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PERSPECTIVE ON THE PERFORMANCE MONITORING AND ACCOUNTABILITY 2020 (PMA 2020) SURVEYS[1]

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STRENGTHENING THE DEMOGRAPHIC EVIDENCE BASE FOR THE POST-2015 DEVELOPMENT AGENDA

Session 3. Existing survey programs and need for new survey modules or new thematic surveys designed to "count the uncounted" in support of more effective policy interventions

Perspective on the Performance Monitoring and Accountability 2020 (PMA 2020) Surveys

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Introduction

Although a population goal is not among the 17 developmental ones in the Agenda for Sustainable Development, nor among the169 specific targets in the framework, at least 62 of the total 173 indicators have population denominators and of them, 42 cite national household surveys as the source of data. The numerators of these indicators are counts of individuals with particular conditions, ideally measured at the same time as the denominator of exposed populations. Thus, a considerable share of the monitoring effort for progress on the Sustainable Development Goals (SDGs) will require enumerating population-level change with the regular and timely conduct of national household surveys, such as the DHS and MICS. Household populations are by definition residential and thus do not include institutionalized persons. In addition, household surveys do not usually reach mobile, migratory populations, both of which are growing whether due to voluntary migration from rural to urban areas or involuntary displacement. Thus migration surveys at origins and destinations or migration histories within household surveys are important for national development and emergency response planning. Enumeration at different points in time, i.e., in the cross-section, imposes its own limits on causal explanation of observed trends and relationships. To address the depth and significance of cross linkages among SDGs and their targets, population-based longitudinal surveys will be necessary in order to observe conditions and changes in the same individual and institutional units over time.

Thematic surveys, such as PMA2020[1], focus on monitoring a core set of family planning (FP) indicators to assess change in demand for and supply and use of contraception. These measures directly relate to Goal 3.7 (universal access to sexual and reproductive health care services). PMA2020 surveys also cover basic water, sanitation and hygiene indicators, including those for Targets 6.1-6.3. The FP indicators reflect the goal of the 2012 London Summit[2] to provide contraceptive access to 120 million new users by 2020 and track the quality, availability, cost, composition and use of services both at the population and health facility levels in selected countries. While the London Summit goal seeks to improve contraceptive access to 69 low-income countries, PMA2020 focuses presently on only 11 countries or sites[3] which represent approximately half of the female population in childbearing ages in the target countries.

This note will first describe PMA2020 surveys' design and data quality features and then discuss some potential applications that can expand the coverage and monitoring of other

[1] See www.pma2020.org
[2] See www.familyplanning2020.org
[33] Ghana, Ethiopia, Kenya, DR Congo, Uganda, Nigeria, Burkina Faso, Niger, Indonesia, India (Rajasthan and other states), Pakistan (Sindh and Punjab provinces)

sectors' goals, such as education, gender equality, poverty, and nutrition, as well as expansion to non-FP health areas.

PMA2020 surveys[4]

PMA2020 which began in 2013 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. PMA2020 follows the same multi-stage cluster sample design used by the DHS or MICS, obtaining sampling frames from the national statistical office.[5] It conducts surveys at 3 levels: household, eligible female, and health facility. 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 sampled clusters, who are trained to use the smartphones to gather survey data from a probability sample of households and eligible female members and public and private facilities linked to their clusters. Once trained, the REs can be deployed to conduct multiple survey rounds and between FP rounds, can be trained to collect data in other areas or for subpopulations. At present, the PMA2020 platform is being adapted to test measurement of newborn health indicators, adolescent health, and primary health care capacity.

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. The strength and reach of mobile phone networks have also advanced to a point where data can be uploaded in urban and rural areas alike in most countries of the world. PMA2020 takes advantage of free, open-source software called Open Data Kit[6] to build, collect and transmit data to a secure cloud server with restricted access. The data are downloaded daily through ODK Briefcase, analyzed for missing or inconsistent data. Multiple protocols are in place to limit data loss both on the phone and on the cloud. GPS locations of households and facilities are also recorded for post-survey verification measures. A dataset without identifying information is stored elsewhere on the cloud server for staff access to conduct standardized analytic routines. Measures for the core FP indicators are immediately produced and reviewed, often comparing these results to earlier DHS ones.

Multiple rounds of PMA2020 surveys (20 in total) have now been conducted in Ghana, Ethiopia, Kenya, Uganda, Burkina Faso and Indonesia at the national level (with urban/rural estimates) and sub-nationally in Nigeria (Kaduna and Lagos states), the Democratic Republic of the Congo (Kinshasa) and Niger (Niamey). A PMA2020 survey is in development for Rajasthan state in India and planned for Sindh and Punjab provinces in Pakistan. Table 1 compares some of the known features of DHS and PMA2020 surveys.

In terms of periodicity, PMA2020 surveys are fielded semi-annually in the first two years and annually thereafter. Once the sampling plan is in place and supervisors and REs are recruited,

[4] Extracted from S Radloff, A Tsui, H Olson, et al. "Transforming national population surveys in developing countries with mobile phone technology", paper presented at the annual meeting of the Population Association of America, April 30-May 2, 2015, San Diego.
[5] The sample size is powered on a recent estimate of modern contraceptive prevalence among all women ages 15 to 49 years, with usually a 2% and 3% margin of error at the national and urban/rural levels respectively.
[6] www.opendatakit.org

there is a one-week Training of Trainers session for supervisors, who then train their assigned REs over a two-week period. This includes familiarizing them with smartphones and ODK. Listing and mapping households and service delivery points (SDPs) follow immediately. Supervisors randomly select 35 to 42 households, depending on estimated eligible female to household ratios and non-response rates, and up to 3 private SDPs from each cluster listing for the RE to interview. Supervisors conduct the public SDP interviews. Each RE's workload is about 40 household and 40 eligible women interviews, plus the randomly selected private health facilities, which are often pharmacies, private clinics and retail providers of contraceptives. Fieldwork is completed in four weeks on average, indicating a total of about 2 to 2.5 months of dedicated time to each PMA2020 round. The two-page brief is generated as soon as 95% or more of the expected interviews are completed.

An important gauge of accuracy is the width of the survey margin of error. For budgetary reasons, the PMA2020 surveys are not powered to provide subnational estimates for provinces or regions, although there have been exceptions (all 10 regions in Ghana, all DHS-defined regions in Uganda, 9 counties in Kenya, and 5 regions in Ethiopia). Table 2 provides the PMA2020 sample sizes, total and modern contraceptive prevalence (mCPR) estimates and 95% confidence intervals for all women ages 15-49 across five countries. Given the semi-annual periodicity of PMA2020 surveys in the first two years, by pooling two rounds of data the sample is effectively doubled and the confidence band interval narrowed allowing for direct comparison with DHS estimates. PMA2020 estimates track rises in mCPRs reasonably well relative to earlier DHS ones. For example, the estimated mCPR in Kenya increases from 32.0% (30.4-33.6%) in the 2008 KDHS to 42.2% (39.9-44.4) with the pooled PMA2020 sample and their confidence intervals do not overlap suggesting a statistically significant change at $p<.05$. In the case of Kinshasa's estimates under PMA2020 Round 1 and a co-timed DHS, the estimates are very close, i.e., the 95% confidence intervals of 32.0-37.7% and 31.5-36.3% overlap, as seen in Figure 1.

Last, trends in mCPR estimates are tracked by the UN Population Division, with time-sequenced confidence bands calculated using a Bayesian probability density function. Trend estimates for the mCPR are presented in Figure 2 for 5 countries, with PMA2020 point estimates displayed alongside those from DHS, MICS and other national surveys. PMA2020 results are in line with prior survey estimates; in Kenya, the estimate for 2014 was higher than might have been predicted from past trends (prior red circles) but the 2014 KDHS released in 2015 arrived at a point estimate that was very similar. Overall, the results with respect to mCPR affirm the potential of using smartphones and resident enumerators for rapid survey monitoring of contraceptive practice. PMA2020 Detailed Indicator Reports also show consistency for WASH indicators compared with those measured in the DHS.

Overall, 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 numerators based in sample clusters. The PMA2020 platform was inspired by the Indian Sample Registration System which also uses resident enumerators but not the mobile technology. PMA2020's platform's features enable the focused content of its surveys to be fielded in about 30 minutes with the female respondent, have a flexible structure to accommodate modifications in response to programmatic interests and new content modules sponsored by other parties in subsequent, independent rounds, and to be repeated annually for continuous monitoring. Data quality is strong and to date, including consistent patterns in client volumes captured in the SDP survey compared against national service statistics. Possible interviewer bias from REs has also not emerged as a practical or empirical concern.

Potential for SDG indicator monitoring

As noted earlier, the PMA2020 platform has the potential to provide continuous monitoring for key indicators in other SDG goals and targets, where these involve populations in their denominators.[7] We comment in this section on applications of the PMA2020 platform beyond its existing family planning and WASH focus.

1. *Civil and vital registration systems (CVRS)*

Given the required listing and mapping of households (and SDPs) within the selected cluster (of about 200 households) for PMA2020, a sample census of households (HHs) is being generated. Population age-sex pyramids, for example, are routinely produced from enumerated household residents to investigate data quality issues such as age heaping. The HH questionnaire obtains information on assets by which to construct wealth scores and quintiles but could also be expanded for more detailed income and expenditure measurement. While approximately 35 households with eligible females are systematically selected for further interviews, all households in the cluster could be queried for demographic events of the type gathered in vital registration systems, e.g., recent births, deaths, marriages, and migrations, as well as health surveillance systems, e.g., infections, injuries, accidents, substance use and behavioral risks. A survey with 150-250 clusters which characterize PMA2020 surveys in populous countries such as Ethiopia, Nigeria, India, and Indonesia can generate vital events observed for a household population of 150,000 to 250,000.

By expanding the CVRS focus to clusters contiguous to the sampled/index, one could amplify that population by 4 to 5 times, providing a robust base for a national population register. From this base of approximately 750,000 to 1 million persons, periodic modules to monitor economic, educational, health or nutrition indicators among all or subsamples of household members (males, newborns, children, adolescents and the elderly) can be readily fielded. The smartphone's (or smart device's) capacity for self-regulation with built-in logic and consistency checks on respondent reports and the speed of data transmission via the mobile platform make this mode of continuous monitoring particularly appealing.

2. *Linkages with other data systems*

In PMA2020, the surveys of individual respondents and health facilities are linked by design. For each cluster a random sample of up to 3 private facilities within its boundaries and all public facilities from the lowest level up to the first referral hospital designated to serve local residents are selected for interviews. Thus it is possible to investigate the relationship between the health system via supply-side factors and the client population via demand-side factors. Specifically the average geographic distance between her household and available facilities with some trait X, such as contraceptive implants, condoms or anti-retroviral therapy drugs, can be measured.

Where public administrative records are sufficiently complete, e.g., for tax, social security, or school enrolment purposes or birth certificates, they can be linked at the cluster-level to assess an indicator such as proportion of girls in five-year age groups enrolled in tertiary education and monitored by region over time. Spatial or satellite image data, such as of land use-land cover measures for an area polygon with boundaries coinciding with those of a cluster can be linked to assess relationships with patterns of deforestation or population urbanization.

[7] A further statistical advantage is building a (longitudinal) panel of sample clusters within a country setting wherein trends can be tracked and trend tests applied.

3. *Sample size and resource considerations*

There are resource considerations that accompany sample size considerations. While sample power calculations and tolerance for margins of error will drive the desired sample sizes for different indicators, and hence the number of clusters and REs, so also does the need for subnational estimates to support development planning. PMA2020's experience has been to encounter strong governmental demand for subnational data to enable local administrators' use of the data for planning and budgeting. As an externally funded project, PMA2020 has often not been able to respond fully to such requests. Instead the response has been selective by identifying one or two states or provinces to oversample in order to show proof of concept for local estimation in hopes that the government or other donors will co-finance any additional expansion. From a cost perspective, PMA2020's sponsor, the Bill & Melinda Gates Foundation, has absorbed the major front-end expenses by investing in building the country infrastructures, i.e., platforms with mobile devices and trained REs.

Closing comments

Rapid advances in telecommunications and mobile technologies will benefit data collection and monitoring efforts in ways that are not possible to imagine at present. The challenge is not only to conceptualize the possibilities but to plan smartly to take advantage of the growth in these information technology opportunities to generate strong data, measurements, and analyses and support evidence-based policy decisions to improve the human condition and physical environments in a sustainable manner. PMA2020 has a "softer side" in empowering more than 1000 female enumerators, often residing in rural sites, with periodic but long-term employment, smartphone skills, and growing personal confidence for public interactions. The annual dissemination of PMA2020 results to stakeholder groups has enabled immediate program responses to service gaps or user needs in a number of settings.

The population-based nature of PMA2020 survey design coupled with the speed of telecommunications transmission and large database computations are quickly leading to the building of big data systems of a demographic nature. Capitalizing on the household enumeration stage of PMA2020 surveys can help launch CVR systems to cover large populations. Data visualization will promote the consumption of observed patterns and relationships; the project has yet to tap into the potential linkages with video production and video-streaming to promote community-level dissemination. Other technologies, such as drones for aerial surveillance, can speed ground-truthing of clusters for listing and mapping, or internet expansion efforts, such as by Google with weather balloons or Facebook's internet.org initiative, promise unprecedented and transformational information access by low-income populations. The challenge will be not just to bring equity in benefits experienced by populations with the achievement of the Sustainable Development Goals in 2030 but to ensure that demographic data systems are themselves enduring, replenishing, comparable and long-serving.

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

Design element	**DHS**	**PMA2020**
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 Female Male Service provision assessment	Household Female -- Health facility
Survey respondent(s)	Eligible female 15-49 years Eligible males 15-59 years Health facility manager	Eligible females 15-49 years -- Health facility manager
Measurement	Personal interview of >1 hour duration Biomarkers Anthropometry	Personal interview for 30 minute duration on average
Sample design	Probability sample of households Occupants enumerated to identify eligible female and male respondents Health facilities survey (SPA) independently conducted using master list of health facilities, largely public sector	Probability sample of households Occupants enumerated to identify eligible female respondents 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 Final report 400-500 pages	Two-page brief produced for core indicators within 2 weeks of final form upload 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. Estimates of total and modern contraceptive prevalence among all women and 95% confidence intervals for PMA2020 surveys in 5 countries, 2013-2014

Source	Round/ Phase	Female sample 15-49	Year	All women 15-49 years							
				CPR				mCPR			
				CPR	SE	95% CI		mCPR	SE	95% CI	
Ghana											
PMA2020	Round 1	4208	2013	15.39	1.05	13.29	17.49	14.30	1.05	12.20	16.40
PMA2020	Round 2	3893	2014	15.98	1.16	13.66	18.30	14.51	1.07	12.37	16.65
PMA2020	Round 1&2	8101	2013-2014	15.66	0.78	14.10	17.22	14.38	0.75	12.88	15.88
DHS		9656	2008	19.35	0.74	17.87	20.83	13.49	0.58	12.33	14.65
Ethiopia											
PMA2020	Round 1	6528	2014	23.68	1.62	20.44	26.92	23.36	1.62	20.12	26.60
PMA2020	Round 2	6648	2014	24.18	1.47	21.24	27.12	23.59	1.51	20.57	26.61
PMA2020	Round 1&2	13176	2014	23.54	1.10	21.34	25.74	23.05	1.11	20.83	25.27
DHS		16515	2011	19.58	0.75	18.08	21.08	18.70	0.75	17.20	20.20
Mini-DHS*		8070	2014	28.84	1.39	26.06	31.62	27.78	1.39	25.00	30.56
Kenya											
PMA2020	Round 1	3815	2014	42.69	1.85	38.99	46.39	42.50	1.85	38.80	46.20
PMA2020	Round 2*	4323	2014	41.17	1.33	38.51	43.83	41.50	1.32	38.86	44.14
PMA2020	Round 1&2	8138	2014	42.16	1.13	39.90	44.42	41.98	1.13	39.72	44.24
DHS		8444	2008-09	32.02	0.81	30.40	33.64	27.96	0.74	26.48	29.44
Uganda											
PMA2020	Round 1	3974	2014	22.46	1.31	19.84	25.08	21.25	1.27	18.71	23.79
DHS		8674	2011	23.60	0.75	22.10	25.10	20.68	0.63	19.42	21.94
DR Congo/Kinshasa											
DHS			2007	34.35	1.25	31.85	36.85	12.75	1.02	10.71	14.79
PMA2020	Round 1	2197	2013	33.90	1.22	31.50	36.30	16.60	1.01	14.62	18.59
PMA2020	Round 2	2902	2014	30.30	0.86	28.58	32.02	16.90	0.70	15.50	18.30
DHS		1804	2013-14	34.87	1.42	32.03	37.71	15.24	0.99	13.26	17.22

*Not affiliated with DHS program

Figure 1. 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

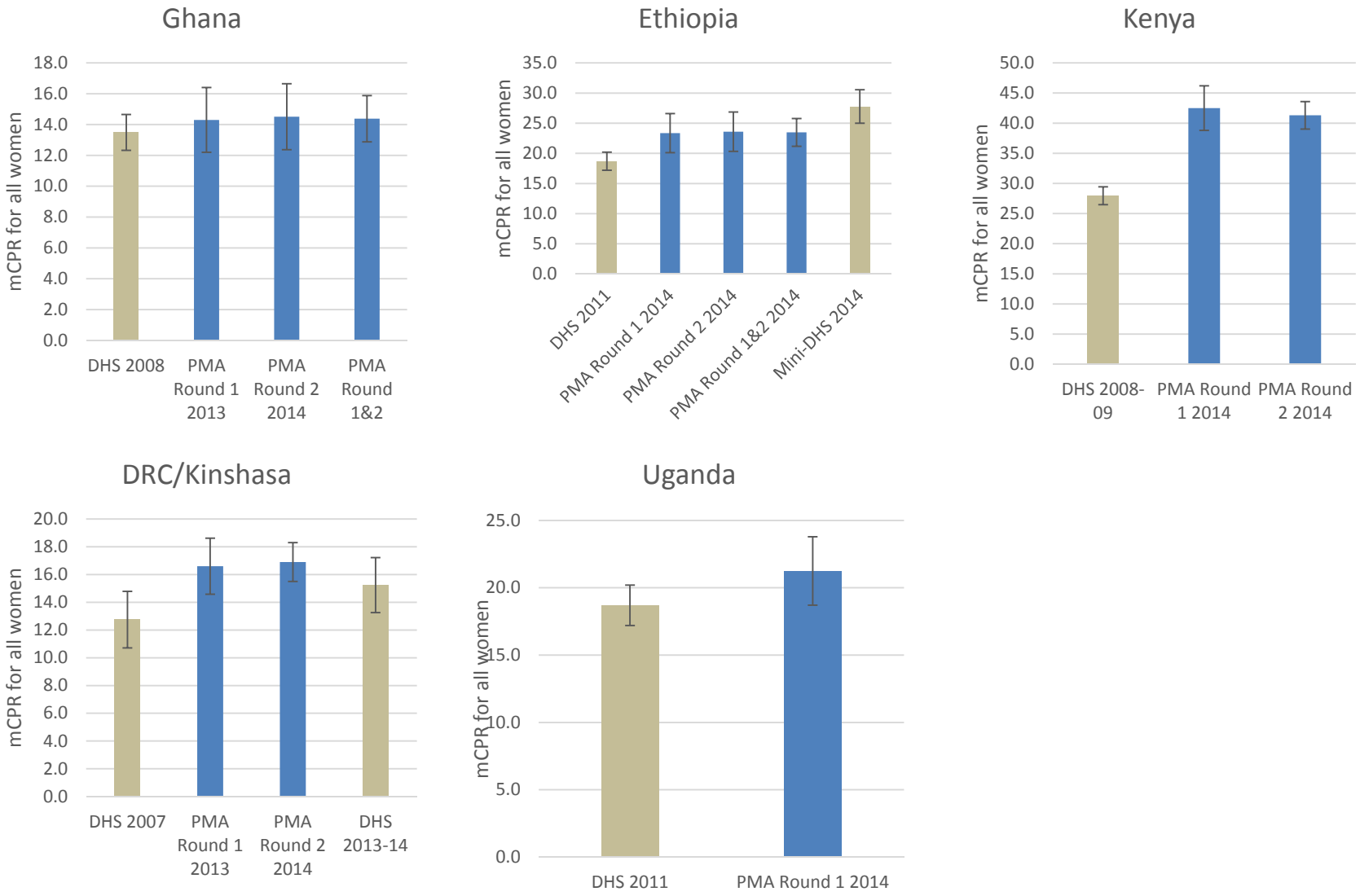

Figure 2. United Nations Model-based Estimates of Modern Contraceptive Prevalence Rates for Burkina Faso, Ethiopia, Ghana, Uganda, and Kenya