# *Transforming National Population Surveys in Developing Countries with Mobile Phone Technology*[1]

*[1]Scott Radloff, [1]Amy Tsui, [1]Hannah Olson, [1]Linnea Zimmerman, [1]Luke MacDonald, [2]Easmon Otupiri, [3]Solomon Shiferaw, [3]Assefa Seme, [4]Peter Gichangi, and [5]Fredrick Makumbi*
*[1]The Bill & Melinda Gates Institute for Population and Reproductive Health*
*Johns Hopkins Bloomberg School of Public Health*
*[2]Kwame Nkrumah University of Science and Technology*
*[3]Addis Ababa University, Ethiopia*
*[4]International Center for Reproductive Health, Kenya*
*[5]Makerere University School of Public Health*

## Background

Mobile phone technologies have advanced markedly in recent years, such that today's smartphones can perform a wide variety of functions previously possible only with much larger and more expensive computing devices. In addition, the strength and reach of mobile phone networks have advanced to a point where data can be uploaded in urban and rural areas alike in most countries of the world. Given these technological advances, it is now possible to utilize smartphones to collect and transmit data to a cloud server for close to real-time aggregation, analysis, and reporting.

Over the past two years, the Performance Monitoring and Accountability (PMA) 2020 project, in partnership with country research organizations, has launched and completed nationally-representative household surveys in seven countries: Ghana, Democratic Republic (DR) of Congo/Kinshasa, Ethiopia, Kenya, Uganda, Burkina Faso, Nigeria/Kaduna & Lagos states, using mobile phone technology. New surveys are soon to be launched in Indonesia, Niger, Pakistan, and one Indian state.

***PMA2020 Surveys.*** PMA2020 is a five-year research project that supports rapid-turnaround surveys to monitor progress in contraceptive access and use and track equity and quality dimensions of family planning service delivery. It also assesses water, sanitation and hygiene environments at the household level. The project uses Android smartphones to efficiently collect and transmit the data to a central, cloud server – for immediate aggregation and close to real-time tabulation and analysis. The project employs a network of female resident enumerators (REs), recruited from or near sample clusters, that are systematically selected using a multi-stage design. The REs are trained to use the smartphones to gather survey data from a probability sample of households and facilities within their communities. Once trained, they can be deployed to conduct multiple survey rounds .

[1] The PMA2020 project relies on the talents of a large number of individuals, both in the U.S. and at the different sites. Special thanks are given to Saifuddin Ahmed, Caroline Moreau, Stan Becker, Kellogg Schwab, Qingfeng Li, Jose Rimon, Jane Bertrand, Philip Anglewicz, and Win Brown for their technical support. The project team is also grateful for support from the Bill & Melinda Gates Foundation.

Surveys are fielded within a 4-6 week period with data tabulations completed and disseminated shortly thereafter. Data are fed back at the national and subnational levels to inform policies and program practice.

The project will support surveys in 10 countries. In each country, a local partner is engaged to implement the survey with technical and resource support provided by the project based in the Gates Institute at the Department of Population, Family, and Reproductive Health, Johns Hopkins Bloomberg School of Public Health.

**Aims**

This paper provides preliminary assessments of the survey experience to date using mobile technology. We focus on six main design elements: smartphone technology, human resources, sample design, measurement instrumentation, fieldwork, and analysis. We conclude with a comparison of survey estimates obtained by both the DHS and PMA2020 in the same countries and their respective precision as judged by the margin of error.

**Data and methods**

First, to outline the survey program differences, comparisons are made for the design elements between PMA2020 and the Demographic and Health Survey, which is the standard bearer for household surveys in low-income countries. Table 1 contrasts the two along ten design elements. Unfortunately, it is not possible to include a cost comparison with the DHS due to data unavailability.

Second, we analyze PMA2020 survey implementation data for speed of submissions, mean interview time, resident enumerator characteristics, and accuracy of national estimates of modern contraceptive prevalence.

**Results**

***1. Smartphone technology***

The growth of information and communication technologies and mHealth applications in low income countries present ideal tools for generation and analysis of family planning statistics. PMA2020 has thus far been relying on one particular product, the Alcatel 5020D, which is a 3G-capable dual-sim smartphone with an operating system of Android 4.1 or better, a 4-inch display screen and a unit cost under US$200.

There are now several software packages with the ability to build survey data collection forms for smart devices; PMA2020 uses Open Data Kit (www.opendatakit.org), a free and open-source programming tool for mobile data collection.

The phone must be equipped with a camera and an augmented GPS receiver to record the geo-coordinates of households and health facilities from which distances can be calculated. An image of the household front door is taken with permission and without the visible presence of persons. The GPS coordinates also provide survey supervisors with a means of verifying surveys were completed by REs at the appropriate locations. GPS location, and any other respondent identifying information, is redacted from analysis and public access files.

Data are sent to and aggregated on a secure cloud server with restricted access. Every twelve hours, data are downloaded using ODK Briefcase, a program written to convert data into a format readable by standard statistical analysis software, and examined for inconsistencies and quality assurance. Multiple protocols are in place to limit data loss, including internal backups within the phone and external backups to an additional cloud-based storage location. In the event that data are not received by a central cloud server, available through different service providers, they can be recovered from either the backup cloud server or the phone's password-protected internal hard drive.

Data transmission depends on the penetration of mobile data connection networks in each country. Current coverage ranges from 20% in Niger, to nearly 50% in Ghana (GSMA, 2013). Subscriber growth in Africa, however, is rapidly increasing, even though regional coverage averages about 30%, as compared to 73% for Asia-Pacific. In the absence of 3G/4G networks, transmission speeds can be slow. However, the transmission of data from the phone can also take place through Wi-Fi networks and hard transfers to other devices, such as laptops. One data gathering complication has been slowness in readings of geo-positioning information, when connecting with satellite systems is difficult, an issue that arises on professional dedicated GPS devices as well.

To assess actual field experience with data uploads, PMA2020 has introduced questions to REs at refresher trainings that yield percentages of enumeration areas where data uploads through the cell network are possible. Where this is not possible, it is possible to know the average travel time for an RE to find a "hotspot" for data uploading.

### *2. Human Resources*

Conventional surveys in low-income countries rely on centrally recruited, trained and deployed field teams to conduct person-to-person interviews. The teams often consist of a field supervisor, field editor, and 3-4 interviewers usually of the same gender as target respondents. The teams travel between selected enumeration areas and so incur travel and accommodation costs as data are collected. Once data collection is completed, the field staff are disbanded or transferred to another survey project.

PMA2020 resident enumerators are a decentralized network of trained female interviewers. Female interviewers are used due to the topical content of the survey. The numbers of EAs and REs recruited in the countries/settings are shown in the table below. Some sites recruited extra REs for back-up and others were unable to recruit one per EA and thus have slightly fewer than expected.

The desired qualifications for an RE are a secondary school education, technology savvy and comfort, residence in or near the selected enumeration area (EA), maturity for interpersonal interactions, fluency in the local community language as well as the featured language in the survey instrument, and physical mobility to move around for listing, mapping and interviewing. We have also avoided using health workers; this could introduced response bias since the enumerators are assessing the quality of the service environment.

Figure 1 dispays the age, marital status, parity, job status, education and EA residence of REs in Kenya, Ghana and Uganda, as well as for Kaduna State in Nigeria. Based on the profile information for the REs displayed in Figure 1, most are in their 20's; about half are married; half have no children; roughly two-thirds are unemployed or employed part-time; nearly 70% are educated beyond secondary school; and about 70% live in or near (within 10km of) their enumeration areas. The bar charts show that there is some amount of variation in the profiles across the 4 countries. Experience has shown that younger REs are more able to learn the mobile phone technology. This needs to be counterbalanced by the ability of more mature REs to elicit honest responses when interviewing older women. The RE profiles can be used to assess those characteristics most closely associated with retention – and so may inform future recruitments.

Key to the long-term viability of this survey approach, is the resilience of the RE network. The recurrent costs for maintaining the network hinges on the ability to retain skilled enumerators over time, reducing costs associated with training new enumerators. Experience in retention is presented in the chart immediately below for 4 countries: Ghana, Ethiopia, Kenya, and Uganda. In each country, the project experienced some level of RE attrition between each survey round. This is especially true between Round 1-2 in both Ethiopia and Kenya, both with double-digit attrition. Attrition between Round 2-3 was markedly lower in both countries, dropping from 14 to 6% in Ethiopia and from 13 to 4% in Kenya. Lower attrition is observed for Ghana and Uganda – both experiencing 4-6% attrition between survey rounds. While it is still early, countries seem to be converging on 4-6% as a steady state. Attrition has been attributed to a number of factors: migration, taking other jobs, and termination due to poor performance. Of special note is that in 3 of the 4 countries, the number of enumerators trained was fewer than the number of enumeration areas. This was due to a combination of difficulty recruiting in certain geographies and recruits who were unable to complete the training or perform their duties. In these instances, other REs from nearby enumeration areas did double-duty or supervisory staff stepped in to conduct these interviews.

| Country | # of Enumeration Areas | # of REs trained for Round 1 | Attrition Round 1-2 | Attrition Round 2-3 |
|---|---|---|---|---|
| Ghana | 100 | 118 | 4 (4%) | 5 (5%) |
| Ethiopia* | 200 | 182 | 25 (14%) | 6 (3%) |
| Kenya* | 120 | 118 | 15 (13%) | 5 (4%) |
| Uganda | 110 | 106 | 6 ( 6%) | -- |

** In addition, the Ethiopia team promoted two REs to supervisor for Round 2; the Kenya team promoted two REs to serve as coordinators, each supervising 13-14 REs for Round 2 as well as continuing to conduct interviews in their own assigned enumeration area.*

The female questionnaire asks the RE to record whether and how well she knows the respondent. Because REs are recruited from or near their enumeration area, they may be acquainted with some of the women they interview. We explore this association with responses received on a number of potentially sensitive questions, as seen in Table 2. The

patterns suggest the acquaintance effect varies across questions but does not systematically bias responses. Non-response rates to questions about being a co-wife, being currently pregnant, experiencing child loss, reporting on last menstrual period and timing of first and recent sex are small overall and only nominally higher if the RE is very well acquainted with the respondent.

### *3. Sample design*

The PMA2020 survey uses a multi-stage cluster sample design, akin to the Demographic and Health Survey (DHS), to draw a probability sample of households, eligible females and service delivery points (SDPs). Each EA has approximately 200 households. The indicator used to power the female survey is modern contraceptive prevalence rate among all women ages 15 to 49 with a minimum margin of error of ±2 percentage points at the national level and ±3 percentage points for urban and rural strata. The SDP sample is linked to the selection probability of the enumeration areas. At the EA level, the RE lists and maps all households and private health facilities. She is assigned a random selection of 35-44 households, depending on the number of eligible women per household, and consents the household and female respondents for interviews. She also conducts the SDP survey for up to 3 randomly selected private facilities. Supervisors obtain the list of public health facilities that have the selected EAs in their catchment areas. In general each EA is linked to a health post, health center, and district/referral hospital that are surveyed.

The sampling approach follows those for standard household surveys, including the DHS. However, the DHS' Service Provision Assessment (SPA) is conducted as an independent survey and not linked to the EAs of DHS household/population survey. The PMA2020 approach seeks to assess the service availability environment for EA residents and distances to facilities qualified to supply contraceptive methods, irrespective of whether they actually provide or not. The SPA approach, unless it is a census of all health facilities, does not enable a link between the consumer population and the proximate supply environment.

The two differ in interpretation as well. The SPA provides a measure of the percent of health facilities (sampled from a frame) with selected characteristics. The PMA2020 SDP survey provides a measure of the percent of household residents or eligible women with access to facilities with selected characteristics linked to their cluster. If a national frame of SDPs, both public and private, is available, the PMA facility sample can be weighted to provide SPA-type measures.

### *4. Measurement instrumentation*

*Question wording.* The vast majority of questions included in the PMA2020 household and female questionnaires are taken from the DHS and many of those used in the SDP survey from the SPA. Thus in terms of measurement reliability, results from the two types of surveys should be directly comparable. The PMA2020 female and SDP survey questionnaires are designed to measure indicators that are core to FP2020[2] and the country's family planning efforts. This constraint on content keeps the questionnaire

[2] See www.familyplanning2020.org

focused and brief to be administered in a short period of time.

*GPS performance/accuracy.* As mentioned earlier, photo images of the household door/gate and GPS readings for the household and SDP locations are obtained. REs report delays in obtaining GPS readings when satellite response is slow or in urban areas if there are high rise obstructions. The REs are instructed to obtain GPS readings with an accuracy equal to or less than 6m. At refresher trainings, REs are asked to report their experience in generating GPS readings at the selected households and facilities. The percent of households where accurate GPS readings were attained can be calculated directly from the data while the average amount of time spent to obtain that reading will be reported by REs.

*Utility of platform for other data collection.* The PMA2020 survey platform was designed to accommodate added rounds of data collection, encompassing other health sectors. Since the fieldwork is completed in a 4-6 week period, the resident enumerators become idle for several months between survey rounds. This idle time could easily be used for other data collections. The first example for this was in Uganda, where the enumerator network was employed to conduct a survey on the burden of surgically-reparable conditions in the population. This survey was fielded between the first and second rounds of the FP/WASH survey, during August-September 2014. The survey was originally to have been implemented using traditional paper-and-pencil modality by a consortium comprised of Duke University, University of Minnesota, and Makerere University. It required programming the survey instrument into ODK, bringing all enumerators and supervisors together for a 3-day training on the new module, oversight of the fieldwork, and data management and analysis. The consortium selected 24 households in each of 105 enumeration areas and a short questionnaire was administered; fieldwork was completed in 3 weeks with 2,315 households interviewed, leading to the production of a results report soon thereafter.

### *5. Field implementation*

*Connectivity to mobile network.* For the resident enumerators to upload data requires having an adequate connection to a mobile network. Once the enumerator has completed a questionnaire, she is instructed to save it and upload the data via the mobile network. If she has a poor signal, she can move to the next household and continue data collection until she has found a location with a stronger signal. If none can be found in the enumeration area, she can travel to a hotspot located outside the enumeration area. Our experience in Kenya, displayed below, shows that 68% of REs were able to find an adequate connection throughout her enumeration area; 18% were able to find a hotspot somewhere within her enumeration areas; and 14% had to travel outside her enumeration areas to find a hotspot for uploading the survey data forms. These percentages will vary from country-to-country, but over time, there should be greater numbers able to connect.

| Connection status in Kenya | Number | Percent |
|---|---|---|
| *Found connection at each interview site* | *82* | *68%* |
| *Found a hotspot within enumeration area* | *21* | *18%* |
| *Found a hotspot outside enumeration area* | *17* | *14%* |

| | | |
|---|---|---|
| Total | 120 | 100% |

*Connectivity to obtain GPS coordinates.* Before submitting forms to the server, the resident enumerator is asked to take a GPS reading from outside the entry area to the household or facility being interviewed. Instruction tips are given for finding a signal that will yield a reading accurate within 6 meters. This can often take time and patience. During the refresher training for REs in Uganda, held just before commencing with the second round of data collection, they were asked about their experience in obtaining accurate GPS readings. The results are shown below. Most all, 90%, were able to get an accurate reading and only 3% were unable to at all, with the remaining 6% able to get a reading sometimes. Of those who were able to get an accurate reading, 26% obtained a reading in less than a minute, 59% required 1-5 minutes, and 15% required more than 5 minutes. So in most instances, obtaining GPS readings often required patience, but was not an insurmountable task.

| GPS Connection Experience in Uganda | | |
|---|---|---|
| Were you able to get GPS coordinates? | Number | Percent |
| *Yes* | *57* | *90%* |
| *Sometimes* | *4* | *6%* |
| *No* | *2* | *3%* |
| *Total* | *63* | *100%* |
| If so, how long did it typically take? | | |
| *< 1 minute* | *16* | *26%* |
| *1-5 minutes* | *36* | *59%* |
| *> 5 minutes* | *9* | *15%* |
| *Total* | *61* | *100%* |

*Turnaround time.* PMA2020 survey rounds have been completed in a 4-6 week period each with the production of an initial "key indicator report" (two pager) within 2-4 and a detailed report within 4-6 weeks after data collection is complete, creating close to real-time data processing. Figure 2 below provides a comparison of the timing of interview submissions across five surveys. The majority of interviews are submitted in the first 40-45 days of data collection. The spikes likely represent weekends, when many REs are available to conduct their work. After this period, many of the spikes are associated with interview forms that were not successfully transmitted by REs and subsequently uploaded by supervisors/data managers.

Figure 3 shows the mean length of interviews by date of submission. The interview duration record begins when an RE first attempts to conduct an interview – once the form is opened on the smartphone, time will continue to accumulate until the RE has either finished the interview or attempted three visits. We expect that forms submitted later in the period reflect those questionnaires that were more difficult to complete, and thus, have longer interview times. The data confirm this and demonstrate that REs are attempting

multiple visits.

### *6. Analysis*

PMA2020 surveys are conducted in the same countries where DHS surveys also take place. We can compare indicators measured by the two survey programs in proximate years, which so far is possible for Ghana, DR Congo, Ethiopia, Kenya and Uganda. To illustrate the comparability of results from the smartphone-based PMA2020 survey with the DHS, in Table 3 we provide the estimated modern contraceptive prevalence rates for six countries, although the Democratic Republic of Congo sample and data are limited to the capital city of Kinshasa only.

An important gauge of accuracy is the width of the margin of error. Figure 4 shows the 95% confidence interval around the national (or city) estimates, which equates to ±2 percentage point. The larger sample sizes of DHS surveys, typically designed to provide subnational estimates, generate point estimates with smaller error margins. As seen in Table 3, in the case of Kinshasa, the PMA2020 estimate of 18.2% is very close to the DHS estimate of 19.0% for nearly the same period. In Ghana and Uganda, the confidence intervals overlap suggesting the change may not be statistically significant at $p<.05$. However, the substantial increase in estimated mCPR in Kenya is significant and likely so at $p<.10$ for Ethiopia. Given the semi-annual periodicity of PMA surveys, pooling two rounds will about double the sample and narrow the confidence bands interval for further comparisons with DHS estimates. Also of note is that the margin of error around trend data collected by PMA is narrower than for point estimates, since we are tracking a panel of enumeration areas over time; we draw a new sample of households in each round, but from the same cluster.

Last, the trends in mCPR estimates are tracked by the United Nations Population Division, with time-sequenced confidence bands calculated using a Baysean probability density function. Trend estimates for mCPR are presented in Figure 4 for 5 countries. PMA point estimates are displayed alongside DHS and other survey data. The graph shows the PMA survey estimate to be roughly in line with prior survey estimates. In Kenya, the PMA estimate came it higher than would have been predicted based on recent trends – but since releasing this result, the DHS has produced an estimate that is very similar, which reinforces this accelerated trend. In Uganda, the PMA point estimate is slightly lower than would have been predicted from past trends – essentially showing no change since the last DHS in 2011. Overall, the results with respect to mCPR provides affirmation of the potential for using smartphones and resident enumerators for rapid survey monitoring of contraceptive practice and other health and development indicators.

## Discussion

PMA2020 employs technological innovation at every stage of survey implementation from data collection to aggregation, analysis, and dissemination, tapping the capacity of smartphones and other mobile devices, telecommunication networks, and national networks of female enumerators based in the sample clusters. Their familiarity with local respondents does not appear to bias responses unduly and the project has benefited from

their insights, adaptive postures and flexibility to changes needed in real-time, such as modifying question wording.

Experience has shown that enumerators can be trained within a 2-week period to conduct the survey using smart phones. Fieldwork can be completed within a six-week period and that key indicators can be generated and populated within a report within a few weeks after data collection concludes. This is made possible, in part, by the ability to track implementation progress and to begin cleaning the data as the fieldwork is underway.

Data generated are largely consistent with DHS data within the margin of error associated with sampling. PMA2020 precision can be enhanced by pooling data in consecutive rounds. The full value of PMA2020 data is now being realized as multiple rounds are completed and a picture of indicator trends produced.

Still to be learned is the long-term resiliency of the enumerator network. We have seen variation in the levels of attrition across countries, but generally note greater retention with time. Higher rates of retention will result in greater cost-efficiencies with the reduction in new trainings. The project is exploring the factors contributing to retention, as well as searching for ways of reducing costs in other ways – without sacrificing quality.

As mobile communication coverage increases penetration into rural areas in low-income countries, the potential to deploy rapid surveys frequently increases. PMA2020 is incorporating other technological changes in its design and using lessons from one setting to strengthen applications in others. An important area for intensified effort is community-level dissemination, to investigate how REs may help share results to local health authorities and civic leaders that will assure program accountability is also part of the transformation equation.

Figure 1. Selected characteristics of PMA2020 Resident Enumerators in four countries and one Nigerian state

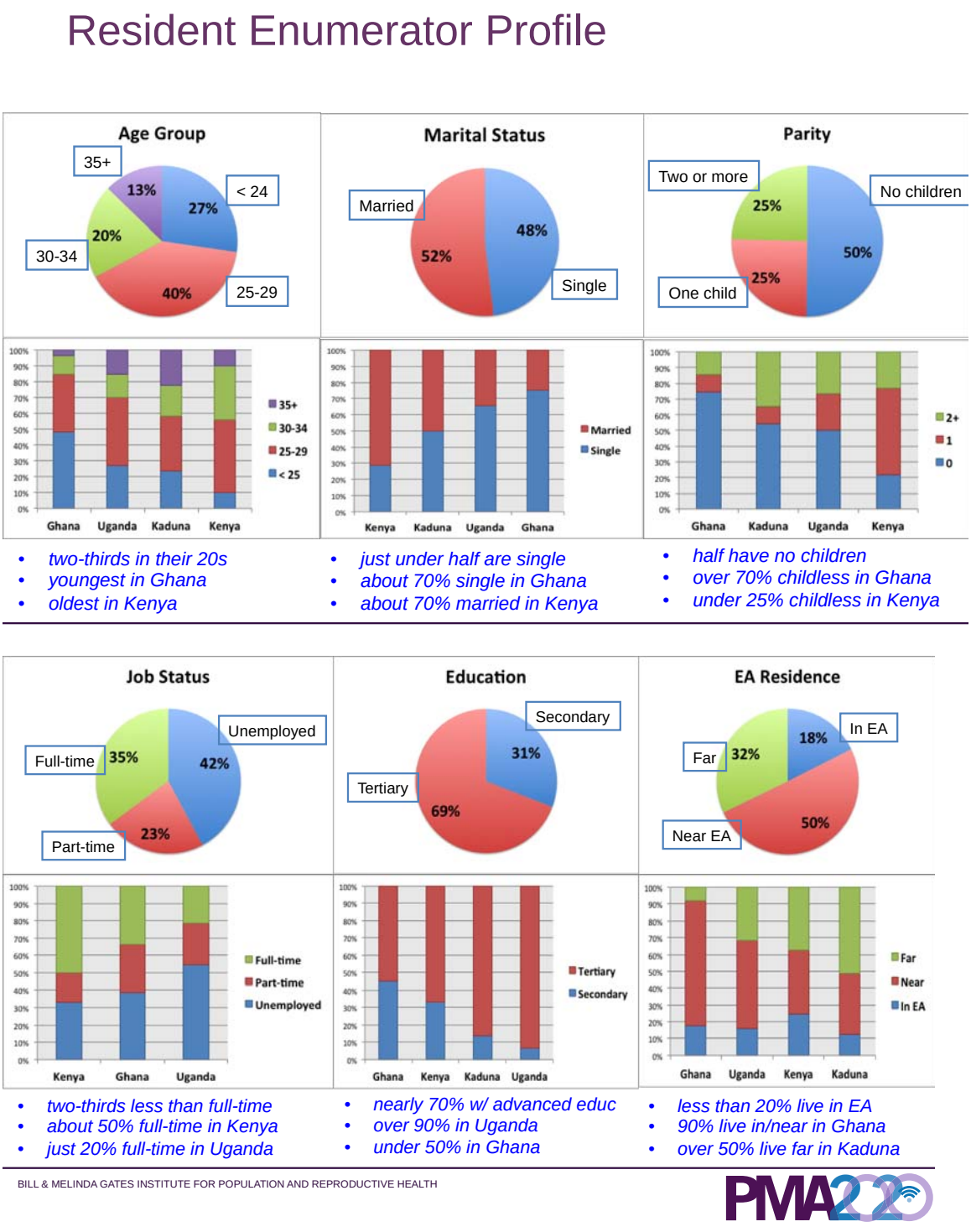


Figure2. Number of interview form submissions per day across four countries and five survey rounds by collection duration

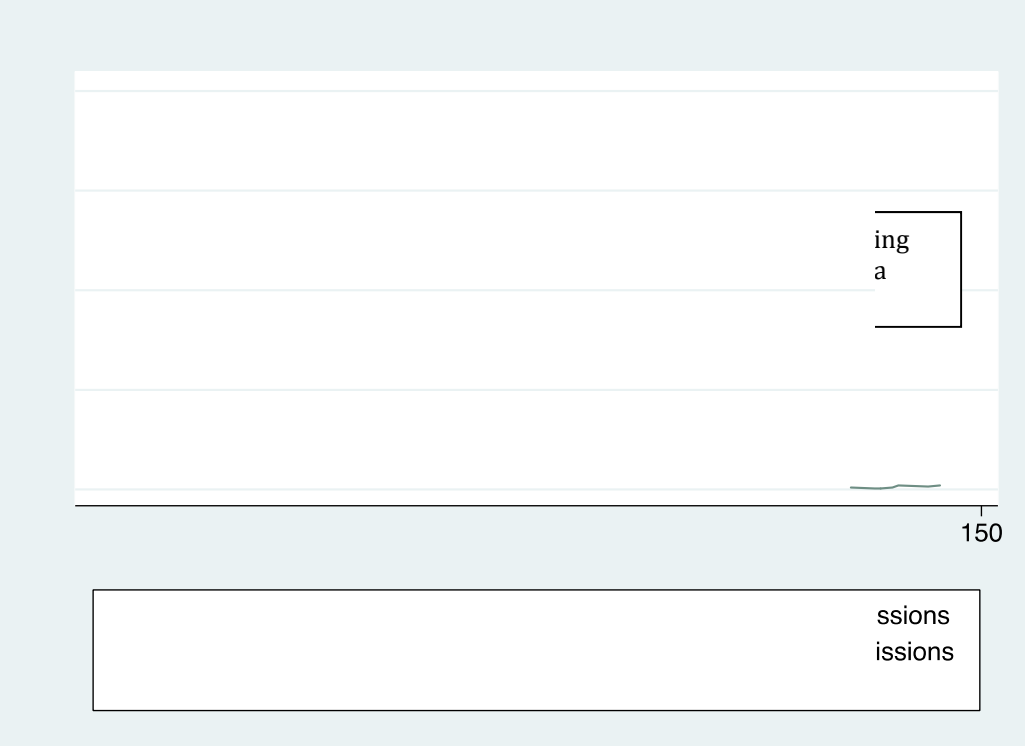



Figure 3. Mean duration for form completion by fieldwork day across four countries

Figure 4. National estimates of modern contraceptive prevalence rates for married women age 15 to 49, and 95% confidence intervals, in six countries: PMA 2013-2014 and latest DHS

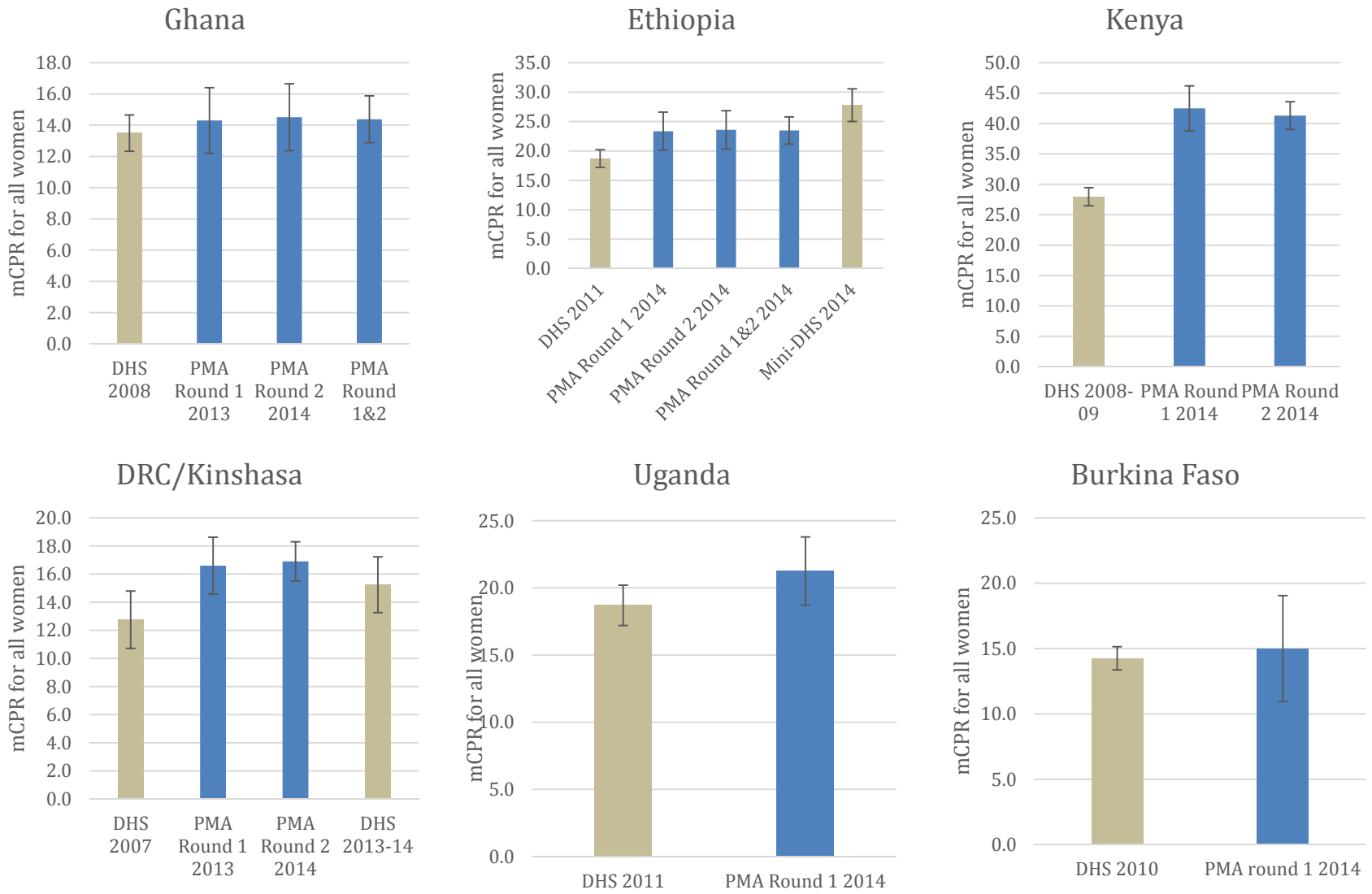
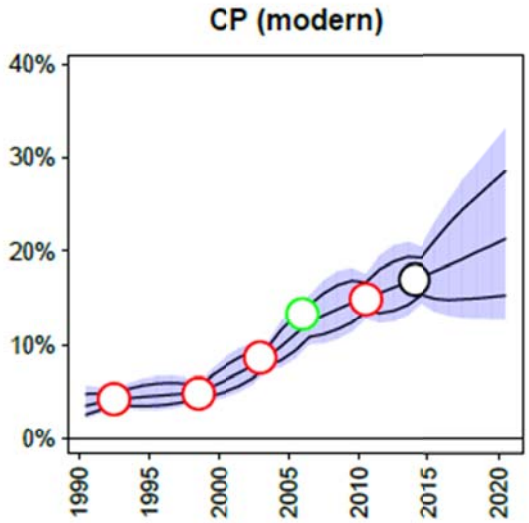
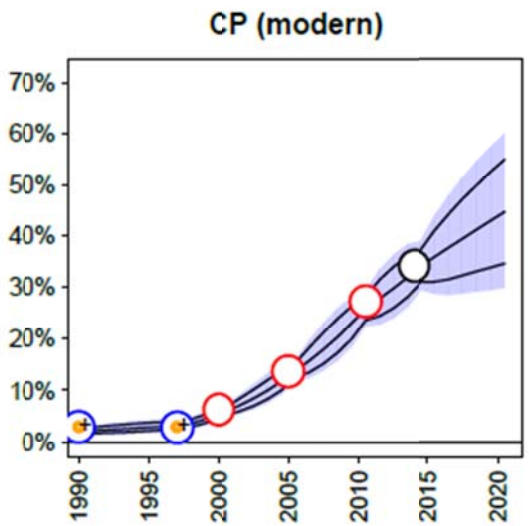


Figure 5. United Nations Model-based Estimate of Modern Contraceptive Prevalence Rate for Burkina Faso, Ethiopia, Ghana, Uganda, and Kenya Faso

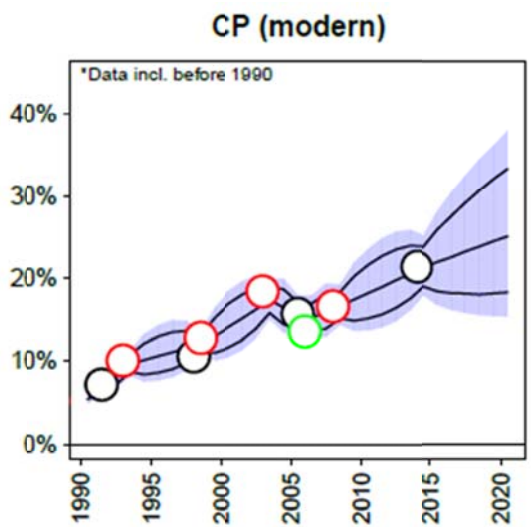
Burkina Faso



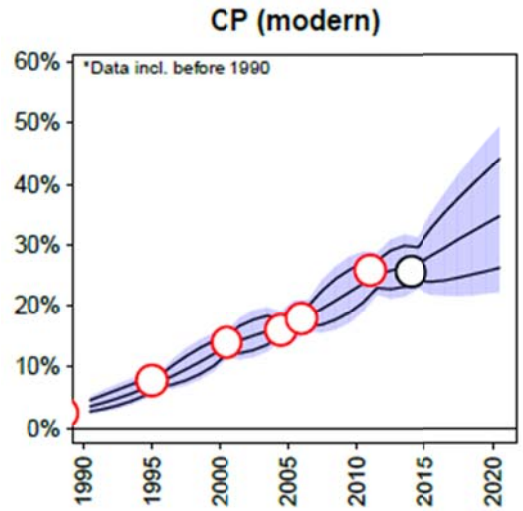

Ethiopia



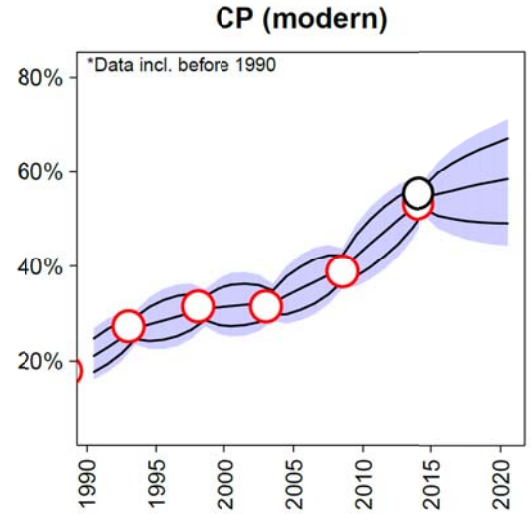

Ghana




Uganda




Kenya




- DHS
- MICS
- Other international survey
- National survey

Table 1. Comparison of design elements for Demographic and Health Surveys and Performance Monitoring and Accountability Surveys

| **Design element** | **DHS** | **PMA** |
|---|---|---|
| Smart device | Paper, PDA, tablets of different specifications over the years | Mobile/smart phone using Android OS 4.1 or higher with GPS and camera |
| Human resources | Supervisors and interviewers recruited, trained and deployed for dedicated fieldwork time | Resident enumerators--a female residing in/near selected enumeration area of about 200 households; trained to use ODK forms on smartphone and in survey procedures similar to DHS |
| Survey Instruments | Household<br>Female<br>Male<br>Service provision assessment | Household<br>Female<br>--<br>Health facility |
| Survey respondent(s) | Eligible female 15-49 years<br>Eligible males 15-59 years<br>Health facility manager | Eligible females 15-49 years<br>--<br>Health facility manager |
| Measurement | Personal interview of >1 hour duration<br>Biomarkers<br>Anthropometry | Personal interview for 30 minute duration on average |
| Sample design | Probability sample of households<br>Occupants enumerated to identify eligible female and male respondents<br>Health facilities survey (SPA) independently conducted using master list of health facilities, largely public sector | Probability sample of households<br>Occupants enumerated to identify eligible female respondents<br>Health facilities identified through listing/mapping and interviews with local public health authorities |
| Field implementation | Approximately 4 months (large samples often 10,000 women or more) | Approximately 6 weeks (sample sizes range 3500 to 7000 females) |
| Periodicity | Every 5 years | Annually (semi-annually in initial 2 years) |
| Data collection/editing | Reduced reliance on manual data entry; data uploaded between devices from field to central levels | Continuous capture of completed interview data on cloud-based server with multi-site monitoring of data coverage, completion, quality |
| Analysis | Preliminary report about 50 pages<br>Final report 400-500 pages | Two-page brief produced for core indicators within 2 weeks of final form upload<br>Detailed indicator report of about 150 pages produced following two-pager; uploaded to website without hardcopy printing |
| Data accessibility | Public access following user registration | Public access following user registration |

Table 2. Relationship between Resident Enumerator's Level of Acquaintance with Female Respondent and Pattern of Response on Sensitive Questions: PMA2020 Round 1 for Ghana, Ethiopia, Kenya and Uganda

| | Ghana (n=3728) | | | | | Kenya (n=3798) | | | | | Uganda (n=3755) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Question | VWA | WA | NWA | NA | p-level | VWA | WA | NWA | NA | p-level | VWA | WA | NWA | NA | p-level |
| Percent | 20.6 | 24.5 | 27.8 | 27.0 | | 3.1 | 13.4 | 34.3 | 49.2 | | 28.5 | 32.8 | 19.0 | 19.7 | |
| N | 769 | 913 | 1038 | 1008 | | 118 | 507 | 1304 | 1869 | | 1070 | 1231 | 714 | 740 | |
| Does your husband have other wives or does he live with other women as if married? (among married) | | | | | | | | | | | | | | | |
| Yes | 23.8 | 35.4 | 29.7 | 30.5 | 0.000 | 6.5 | 14.6 | 13.9 | 12.8 | 0.001 | 29.6 | 31.6 | 35.8 | 26.8 | 0.004 |
| No | 72.8 | 60.6 | 65.1 | 66.6 | | 89.6 | 85.1 | 80.2 | 82.5 | | 62.6 | 64.5 | 57.8 | 66.4 | |
| Don't know | 2.1 | 3.9 | 4.8 | 2.3 | | 3.9 | 0.3 | 5.9 | 4.5 | | 7.1 | 3.9 | 6.2 | 6.6 | |
| No response | 1.3 | 0.1 | 0.4 | 0.6 | | 0.0 | 0.0 | 0.0 | 0.3 | | 0.7 | 0.0 | 0.2 | 0.2 | |
| How many times have you given birth? | | | | | | | | | | | | | | | |
| Never | 34.7 | 24.8 | 27.9 | 34.1 | 0.000 | 14.4 | 16.8 | 22.6 | 21.6 | 0.000 | 23.6 | 27.3 | 23.5 | 26.1 | 0.009 |
| 1 or more times | 61.0 | 75.1 | 71.4 | 65.8 | | 85.6 | 81.9 | 77.3 | 78.3 | | 75.2 | 72.1 | 76.5 | 73.5 | |
| No response | 4.3 | 0.1 | 0.7 | 0.1 | | 0.0 | 1.4 | 0.2 | 0.1 | | 1.2 | 0.6 | 0.0 | 0.4 | |
| Is your last baby/child still alive? (among those with reported births) | | | | | | | | | | | | | | | |
| Yes | 98.1 | 97.2 | 98.7 | 98.3 | 0.245 | 97.0 | 97.4 | 98.5 | 98.5 | 0.282 | 97.3 | 96.3 | 97.6 | 97.8 | 0.319 |
| No | 1.9 | 2.8 | 0.14 | 1.7 | | 3.0 | 2.7 | 1.5 | 1.5 | | 2.5 | 3.7 | 2.2 | 2.0 | |
| Applicable but no response | -- | -- | -- | -- | | -- | -- | -- | -- | | 0.3 | 0.0 | 0.2 | 0.2 | |
| When did your last menstrual period start? | | | | | | | | | | | | | | | |
| Menopausal/Had hysterectomy | 2.0 | 2.0 | 3.9 | 3.4 | 0.062 | 0.9 | 0.6 | 0.4 | 0.5 | 0.054 | 2.0 | 0.6 | 0.7 | 0.8 | 0.000 |
| Before last birth | 3.0 | 3.7 | 4.8 | 4.2 | | 1.7 | 3.0 | 2.7 | 3.3 | | 3.6 | 3.8 | 7.0 | 4.5 | |
| Never menstruated | 2.2 | 2.1 | 0.1 | 1.5 | | 0.0 | 0.2 | 0.9 | 0.6 | | 2.0 | 1.4 | 1.0 | 0.5 | |
| Time response | 91.2 | 90.8 | 88.3 | 89.9 | | 97.5 | 96.3 | 95.2 | 94.0 | | 91.3 | 92.4 | 89.2 | 92.8 | |
| No response | 1.7 | 1.4 | 1.9 | 1.1 | | 0.0 | 0.0 | 0.8 | 1.6 | | 1.1 | 1.9 | 2.1 | 1.4 | |
| Are you pregnant now? | | | | | | | | | | | | | | | |
| Yes | 6.2 | 9.1 | 6.8 | 7.0 | 0.199 | 6.8 | 5.9 | 6.8 | 6.8 | 0.498 | 10.6 | 9.2 | 11.6 | 8.7 | 0.202 |
| No | 92.6 | 89.4 | 91.0 | 91.1 | | 93.2 | 93.7 | 91.5 | 91.6 | | 86.9 | 89.0 | 85.6 | 89.1 | |
| Don't know | 1.2 | 1.3 | 1.9 | 1.9 | | 0.0 | 0.4 | 1.7 | 1.5 | | 2.5 | 1.5 | 2.5 | 2.2 | |
| Applicable but no response | 0.0 | 0.2 | 0.2 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.2 | | 0.0 | 0.3 | 0.3 | 0.1 | |
| Are you/your partner currently doing something or using any method to delay or avoid getting pregnant? | | | | | | | | | | | | | | | |
| Yes (and used in past) | 12.5 | 13.7 | 15.2 | 15.7 | 0.328 | 50.0 | 46.6 | 41.2 | 42.4 | 0.141 | 22.5 | 21.8 | 21.9 | 26.7 | 0.005 |
| No (and used in past) | 17.6 | 15.0 | 16.6 | 15.3 | | 13.6 | 19.7 | 19.5 | 20.6 | | 15.5 | 13.7 | 17.2 | 18.9 | |
| Never used | 69.5 | 71.1 | 68.0 | 69.0 | | 36.4 | 33.7 | 39.2 | 36.7 | | 61.1 | 64.1 | 60.2 | 53.9 | |
| No response | 0.5 | 0.2 | 0.2 | 0.1 | | 0.0 | 0.0 | 0.2 | 0.4 | | 0.9 | 0.4 | 0.7 | 0.6 | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| How old were you when you first had sexual intercourse? | | | | | | | | | | | | | | | |
| Never (zero) | 13.8 | 10.0 | 11.9 | 15.6 | 0.001 | 8.5 | 7.9 | 11.4 | 8.9 | 0.000 | 10.9 | 12.4 | 9.4 | 12.8 | 0.000 |
| Age 14 or under | 4.2 | 4.1 | 3.9 | 5.0 | | 12.7 | 8.3 | 10.5 | 9.1 | | 11.0 | 154.5 | 15.4 | 8.4 | |
| Age 15 to 24 | 69.8 | 76.0 | 74.6 | 68.6 | | 75.4 | 67.1 | 64.5 | 69.3 | | 71.8 | 63.2 | 65.4 | 71.4 | |
| Age 25 or older | 4.3 | 6.1 | 4.1 | 4.9 | | 3.4 | 5.3 | 5.4 | 4.1 | | 0.8 | 2.3 | 1.1 | 1.5 | |
| Don't know | 5.2 | 2.9 | 4.0 | 3.8 | | 0.0 | 5.5 | 5.5 | 4.9 | | 1.5 | 0.4 | 5.0 | 3.0 | |
| No response | 2.7 | 1.0 | 1.7 | 2.3 | | 0.0 | 5.9 | 2.6 | 3.8 | | 2.2 | 2.8 | 3.6 | 3.0 | |
| When was the last time you had sexual intercourse (among those who reported first sex) | | | | | | | | | | | | | | | |
| Time reported in days | 21.3 | 20.7 | 23.3 | 24.2 | 0.260 | 41.7 | 44.3 | 38.8 | 39.1 | 0.056 | 46.5 | 45.8 | 32.8 | 27.3 | 0.000 |
| Time reported in weeks | 23.4 | 24.5 | 22.1 | 23.4 | | 20.4 | 24.7 | 24.1 | 21.0 | | 17.5 | 20.3 | 21.5 | 21.3 | |
| Time reported in months | 36.2 | 32.2 | 34.2 | 29.5 | | 23.2 | 21.0 | 22.1 | 23.4 | | 22.1 | 20.5 | 28.4 | 30.6 | |
| Time reported in years | 14.0 | 18.0 | 15.8 | 17.1 | | 13.0 | 7.6 | 12.7 | 12.8 | | 10.7 | 10.2 | 12.5 | 17.1 | |
| No response | 5.2 | 4.6 | 4.7 | 5.8 | | 1.8 | 2.4 | 2.3 | 3.7 | | 3.1 | 3.2 | 4.8 | 3.7 | |

p level based on chi square test

VWA=Very well acquainted; WA=Well acquainted; NWA=Not well acquainted; NA=Not acquainted

Table 3. National estimates of modern contraceptive prevalence among married women age 15 to 49 and 95% confidence intervals in six countries: PMA2020 and latest DHS

| | PMA2020 | | | | DHS | | | |
|---|---|---|---|---|---|---|---|---|
| Country | Survey year | N | % | 95% CI | Survey year | N | % | 95% CI |
| Ghana | 2013 | 2333 | 18.4 | 15.6-21.2 | 2008 | 2876 | 16.6 | 14.9-18.3 |
| | | | | | 2014 | 5321 | 22.2 | na |
| DR Congo/Kinshasa | 2013 | 1096 | 18.2 | 14.8-21.6 | 2013-2014 | 2255 | 19.0 | 15.8-22.2 |
| Ethiopia | 2014 | 3690 | 33.8 | 28.3-39.3 | 2011 | 10204 | 27.3 | 25.2-29.6 |
| Kenya | 2014 | 2537 | 55.3 | 51.0-59.6 | 2008 | 4928 | 39.4 | 37.1-41.8 |
| | | | | | 2014 | 18549 | 53.2 | na |
| Uganda | 2014 | 2448 | 25.6 | 22.9-29.3 | 2011 | 5418 | 26.0 | 24.2-27.8 |
| Burkina Faso | 2014 | 1525 | 14.8 | 14.6-18.6 | 2010 | 13392 | 15.0 | 14.1-16.0 |