'Who assisted with the delivery of (NAME)?' Issues in estimating skilled birth attendant coverage through population-based surveys and implications for improving global tracking

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ABSTRACT

The percentage of live births attended by a skilled birth attendant (SBA) is a key global indicator and proxy for monitoring progress in maternal and newborn health. Yet, the discrepancy between rising SBA coverage and non-commensurate declines in maternal and neonatal mortality in many low-income and middle-income countries has brought increasing attention to the challenge of what the indicator of SBA coverage actually measures, and whether the indicator can be improved. In response to the 2018 revised definition of SBA and the push for improved measurement of progress in maternal and newborn health, this paper examines the evidence on what women can tell us about who assisted them during childbirth and methodological issues in estimating SBA coverage via population-based surveys. We present analyses based on Demographic and Health Surveys and Multiple Indicator Cluster Surveys conducted since 2015 for 23 countries. Our findings show SBA coverage can be reasonably estimated from population-based surveys in settings of high coverage, though women have difficulty reporting specific cadres. We propose improvements in how skilled cadres are classified and documented, how linkages can be made to facility-based data to examine the enabling environment and further ways data can be disaggregated to understand the complexity of delivery care. We also reflect on the limitations of what SBA coverage reveals about the quality and circumstances of childbirth care. While improvements to the indicator are possible, we call for the use of multiple indicators to inform local efforts to improve the health of women and newborns.

INTRODUCTION

Skilled attendance at birth is believed to prevent maternal and neonatal mortality during labour, delivery and the early postnatal period via effective care provided by trained and competent health personnel in

Summary box

► Increasing skilled birth attendant coverage has not corresponded to expected declines in maternal and neonatal mortality in many low-income and middle-income countries, calling into question the accuracy and validity of skilled birth attendant coverage estimates and what the indicator truly measures.

► Skilled birth attendant coverage can be reasonably estimated from population-based surveys in settings of high coverage, but women have difficulty accurately reporting distinct cadres of healthcare professionals.

► Greater transparency is needed in documenting the basis on which distinct healthcare cadres providing delivery care in countries are designated as skilled or not for the purposes of estimating skilled birth attendant coverage.

► Opportunities to link population-based and facility-based data provide a more nuanced picture of childbirth care and help capture elements of the enabling environment for skilled attendance.

► Some improvements in skilled birth attendant coverage measurement are possible, but the indicator on its own is limited in tracking progress and informing efforts to improve quality of care for women and newborns.

an environment equipped with the necessary drugs and equipment.[1–3] The percentage of live births attended by specified cadres of health personnel (eg, midwives) is widely used to measure skilled birth attendant (SBA) coverage and is a key proxy indicator for monitoring progress in reducing maternal mortality (see box 1). While household surveys, such as the Demographic and Health Surveys (DHS) and Multiple Indicator Cluster

Box 1.   Definition and calculation of the SBA coverage indicator

What is the 'SBA' indicator?
The 'proportion of births attended by skilled health personnel', commonly referred to as 'SBAs', is an SDG indicator (Indicator 3.1.2) and is one of the five indicators tracked by leading maternal and newborn health global initiatives.[37] The SBA indicator is classed as a Tier 1 SDG indicator, in that it is considered conceptually clear, has an internationally established methodology and is reported for >50% of countries.[38]

How is SBA coverage calculated?
Coverage is calculated as the number of live births attended by skilled health personnel expressed as a percentage of the total number of live births in the same period.[9 39] Many low and lower-middle income countries use household surveys with women's self-reports of delivery with particular health personnel to track SBA coverage. Women may respond with multiple attendants but only the 'most skilled' provider from the response options selected is used to calculate SBA coverage. Survey recall periods usually vary from 2 years (MICS) to up to 5 years before the interview (DHS).[32]

DHS,Demographic and Health Surveys; MICS, Multiple Indicator Cluster Surveys;SBA, skilled birth attendant; SDG, sustainable development goal.

Surveys (MICS), have measured delivery with medically trained personnel (doctor, nurse or midwife) since the 1980s and 1990s, SBA coverage was first tracked globally during the Millennium Development Goal (MDG) era (2000–2015), and remains an indicator on the Sustainable Development Goal (SDG) and Global Strategy for Women's Children's and Adolescents' Health agenda. Yet, the discrepancy between increasing SBA coverage and lagging improvements in maternal and neonatal mortality in many low-income and middle-income countries (LMICs) has brought increasing attention to the challenge of SBA measurement and the indicator's limitations in capturing effective, life-saving care.[4–7] Amidst increasing calls to move away from measuring contact with the health system toward capturing quality of care,[8] a critical review and reflection on SBA coverage measurement is needed.

In 2004, the WHO, along with the International Confederation of Midwives (ICM) and the International Federation of Gynaecology and Obstetrics (FIGO) defined the core skills and training required for skilled attendants.[1] WHO considered the statement to be a policy document and has indicated it was not intended to serve as a basis for measurement.[9] Shortages of midwifery-trained personnel led many LMICs to 'upskill' mid to low level health cadres to expand the range and numbers of health personnel they considered to be SBAs to address gaps in coverage.[10–12] There are concerns that the length and quality of training may be insufficient,[9 12] that large gaps exist between international standards and actual provider competencies and practices[13 14] and that the lack of standardisation in cadre names, training and competencies make cross-country comparisons challenging.[10 15 16]

In the transition from the MDG to the SDG era, WHO, Unicef and United Nations Population Fund (UNFPA) undertook a process of revising the definition of SBA. The resulting 2018 joint statement expanded the 2004 statement to consider eight competencies essential for improving the quality of care received by women and newborns.[2] The competency related to intrapartum care was identified as the one specifically relevant to SDG monitoring; it defined a competent maternal and newborn health (MNH) professional as someone who (1) provides and promotes evidence and human rights-based, quality, socioculturally sensitive and dignified care to women and newborns; (2) facilitates physiological processes during labour and delivery to ensure a clean and positive childbirth experience and (3) identifies and manages or refers women and/or newborns with complications.[2] The care competencies include all signal functions of emergency obstetric and newborn care that could be provided by an integrated team of MNH professionals, and the 2018 joint statement noted the importance of the enabling environment to the provision of quality maternal and newborn healthcare.[2 9]

The 2018 joint statement also acknowledged that it was a first step towards improved measurement and called for household surveys and administrative data collection methods at the country level to be revised to support 'meaningful measurement' of SBA coverage.[2] In parallel to the process of reviewing the definition of SBA, Unicef and WHO convened experts on several occasions between 2016 and 2018 to reflect on global tracking of SBA coverage. The aim was to improve measurement of the SBA indicator, and distinguishing which healthcare providers were 'skilled' for the purposes of the indicator and improving country-level reporting.[2 9] To understand what this means in practice, we need to unpack what women can tell us and how the SBA indicator is currently generated via population-based surveys.[17] Then, we can consider the implications of the WHO definitions (2004 and 2018 versions) on meaningful measurement of SBA coverage and effective tracking of progress in MNH. We acknowledge that country-level monitoring needs may differ from what is measured at the global level, but here we focus on the challenges and implications for global tracking of SBA coverage. In this paper, we aim to (1) systematically collate and synthesise published evidence on whether women can accurately recall the person(s) assisting with delivery, (2) describe methodological considerations and points of improvement around how SBA coverage is estimated from DHS and MICS and (3) suggest ways forward in conceptualising SBA coverage and measuring care received by women and newborns.

ACCURACY OF WOMEN'S SELF-REPORT OF BIRTH ATTENDANTS
Population-based surveys rely on women's self-report of the cadre of birth attendant to ascertain whether the attendant was skilled or not. We systematically reviewed

published literature to examine how accurately women can recall the cadres of healthcare personnel assisting them during delivery. Results are summarised below, with a full description of methods and results shown in online supplementary appendix 1. Of 1743 titles screened, and 29 full texts reviewed, 4 studies (in Mexico, Kenya and Ghana) met the inclusion criteria comparing women's self-reports against a gold standard, but only three were large enough to calculate statistical measures of validity or reliability (table 1).

The limited evidence suggests that SBA coverage at the population level can be accurately estimated for an aggregate category of 'skilled' providers, but that women have difficulty accurately reporting distinct cadres of healthcare professionals and, according to Blanc and colleagues' study in Kenya, women tend to underreport attendance by less skilled providers.[18] The high sensitivity but low specificity of the SBA indicator suggests that women's self-reports in population-based surveys are close to capturing the true prevalence in high SBA-coverage settings but would tend to overestimate it in low coverage settings. The four studies were all conducted among women delivering in hospitals, with very few deliveries reported (by women or via the gold standard comparison) as being attended by unskilled attendants. Thus, the findings may not be generalisable to lower-level facility or home-based settings where delivery with non-SBA is likely to be more common. Three of the four studies interviewed women very soon after delivery. Only one study used a longer recall period (up to 15 months) similar to household surveys; it showed some deterioration in the accuracy of women's reporting.[19]

Women use multiple ways to determine the cadre of their provider. Hussein and colleagues found women in Ghana most often identified the cadre of providers by the activities they performed, by the colour of the uniform or by knowing the individual previously, though these means were frequently inaccurate.[20] Qualitative interviews by McCarthy and colleagues in Kenya found women differentiated cadres by the care components they gave, with broad agreement on the kinds of interventions performed by higher cadre providers (eg, caesarean sections). However, many women could not distinguish between types of skilled cadres if multiple attendants provided needed care.[19]

The four studies asked women who was their 'main attendant', rather than using the DHS/MICS question identifying all those assisting with the delivery (figure 1). Women—and researchers—may have differing interpretations of the term 'main attendant'. Interpretations could include recalling the person who spent the most time with the woman, was the most helpful or was the most qualified, leading to potential discrepancies between women's responses and observers' reports. For example, in the study observing deliveries in Mexico, researchers noted the 'main provider' to be the person who 'caught' the baby.[21] The tendency in the Kenya study for women to overreport attendance by doctors and higher-ranked providers compared with observers may have occurred because respondents understood their 'main provider' to be the person in-charge, whereas observers recorded the cadre of individual administering the most care.[18]

In addition to these four studies that tested recall of individual cadres, other studies have examined the accuracy of women's recall of other questions on intrapartum care provision. In a study in Scotland, where women were allocated a midwife, obstetrician or general practitioner as a maternity care coordinator, less than half of women reported the same cadre as specified by staff.[22] A study in Mozambique found women's recall of the number of health professionals assisting during delivery was inaccurate compared with direct observations (area under the curve (AUC): 0.48, 95% CI: 0.44 to 0.53), but that women could more accurately report the presence of a companion during labour or delivery (AUC: 0.61, 95% CI: 0.55 to 0.66).[23] The study also found high individual-level accuracy (AUC: 0.88, 95% CI: 0.84 to 0.91) and low population-level bias in women reporting whether they delivered in a hospital or health centre at 8–10 months recall.[23]

METHODOLOGICAL ISSUES IN SBA COVERAGE MEASUREMENT ON POPULATION-BASED SURVEYS
In addition to the issues arising from women's self-report of individual cadres, the accuracy of SBA coverage measurement also relies on how these data are captured and recorded in household surveys. DHS and MICS provide standard questionnaires with multiple-choice response options which countries can customise to reflect the national cadres providing intrapartum care (figure 1). Countries indicate whether these cadres are considered 'skilled' for estimating SBA coverage based on the Ministry of Health's (MOH) definition of SBA; this may change over time. There is currently a lack of transparency on what basis cadres are designated as 'skilled'. Improving population-based measurement of SBA demands clarity and comparability in response options, careful phrasing and probing to reduce improbable responses and represent all women with births in the recall period.

The lack of clear standards for classifying a delivery attendant as 'skilled' on DHS and MICS has been widely acknowledged.[24] Cadres with the same or similar professional designations can have different competencies in different countries,[16] and cadres may change in whether they are considered skilled from one survey to the next. For example, in Ethiopia, the Health Extension Worker (HEW) cadre was not considered skilled in the 2011 DHS[25] but was considered skilled in the 2016 DHS[26] because HEWs had received an additional 1 year training. Recent evaluations show that HEWs with minimal training lack the competencies to be considered skilled, but those with the additional 1 year higher

Table 1 Studies estimating the validity or reliability of women's self-report of healthcare personnel assisting during delivery

Reference	Study setting, participants and sample size	Recall period	Source of comparison against women's self-report	Statistical measures	Key findings
Blanc et al. 2016a[21]	Public hospital in Mexico City. Pregnant women aged 15–49 years admitted to the study facility for delivery. n=597	Interviews conducted with women prior to hospital discharge.	Direct observation by general medical practitioners or nurses.	*For individual reporting accuracy:* sensitivity, specificity and AUC* *For population-based validity:* IF†	▶ Main provider at delivery was SBA (doctor or medical resident) had a high sensitivity (90.1%) and a low specificity (14.0%), resulting in low individual-level accuracy (AUC: 0.52, 95% CI: 0.48 to 0.56) and low population-level bias (IF: 0.98). Vast majority of participants reported the main provider during delivery was a doctor or a medical resident (94%); both cadres are considered SBA.
Blanc et al. 2016b[18]	Two public hospitals in Kisumu and Kiambu districts, Kenya. Pregnant women aged 15–44 years admitted to study facilities for labour and delivery. n=662	Interviews conducted with women prior to hospital discharge.	Direct observation by registered nurse/midwives.	*For individual reporting accuracy:* sensitivity, specificity and AUC *For population-based validity:* IF	▶ Combined categories of SBA as main provider at delivery had a high sensitivity (95.0%) and a low specificity (15.2%), resulting in a low individual-level reporting accuracy (AUC: 0.55, 95% CI: 0.51 to 0.59) and a low population-level bias (IF: 1.02). ▶ Three provider categories were used: doctor/medical resident, nurse/midwife and student nurse, of which the first two were considered SBA. Main provider was a doctor/medical resident, had a high individual-level accuracy (AUC: 0.86, 95% CI: 0.83 to 0.89) and a large population-level bias (IF: 1.63). Main provider was a nurse/midwife, had a high individual-level accuracy (AUC: 0.80, 95% CI: 0.76 to 0.83) and a low population-level bias (IF: 0.93). Main provider was a student nurse, had a low individual-level accuracy (AUC: 0.57, 95% CI: 0.53 to 0.61) and a large population-level bias (IF: 0.45). ▶ There was a tendency for women's self-report to misclassify medical residents and nurse/midwives as doctors and to misclassify student nurses as nurse/midwives.

Continued

Table 1	Continued				
Reference	**Study setting, participants and sample size**	**Recall period**	**Source of comparison against women's self-report**	**Statistical measures**	**Key findings**
McCarthy *et al.* 2016[19]	Two public hospitals in Kisumu and Kiambu districts, Kenya. Pregnant women aged 15–44 years admitted to study facilities for labour and delivery and who participated in the baseline interview and were reinterviewed in the community. n=515	Interviews conducted 13–15 months after delivery.	Direct observation by registered nurse/midwives and the woman's previous exit interview at hospital discharge.[18]	*For individual reporting accuracy:* sensitivity, specificity and AUC *For population-based validity:* IF *For individual-level reliability:* Agreement between women's responses at discharge and follow-up using the phi coefficient, which ranges from –1 (perfect disagreement) to 0 (no correlation) to 1 (perfect agreement)	▶ Main provider at delivery was SBA (constructed category of doctor/medical resident or nurse/midwife), had a high sensitivity (91.0%) and a low specificity (18.0%) at 13–15 months follow-up; AUC at follow-up (0.54, 95% CI: 0.50 to 0.59) and IF at follow-up (0.98) were similar to baseline AUC and IF reported by Blanc and colleagues.[18] ▶ There was some deterioration in individual-level reporting accuracy for main provider at delivery was a doctor/medical resident at 13–15 months follow-up (AUC: 0.77, 95% CI: 0.73 to 0.81) compared with baseline (AUC: 0.86, 95% CI: 0.82 to 0.89) and for a nurse/midwife at follow-up (AUC: 0.70, 95% CI: 0.66 to 0.74) compared with baseline (AUC: 0.80, 95% CI: 0.76 to 0.83). ▶ Population-level bias for SBA coverage remained low overall and was very similar between baseline and follow-up (IF: 1.0 vs 0.98). Population-level bias was larger at follow-up compared with baseline for main provider was a doctor/medical resident (IF: 2.44 vs 1.57) and nurse/midwife (IF: 0.76 vs 0.94). ▶ Reliability of women's reports of the main provider during delivery between baseline and 13–15 months follow-up was low (r_{phi}=0.32) for both doctor/medical resident and nurse/midwife.
Hussein et al. 2004[20]	Two hospitals in the Greater Accra region, Ghana. Women who had delivered in the study facility in the 10 days before interview. n=9	Interviews conducted with women up to 10 days after delivery.	Birth register and clinical notes of the delivery; interviewers also asked health personnel to recollect circumstances of the birth.	Not assessed.	▶ In seven of nine cases, respondents identified their main attendant as was recorded in the birth register. Of the two discordant cases, the respondents reported delivering without an attendant or that the midwife arrived after delivery of the baby's head. In both cases, the register recorded the birth assisted by a midwife with no mention of partial or non-attendance.

*Plots the indicator's sensitivity ('true positive') against its false positive rate (1-specificity). AUC values range from 0 (zero accuracy) to 1.0 (perfect accuracy) with a value of 0.5 being the equivalent of a random guess.
†Ratio of the prevalence as self-reported by women over the 'true prevalence' according to the gold standard comparison. An IF of 1.0 indicates no bias.
AUC, area under the receiver operating characteristic curve; IF, inflationfactor; SBA, skilled birth attendant.

A. MICS 6 standard individual women's questionnaire

B. DHS 7 standard individual women's questionnaire

Figure 1 Question and response options from sample MICS and DHS individual women's questionnaires. DHS, Demographic and Health Surveys; MICS, Multiple Indicator Cluster Surveys.

level training do demonstrate greater competence.[27] However, women cannot be expected to differentiate HEWs with differing levels of training, and it is unclear whether even the more highly trained HEWs meet the 2018 joint statement criteria to be considered SBA.

Our estimates from 23 countries with a DHS or MICS conducted since 2015 (and data available in February 2018) show the close alignment, with a few exceptions, of the percentage of facility-based deliveries with SBA coverage (table 2, see online supplementary appendix 2 for methods). Notably, Mali and Senegal had higher facility-based deliveries than SBA coverage estimates, indicating some women giving birth in facilities reported assistance by non-SBAs, namely with a 'matrone', an auxiliary cadre providing delivery care in many Francophone countries who may or may not be skilled.[28] In fact, the[29] Mali 2015 MICS report listed SBA coverage including 'matrone' (60.4%) and excluding 'matrone' (43.7%),[29] openly reflecting uncertainty as to whether the country-level categorisation meets international definitions (see online supplementary appendix 2 for a list of individual cadres included in DHS/MICS reports' SBA coverage estimates). In order to have comparable indicators, we need to be confident that cadres designated by countries as skilled meet international standards for SBA.

DHS and MICS also often combine response categories of cadres (eg, nurse/midwife, see figure 1), possibly in response to respondents' inability to accurately distinguish distinct cadres. These combined cadres on the questionnaire or in the datasets limit the ability to check individual cadre competencies against international SBA criteria or assess the role of specific cadres separately. This is less important if all the cadres in such combined categories are skilled; however, categorisations that combine skilled personnel with lower-level cadres who may not be considered skilled lead to inaccuracies in SBA coverage.[24]

The question on DHS and MICS to capture SBA coverage reads: 'Who assisted with delivery of (NAME)?' with an instruction for enumerators to probe for all the persons assisting (figure 1). However, the question phrasing could be interpreted in different ways within different contexts. We explored two of the ways this impacts on estimates of SBA coverage.

First, surveys attempt to capture all those assisting with delivery, but results can be difficult to interpret. Table 2 uses data from 23 countries to show the large variation in the percentage of women delivering in a facility who reported two or more cadres, from 7% in Malawi to 91% in Turkmenistan. This wide range could reflect the reality of differently resourced health systems, or the quality of data collection, including how much time the enumerators had to probe, or how the term 'assisted' was interpreted when translated into local languages. In countries where a team of providers might be considered to encompass all the required competencies under the 2018 joint statement, a woman responding with a single cadre when multiple cadres were supporting care, including those with more skills performing supervisory roles, would tend to underestimate SBA coverage.

Second, misreporting and poor understanding of the survey question may be responsible for seemingly

Table 2 Descriptive analysis of 23 countries with a DHS or MICS since 2015

Country	Survey type	Year	Among all live births*		Among all facility-based live births*			
			Percentage SBA coverage from DHS/ MICS report†	Percentage in health facilities	Percentage reporting >1 delivery attendant	Percentage deliveries with doctor/ nurse/ midwife	Percentage deliveries with other personnel	Percentage deliveries with relative or no one
Afghanistan	DHS	2015	50.5	48.1	23.6	88.6	11.3	0.1
Angola	DHS	2015	49.6	45.6	10.1	97.9	1.5	0.6
Armenia	DHS	2016	99.8	99.3	52.2	99.9	0.0	0.1
Burundi	DHS	2016	85.1	83.9	9.9	99.5	0.4	0.0
Colombia	DHS	2015	95.9	83.3	77.7	99.3	0.4	0.3
Ethiopia	DHS	2016	27.7	26.2	20.3	92.7	6.9	0.4
Guatemala	DHS	2015	65.5	65.0	51.8	99.9	0.1	0.1
India	DHS	2015	81.4	78.9	44.6	97.2	2.5	0.3
Kazakhstan	MICS	2015	99.4	99.3	65.4	100.0	0.0	0.0
Malawi	DHS	2016	89.8	91.4	7.2	97.4	2.0	0.7
Mali	MICS	2015	43.7	64.6	8.5	65.3	34.5	0.3
Mexico	MICS	2015	97.7	96.9	56.4	99.9	0.1	0.0
Myanmar	DHS	2015	60.2	37.1	36.4	99.2	0.8	0.0
Nepal	DHS	2016	58.0	57.4	57.4	96.3	2.4	1.2
Nigeria	MICS	2016	43.0	37.5	25.1	91.3	8.2	0.5
Paraguay	MICS	2016	95.5	93.2	66.8	92.4	7.5	0.1
Rwanda	DHS	2014	90.7	90.7	18.9	99.9	0.1	0.1
Senegal	DHS	2015	53.2	74.5	27.7	70.4	29.5	0.1
Tanzania	DHS	2015	63.7	62.6	20.5	94.2	5.6	0.2
Timor Leste	DHS	2015	56.7	48.5	16.2	97.6	2.1	0.3
Turkmenistan	MICS	2015	100.0	99.4	91.4	100.0	0.0	0.0
Uganda	DHS	2016	74.2	73.4	10.2	97.4	2.4	0.3
Zimbabwe	DHS	2015	78.1	77.0	16.5	99.5	0.3	0.2

see online online supplementary appendix 2 for methods.

*Denominator used was all live births in the past 5 years for DHS and most recent live birth in past 2 years for MICS.

†SBA coverage extracted from each country's DHS/MICS report.

DHS, Demographic and Health Surveys; MICS, Multiple Indicator Cluster Surveys; SBA, skilled birth attendant.

implausible responses, for example, women reporting delivery with a doctor at a health post in settings where this is unlikely,[7] or women indicating delivery by caesarean section with a non-SBA. In Senegal, 10% of women with caesarean sections reported delivery assistance only by non-skilled attendants.[30] It is unclear if these women were interpreting the question to refer to cadres assisting before surgery, whether they were misreporting the cadre or whether they were misreporting the caesarean section. Possible solutions would be to provide an alternate phrasing of the survey question for women delivering by caesarean section to ask who performed the operation or further enumerator instructions to check obvious discrepancies.

Finally, current estimates of SBA coverage omit some births to women in need of skilled delivery care, by excluding women with stillbirths. By only including live births, SBA coverage estimates may be artificially inflated since they fail to capture the providers of care during adverse delivery outcomes. We recommend changing the denominator to be all births (live and stillbirths), while recognising that survey design changes may be needed to improve reporting.[31] For instance, evidence suggests women's ability to accurately report birth attendants deteriorates somewhat over time. We recommend recall periods be shortened to strike a balance between accurate recall and adequate sample sizes for analysis, and support the planned reduction of the 5-year DHS recall period to match the 2-year MICS recall period. The resulting reduced time in completing the questionnaire may also improve data quality.[32] A denominator of all births would still enable disaggregation by live births for comparison to older survey estimates (ie, bridge coding).

WAYS FORWARD FOR IMPROVED MEASUREMENT OF SBA COVERAGE

The global call for improving the quality of maternal and newborn care[33–35] demands we acknowledge the conceptual and measurement limitations of SBA coverage as an indicator of progress. Meaningful measurement of SBA coverage under the 2018 joint statement would capture the proportion of all births that are cared for by an individual healthcare provider or team who can provide all the internationally defined components of maternal and newborn care in an enabled environment.[2] The current approach of tallying the most skilled cadre(s) present, as reported by the woman, ignores the extent of assistance that was provided, whether the healthcare provider had the necessary support or supervision or whether they were working in an environment equipped with the drugs and infrastructure needed to perform routine and emergency care. The way forward must include improving documentation for classifying country cadres as 'skilled', capturing the enabling environment and understanding the complexity of care provision at the country level.

Classification of skilled cadres

There is a clear need for better documentation of why a particular cadre is designated as skilled. A recent systematic scoping review of MNH professionals in LMICs identified 123 unique cadre names, with 67% of cadres conforming to the international standards of doctor, nurse or midwife, and 57% classified as skilled according to the 2004 WHO definition.[16] Clarifying the training requirements and regulation of delivery care providers is an important step towards more consistent measurement, but this is a moving target since the training of health personnel and their scope of practice in different countries change over time. A step towards creating greater accountability for country governments' progress in meeting this SDG indicator would be recording and making public documentation on why cadres in survey response options are considered skilled by MOH officials, listing the cadre's training and qualifications, using the 2018 joint statement of core competencies.[2] Improving transparency around how cadres were classified and captured on surveys would enhance understanding of a country's range of delivery care providers and accuracy for all users of the data, including country officials, researchers and UN agencies. However, country and survey programme implementers must be included in discussions of feasibility for this process and its implications for other indicators.

The 2018 joint statement emphasises competencies over cadre names. Yet, there remains a lack of clarity on the governance mechanisms to map country cadres and associated training programmes to the competencies, and on who has the final say on whether these meet the revised SBA definition. We see professional organisations, such as FIGO, ICM and International Council of Nurses member associations, and national regulatory bodies as playing a key role in this process. However, it must be acknowledged that there are competing interests at stake in cadre designations. Countries will be reluctant to downgrade current cadres from skilled to unskilled to avoid a drop in national SBA coverage levels; at the same time, professional associations potentially have vested interests in restricting the ranks of SBAs to midwives and obstetricians. Perhaps, the greatest importance of the 2018 joint statement lies in informing the accreditation of training programmes for midwifery skills.

### Capturing the enabling environment

Evidence suggests that women can report the type of facility where they delivered more accurately than cadre of attendant, and having skilled attendance depends not just on the training and competencies of skilled attendants but also the service environment, including necessary equipment, support and referral options. In light of the 2018 joint statement's emphasis on the important role of the enabling environment, we echo Marchant and colleagues' recommendations about the need to advance techniques to link population-based and provider-based data.[35] We encourage surveys and health management information systems to provide more detail on the place of delivery, by level and sector, in order to facilitate linking population-based surveys to facility data.[36] This includes disaggregating private sector health facilities to distinguish hospitals from lower-level clinics where possible.[24]

Campbell and colleagues show that cross-tabulating the most skilled person attending the delivery with the place of delivery reported by women, generates a useful picture of maternity care services.[7] Linking what women can tell us in household surveys with what facility surveys can tell us yields an even more nuanced picture of care coverage. For example, based on the Kenya 2014 DHS, 61.3% of births were assisted by skilled health professionals in a health facility. However, by using information on facility capability from an analysis of the Kenya 2010 Service Provision Assessment survey, we could state that only 22.1% of births in Kenya were assisted by skilled personnel in a facility meeting the criteria for routine maternal care (see online supplementary appendix 3 for methods). Relying entirely on the presence of a skilled cadre risks painting an overly optimistic picture of progress, whereas using multiple sources linking person and place yields a more comprehensive picture.

Understanding complexity in skilled assistance

As illustrated in the example of Kenya, SBA coverage estimates tell only part of the story, and further disaggregation of where and with whom women deliver can help to unravel what delivery care looks like in its complexity.[7] The patterns arising can inform efforts to improve delivery care that are tailored to the specific country and health system contexts.

In response to the 2018 joint statement that a team of MNH professionals could cover the required competencies, we examined how women reported different combinations of attendants among facility-based deliveries
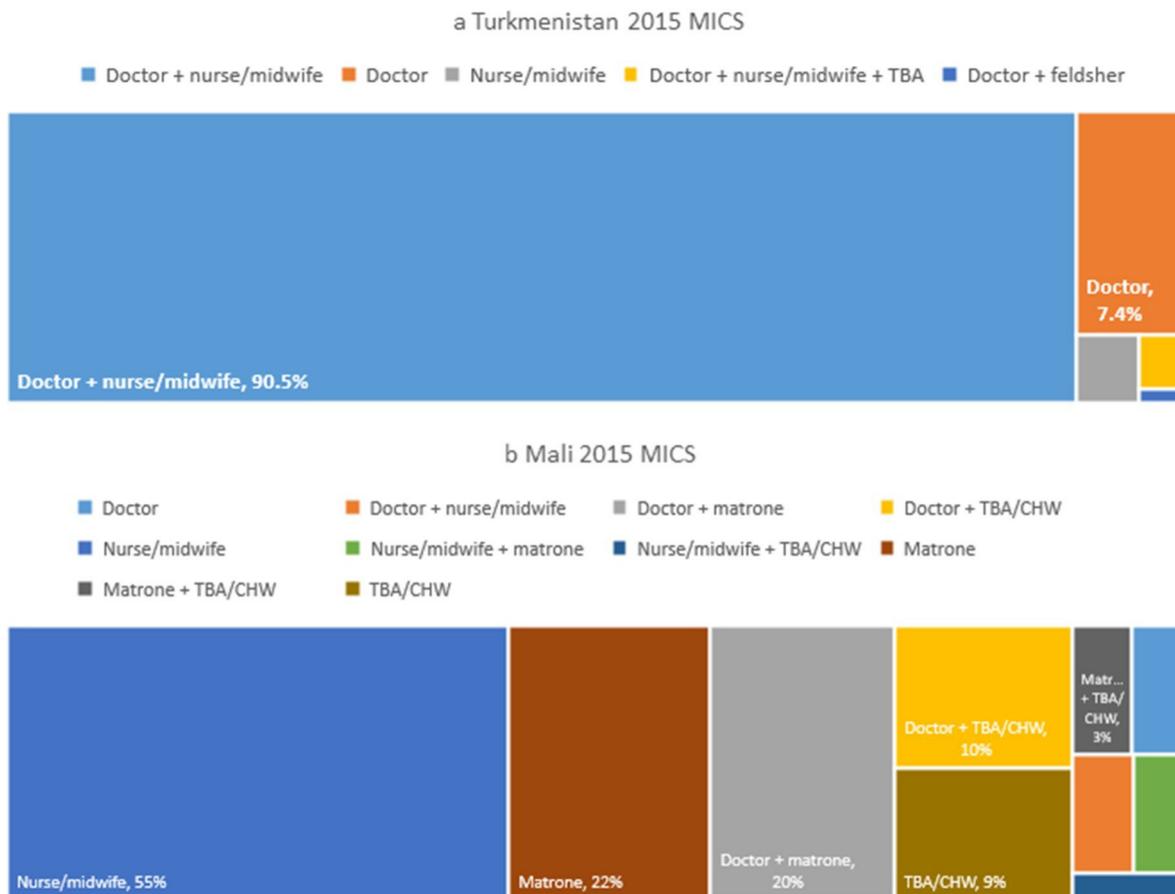
Figure 2 Attendants at delivery among all facility-based deliveries in recall period. TBA, traditional birth attendant; CHW, community health worker; MICS, Multiple Indicator Cluster Surveys.

(figure 2, see online supplementary appendix 2 for methods). For nearly all facility-based deliveries in Turkmenistan (91%), women reported assistance by both a doctor and a nurse/midwife. In Mali, the majority of women reported assistance by a nurse, midwife or matrone (55%). However, nearly a third of women delivering in facilities in Mali reported that a combination of both a doctor and a matrone, traditional birth attendant (TBA) or community health worker assisted, of whom only doctors are SBAs. This suggests that reliance on SBA coverage as indicated by 'doctor' as the highest cadre of attendant would mask these possible collaborations between the formal health system and community-based, potentially unskilled cadres, though the extent of assistance performed by the different cadres may vary considerably. Measurement efforts should consider capturing teams of professionals assisting with deliveries to enhance understanding of a country's provision of childbirth care.

Disaggregation and linking of current data sources provide additional insight, but engaging with local, contextual knowledge and refining the survey question are needed to interpret and understand what delivery assistance actually looks like. For common patterns, such as the nearly one-third of women in Mali reporting delivery with a doctor and lower-skilled cadre (figure 2b), research is needed to understand who is present and/

or provides most of the care during labour and delivery, and who is responsible for intervention in the event of complications. More clarity is also needed on what we are currently capturing as attendant at birth in population-based surveys. The survey question could be rephrased to more accurately capture everyone who was present at any point during labour and delivery, the person(s) assisting at a critical moment (eg, the person who caught the baby), or the person in charge. It is worth keeping in mind, however, that women are in a unique situation during childbirth and may be unaware of or unable to recall the details needed to answer some of these questions. Women would also not be expected to know, for example, who was supervising the ward or her attendants if they were not directly involved in her care. Efforts to refine the question should, in the long term, join forces with movements promoting respectful care, which encourage providers to introduce themselves and let woman know their name and position.

CONCLUSION

The global health community must acknowledge the limitations of SBA as an indicator and seek to improve it by providing clear metadata on who is considered to be an SBA, and including stillbirths in the denominator. It

also needs to advocate for multiple indicators reported at different levels to track the complexity of inputs required to improve MNH, including by cross-tabulating where and with whom women deliver, linking to facility assessments to characterise the enabling environment, and understanding teams of multiple attendants. Global monitoring requires harmonised indicators that lose the level of detail required to improve care and service delivery at the local level. As such, greater use of current and emerging data sources, including for disaggregation and linking, is needed to understand the kind and quality of delivery care women receive, including for respectful care. The 2018 joint statement represents an aspirational approach to care but also to coverage measurement. While improvements in measurement of the SBA indicator are possible, we must also recognise what SBA coverage can and cannot tell us about ongoing efforts to ensure high-quality, life-saving care for women and newborns.

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