential area, and household wealth. See Appendix 5 for full results.

Appendix 1. Study countries and surveys

Country	Survey year	Survey sample size, women	Index pregnancies and children in the maternal and child health section	
			Pregnancies	Children
<b>Ghana</b>				
	1988	4,488	Live births in past 5 years	Living children born in past 5 years
	1993-94	4,562	Births in past 3 years	All children born in past 3 years
	1998	4,843	Live births in past 5 years	Living children born in past 5 years
	2003	5,691	Births in past 5 years	Living children born in past 5 years
	2008	4,916	Births in past 5 years	Living children born in past 5 years
<b>Kenya</b>				
	1988-89	7,150	Live births in past 5 years	Living children born in past 5 years
	1993	7,540	Births in past 5 years	All children born in past 5 years
	1998	7,881	Births in past 3 years	Living children born in past 3 years
	2003	8,195	Births in past 5 years	Living children born in past 5 years
	2008-09	8,444	Births in past 5 years	Living children born in past 5 years
<b>Uganda</b>				
	1988-89	4,730	Live births in past 5 years	Living children born in past 5 years
	1995	7,070	Births in past 4 years	Living children born in past 4 years
	2000-01	7,246	Births in past 5 years	Living children born in past 5 years
	2006	8,531	Births in past 5 years	Living children born in past 5 years
	2011	8,674	Births in past 5 years	Living children born in past 5 years
<b>Zimbabwe</b>				
	1988-89	4,201	Live births in past 5 years	Living children born in past 5 years
	1994	6,128	Births in past 3 years	Living children born in past 3 years
	1999	5,907	Births in past 5 years	Living children born in past 5 years
	2005-06	8,907	Births in past 5 years	Living children born in past 5 years
	2010-11	9,171	Births in past 5 years	Living children born in past 5 years

Appendix 2. Number of women by interview length calculation status by country and survey

Survey	Interview length calculated			Interview length not calculated due to:			Total
	included in analysis	excluded from analysis		multiple visits	inconsistent time value	time value missing	
		lower outlier	upper outlier				
Ghana							
1988	4,028	29	39	338	0	54	4,488
1993-94	4,006	35	40	436	25	20	4,562
1998	4,236	34	37	526	0	10	4,843
2003	5,002	28	50	558	0	53	5,691
2008	4,156	40	42	648	1	29	4,916
Kenya							
1988-89	6,504	56	66	432	0	92	7,150
1993	6,104	31	56	1,275	2	72	7,540
1998	6,677	58	65	1,004	0	77	7,881
2003	6,739	66	68	1,266	0	56	8,195
2008-09	7,373	64	75	914	0	18	8,444
Uganda							
1988-89	4,338	30	44	276	0	42	4,730
1995	6,373	64	62	410	0	161	7,070
2000-01	6,596	62	62	402	0	124	7,246
2006	7,594	72	76	701	0	88	8,531
2011	7,769	69	79	736	0	21	8,674
Zimbabwe							
1988-89	3,594	21	268	281	16	21	4,201
1994	5,045	46	50	894	0	93	6,128
1999	5,197	50	53	527	0	80	5,907
2005-06	7,921	72	75	625	103	111	8,907
2010-11	8,464	67	85	427	128	0	9,171
Total	117,716	994	1,392	12,676	275	1,222	134,275

Appendix 3. Select DHS flag variables indicating inconsistencies found in editing reported responses compared to computed values

Response	Inconsistencies
Time since LMP	<ul style="list-style-type: none"> <li>• Duration given is greater than the interval since the last birth and the respondent did not say, in the maternity section, that she was still amenorrheic since her last birth</li> <li>• Duration given plus the duration of amenorrhea after the last birth is greater than the interval since the last birth</li> <li>• Duration was reported, but the respondent's period had not returned since the last birth</li> <li>• Respondent reported her last period was before her last birth, but she had never given birth</li> <li>• Respondent reported never having menstruated, but reported in the maternity section that her period had returned after her last birth</li> <li>• Respondent reported her last period was before her last birth, but reported in the maternity section that her period had returned after her last birth</li> <li>• Respondent reported a duration since her last period, but this would place her last period during her last pregnancy</li> <li>• Respondent reported never having menstruated, but she had children</li> <li>• Duration was reported, but the duration would place her period before her last birth.</li> </ul>
Age at first sexual intercourse	<ul style="list-style-type: none"> <li>• Respondent reported age at first sexual intercourse that exceeds her current age</li> <li>• Respondent reported her age at first sexual intercourse as occurring more than one year after the conception of her first child</li> <li>• Respondent reported her age at first sexual intercourse as occurring up to one year after the conception of her first child</li> <li>• Respondent reported that her first sexual intercourse was at the time of her first marriage, but the respondent was never married</li> <li>• Respondent reported that her first sexual intercourse was at the time of her first marriage, but her first marriage occurred after the conception of her first child</li> <li>• Respondent reported her first sexual intercourse as being after her first marriage*</li> </ul>
Time since last sexual intercourse	<ul style="list-style-type: none"> <li>• Duration given is greater than the interval since the last birth and the respondent did not say, in the maternity section, that she was still abstaining from sexual relations since her last birth</li> <li>• Duration given plus the duration of abstinence after the last birth is greater than the interval since the last birth</li> <li>• Duration was reported, but the respondent had not resumed sexual intercourse since the last birth</li> <li>• Respondent reported her last intercourse was before her last birth, but she had never given birth</li> <li>• Respondent reported her last intercourse was before her last birth, but she was currently pregnant</li> <li>• Respondent reported her last intercourse was before her last birth, but reported in the maternity section that she had resumed sexual intercourse after her last birth</li> <li>• Respondent reported a duration since her last intercourse, but this would place her last intercourse before her last pregnancy</li> <li>• Respondent reported a duration since her last intercourse, but this response was inconsistent with her response concerning the number of times she had had sexual intercourse in the four weeks preceding the survey.</li> <li>• Duration was reported, but the duration would place her last sexual intercourse before her last birth.</li> </ul>

\* This reporting may well be intentional, rather than random inconsistency in reporting.

(Source: Standard recode manual for DHS 6. Available at [http://measuredhs.com/pubs/pdf/DHSG4/Recode6\\_DHS\\_22March2013\\_DHSG4.pdf](http://measuredhs.com/pubs/pdf/DHSG4/Recode6_DHS_22March2013_DHSG4.pdf))

Appendix 4. Select background characteristics by survey and country

<b>Country</b>					
<b>Ghana</b>					
<b>survey year</b>	<b>1988</b>	<b>1933</b>	<b>1998</b>	<b>2003</b>	<b>2008</b>
number of women*	4028	4006	4236	5002	4152
never attended school (%)	40.3	35.5	36.1	34.7	25.7
attended some primary (%)	52.6	54.7	16.7	19.8	21.0
attended secondary+(%)	7.1	9.7	47.2	45.4	53.3
parity (mean)	3.2	3	2.7	2.7	2.4
had 1+ births in the last five years (%)	61.3	59.1	49.2	49.8	44
had 2+ births in the last five years (%)	28.1	22.8	16.9	17.3	15.2
ever married (%)	81.5	81.6	78.1	74.2	68.5
currently married (%)	71.4	71	67.1	65.8	59.9
<b>Kenya</b>					
<b>survey year</b>	<b>1988</b>	<b>1993</b>	<b>1998</b>	<b>2003</b>	<b>2008</b>
number of women*	6495	6104	6677	6739	7373
never attended school (%)	24.3	18.3	13.1	17.1	15.5
attended some primary (%)	53.5	58.7	60.5	53.5	52.5
attended secondary+(%)	22.2	23.1	26.4	29.4	32.0
parity (mean)	3.6	3.2	3.0	2.8	2.7
had 1+ births in the last five years (%)	60.0	52.4	48.9	50.9	49.4
had 2+ births in the last five years (%)	32.0	25.3	20.8	21.6	20.5
ever married (%)	75.4	70.4	71.1	73.1	71.6
currently married (%)	68.2	62.1	62.8	62.5	61.2
<b>Uganda</b>					
<b>survey year</b>	<b>1988</b>	<b>1995</b>	<b>2000</b>	<b>2006</b>	<b>2011</b>
number of women*	4338	6373	6595	7594	7769
never attended school (%)	34.6	25.8	20.5	20.7	15.8
attended some primary (%)	53.0	55.6	56.9	58.1	55.7
attended secondary+(%)	12.4	18.5	22.6	21.2	28.5
parity (mean)	3.4	3.2	3.3	3.6	3.4
had 1+ births in the last five years (%)	61.3	61.1	59.1	59.7	57.6
had 2+ births in the last five years (%)	35.6	33.2	32.8	33.1	29.3
ever married (%)	79.6	82.8	78.8	77.5	76.1
currently married (%)	65.7	70.2	65.2	64	63.3
<b>Zimbabwe</b>					
<b>survey year</b>	<b>1988</b>	<b>1994</b>	<b>1999</b>	<b>2005</b>	<b>2010</b>
number of women*	3594	5045	5197	7921	8464
never attended school (%)	13.7	11.9	7.6	4.3	2.5
attended some primary (%)	56.6	49.5	43.8	33.8	29.5
attended secondary+(%)	29.7	38.7	48.5	61.9	68.1
parity (mean)	2.9	2.8	2.4	2.2	2.1
had 1+ births in the last five years (%)	53.4	48	48.5	46.2	48.3
had 2+ births in the last five years (%)	22.4	15.3	12.9	12	11.9
ever married (%)	73.4	73.6	72.7	73.5	75.3
currently married (%)	63	62.1	61.1	58.1	61.4

All estimates are un-weighted average.

\* Women who were included in analyses.

Appendix 5. Associations between interview length and data quality indicators by survey: individual characteristics by survey: multivariate linear regression analysis

	Odds ratio of inconsistent reporting of LMP				Odds ratio of inconsistent reporting of age at sexual debut			
	Ghana 2008	Kenya 2008	Uganda 2011	Zimbabwe 2010	Ghana 2008	Kenya 2008	Uganda 2011	Zimbabwe 2010
Interview length (ref.= <45 min)								
≥ 45min	3.693*** (1.225)	3.494*** (0.849)	2.070** (0.491)	2.198*** (0.391)	1.238 (0.163)	1.362*** (0.127)	1.348* (0.191)	1.660*** (0.139)
<i>Highest education level attended (ref.=no school)</i>								
Primary	0.903 (0.257)	0.617* (0.135)	0.822 (0.136)	1.127 (0.293)	1.314* (0.142)	1.229 (0.208)	0.937 (0.126)	1.221 (0.236)
Secondary +	0.884 (0.287)	0.404** (0.112)	0.805 (0.153)	0.984 (0.289)	1.097 (0.123)	0.870 (0.157)	0.690* (0.105)	0.954 (0.181)
<i>Residential area (ref.=rural)</i>								
Urban	1.341 (0.388)	0.735 (0.182)	0.759 (0.130)	0.973 (0.205)	0.981 (0.135)	1.002 (0.110)	0.924 (0.097)	0.953 (0.104)
<i>Wealth quintiles (ref. = middle quintile)</i>								
Lowest	1.045 (0.245)	1.315 (0.280)	0.855 (0.200)	1.227 (0.141)	1.018 (0.183)	0.818 (0.102)	1.169 (0.193)	0.914 (0.104)
Second	1.193 (0.302)	1.620* (0.313)	1.168 (0.196)	1.039 (0.110)	1.318* (0.146)	0.872 (0.086)	1.201 (0.130)	0.989 (0.109)
Fourth	0.719 (0.241)	1.205 (0.249)	0.682* (0.112)	0.737 (0.135)	0.972 (0.133)	1.060 (0.118)	1.082 (0.135)	1.026 (0.097)
Highest	0.468 (0.201)	1.191 (0.326)	0.506*** (0.091)	0.485*** (0.085)	0.857 (0.164)	1.068 (0.129)	0.958 (0.128)	0.905 (0.084)
<i>Age groups, in years (ref. = 21-25)</i>								
15-20	0.246*** (0.084)	0.381*** (0.090)	0.343*** (0.080)	0.469*** (0.074)	0.185*** (0.047)	0.221*** (0.035)	0.290*** (0.047)	0.248*** (0.036)
26-30	0.870 (0.251)	0.799 (0.117)	1.024 (0.146)	0.932 (0.122)	1.181 (0.169)	1.417*** (0.146)	1.077 (0.124)	1.450*** (0.134)
31-35	0.604 (0.160)	0.811 (0.128)	1.039 (0.151)	1.000 (0.121)	1.694*** (0.265)	1.658*** (0.163)	1.225 (0.133)	1.417*** (0.128)
36-40	0.451** (0.136)	0.610** (0.116)	0.602** (0.098)	0.663** (0.084)	1.907*** (0.322)	1.703*** (0.179)	1.018 (0.117)	1.584*** (0.147)
41-45	0.257*** (0.086)	0.217*** (0.068)	0.237*** (0.061)	0.368*** (0.072)	2.261*** (0.364)	1.712*** (0.191)	1.378* (0.174)	1.284* (0.133)
46-49	0.211** (0.103)	0.245*** (0.094)	0.186*** (0.072)	0.122*** (0.042)	1.530** (0.238)	1.407* (0.189)	0.837 (0.158)	1.518*** (0.184)
N	4152	7373	7769	8464	4152	7373	7769	8464

Standard errors in parentheses. \* p<0.05, \*\* p<0.01, \*\*\* p<0.001"

## Appendix 5. continued.

	Odds ratio of inconsistent reporting of time of last sex				Odds ratio of incomplete reporting of husband/partner's Education			
	Ghana 2008	Kenya 2008	Uganda 2011	Zimbabwe 2010	Ghana 2008	Kenya 2008	Uganda 2011	Zimbabwe 2010
Interview length (ref. = <45 min)								
≥ 45min	2.312*** (0.432)	2.109*** (0.297)	1.900*** (0.251)	1.249 (0.144)	1.048 (0.267)	0.597 (0.180)	1.083 (0.256)	0.987 (0.143)
<i>Highest education level attended (ref.=no school)</i>								
Primary	0.705** (0.091)	0.841 (0.144)	0.813 (0.092)	0.813 (0.231)	1.056 (0.234)	0.848 (0.301)	1.052 (0.236)	1.240 (0.482)
Secondary +	0.516*** (0.069)	0.856 (0.171)	0.817 (0.117)	0.754 (0.216)	0.510** (0.120)	0.397* (0.184)	0.762 (0.221)	0.711 (0.314)
<i>Residential area (ref.=rural)</i>								
Urban	1.407* (0.228)	1.081 (0.149)	1.316* (0.157)	0.896 (0.129)	1.171 (0.280)	2.946** (1.086)	1.140 (0.257)	1.784* (0.475)
<i>Wealth quintiles (ref. = middle quintile)</i>								
Lowest	1.677** (0.266)	1.251 (0.182)	2.566*** (0.354)	1.082 (0.135)	0.659 (0.182)	1.169 (0.486)	0.807 (0.206)	0.960 (0.216)
Second	1.241 (0.203)	1.047 (0.139)	1.285 (0.175)	1.035 (0.138)	1.062 (0.282)	1.281 (0.656)	1.179 (0.283)	0.892 (0.171)
Fourth	0.719* (0.114)	0.886 (0.118)	1.002 (0.138)	0.847 (0.100)	1.020 (0.217)	1.483 (0.622)	1.396 (0.326)	0.632 (0.207)
Highest	0.454*** (0.101)	0.637* (0.112)	0.727* (0.114)	0.822 (0.122)	1.005 (0.323)	0.739 (0.396)	2.655*** (0.741)	0.437* (0.155)
<i>Age groups, in years (ref. = 21-25)</i>								
15-20	0.774 (0.133)	1.458** (0.190)	1.022 (0.156)	1.392** (0.156)	1.293 (0.713)	2.113 (1.000)	0.326** (0.139)	0.884 (0.342)
26-30	0.996 (0.172)	0.708** (0.087)	0.809 (0.095)	0.875 (0.105)	0.894 (0.207)	1.899 (0.749)	0.739 (0.133)	1.154 (0.300)
31-35	0.782 (0.115)	0.494*** (0.074)	0.768* (0.093)	0.875 (0.096)	0.909 (0.194)	1.478 (0.594)	0.787 (0.140)	1.181 (0.289)
36-40	0.715** (0.091)	0.561*** (0.083)	0.710* (0.103)	0.649** (0.094)	0.965 (0.222)	1.883 (0.846)	1.015 (0.189)	1.587 (0.418)
41-45	0.348*** (0.083)	0.240*** (0.051)	0.363*** (0.059)	0.467*** (0.080)	0.870 (0.240)	1.494 (0.707)	0.872 (0.157)	1.341 (0.373)
46-49	0.192*** (0.051)	0.128*** (0.033)	0.340*** (0.073)	0.350*** (0.081)	1.436 (0.392)	1.841 (0.784)	0.980 (0.191)	1.148 (0.395)
N	3506	6239	6708	6998	2844	5280	5910	6373

Standard errors in parentheses. \* p&lt;0.05, \*\* p&lt;0.01, \*\*\* p&lt;0.001"



Appendix 6. Number of unique languages collected by survey

Country	Survey year	Language of questionnaire	Language of Interview	Women's language
Ghana	2008	4	7	8
Kenya	2008-09	14	15	15
Uganda	2011	8	12	13
Zimbabwe	2010-11	3	5	-

- data not available in the survey.

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