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Beyond counting stillbirths to understanding their determinants in low-and middle-income countries: a systematic assessment of stillbirth data availability in household surveys

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Abstract

Objective: To systematically map data availability for stillbirths from all countries with DHS surveys to outline the limitations and challenges with using the data for understanding the determinants and causes of stillbirths, and for cross-country comparisons.

Methods: We assessed data sources from the DHS program website, including published DHS reports and their associated questionnaires for surveys completed between 2005 and 2015.

Results: Between 2005 and 2015, the DHS program completed 114 surveys across 70 LMICs. Ninety-eight (86.0%) surveys from 66 countries collected stillbirth data adequately to calculate a stillbirth rate, while 16 surveys from 12 countries did not. The method used to count stillbirths varied; 96 (84.2%) surveys used a live birth history with a reproductive calendar, while 16 (14.0%) surveys from 12 countries did a full pregnancy history. Based on assessment of questionnaires, antenatal and delivery care information for stillbirths was only available in 15 surveys (13.2%) from 12 countries (17.1%). Data on maternal conditions/complications were captured in 17 surveys (16.0%), but only in six could these be linked to stillbirths. Data on other recognized risk factors were scarce, varying considerably across surveys. Upon further examination of datasets from surveys with maternity care data on non-live births we found incomplete capture of these data; only two surveys had adequately and completely collected them for stillbirths.

Conclusion: Substantial variation exists in DHS surveys in the measurement of stillbirths, with limited scope to examine risk factors or causes. Without immediate improvements our understanding of country-specific trends and determinants for stillbirths will remain hampered, limiting the development, and prioritization of programmatic interventions to prevent these deaths.

Keywords: stillbirth; fetal death; perinatal mortality; measurement; demographic and health survey; low and middle-income countries

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Introduction

Stillbirths until recently have received little attention on the global public health agenda, yet every year there are almost as many stillbirths globally as early newborn deaths (1). A large proportion of stillbirths could be prevented if our understanding was improved through high-quality and complete data that accurately describes the burden, causes, and risk factors. Low and middle-income countries (LMICs) are disproportionately affected, accounting for 98% of the 2.6 million stillbirths that occurred in 2015 (2). However, stillbirths are not routinely reported in vital statistics in LMICs and the global and national stillbirth estimates published in 2006, 2011 and 2016 were generated using complex modelling due to the absence of quality data (1-3).

Over the past two decades there has been little improvement in reducing stillbirths, particularly in South Asia and sub-Saharan Africa, where the largest burden lies (2, 4). The lack of country-specific data for stillbirths is a major barrier to reducing stillbirths as it prevents sufficient understanding of the circumstances surrounding stillbirths, and impedes opportunities for intervention in countries with the highest burden. A systematic review of the literature examining the causes and risk factors associated with stillbirths in LMICs found only 2% of studies included were from low-income countries and these were mostly hospital-based, highlighting the need for more population-based studies in these settings (5). The 2011 stillbirth *Lancet* series advocated for improved data collection in LMICs by focusing on existing, nationally representative population-based surveys including the Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS) and demographic surveillance sites (1, 3, 4, 6). The lack of investment in improving stillbirth data persists and the gap was raised again in 2015 (7), however, few changes have occurred to improve household survey data (1, 4, 7).

DHS surveys are large, nationally representative household surveys and the most widely implemented and publicly available source of population, health and nutrition information in LMICs (8). Operating since 1984, the USAID-funded DHS program has conducted surveys in over 80 countries (9). DHS data is widely used to understand determinants of maternal and child health outcomes and to conduct globally comparable analyses across countries and time periods (10, 11). They are also the main source of data for stillbirths for high-burden countries; however, these data are recognised as being inadequate, underestimating stillbirths by over a third (1) and have rarely been used to examine underlying risk factors and causes of stillbirths.

In 2014, the landmark *Every Newborn Action Plan* launched at the World Health Assembly-set targets to achieve stillbirth rates of 12 or fewer per 1000 births by 2035 and was endorsed by 190 countries (12). To track progress towards achieving this goal and devise programs to target the key causes and determinants of stillbirths, adequate data are imperative. Here we methodically assess

how stillbirth data are captured in the DHS, and what data are available for identifying risk factors that can inform strategies for stillbirth prevention and neonatal survival.

Methods

Study design

We reviewed data sources available through the DHS program website, including published DHS reports and their associated questionnaires.

Sample

Data sources included all published DHS reports available on the DHS program website and their associated questionnaires (9). Selected RHS (Reproductive Health Surveys) reports were accessed from the Global Health Data exchange website (13) following the initial search (see below). DHS surveys typically include three questionnaires – a household questionnaire, a women’s questionnaire, and in some cases a men’s questionnaire. The DHS program also provides several optional modules or questionnaires (for malaria, HIV/AIDs, verbal autopsy questionnaire) that are incorporated by some surveys, all of which were reviewed for relevant data. The STATcompiler tool (14) – an online data analysis tool on the DHS program website was accessed to generate stillbirth and perinatal mortality rates where possible.

Selection of surveys

We limited the search to DHS/RHS surveys completed between 2005 and 2015, and included all countries where the DHS program conducts surveys. Over the ten-year period, countries completed multiple surveys, and rather than restrict our search to the most recent, we included all surveys due to variations in questionnaires over time. Survey types selected for inclusion included all DHS surveys (Standard DHS, Continuous DHS, Interim DHS, and Special DHS) and Special surveys under the *Other* category (described in Box 2). The search was limited to completed surveys where full reports and associated questionnaires were available. Surveys were included only if the data was publicly available and accessible through the DHS program. Selected RHS surveys were included in this analysis as the DHS program integrates data from some of these surveys into its online database, and they also capture stillbirth data. We excluded surveys/ reports that may be accessed or available through other websites, but not through the DHS website, as was the case for several Pacific countries (i.e. Papua New Guinea 2006-07, Nauru 2007, Marshall Islands 2007, and Kirbati 2009, Samoa 2009, Solomon Islands 2007, Tonga 2012, Tuvulu 2007, and Vanuatu 2013) as these could not be identified in a systematic way, and data collection was not always overseen by the DHS program.

Surveys completed prior to 2005 were excluded. Other survey types carried out by the DHS program that do not report pregnancy outcome data were not included (i.e. AIDS Indicator Surveys, Service Provision Assessments, Malaria Indicator Surveys, and Key Indicator Surveys). Ongoing surveys and completed surveys where the full reports were not yet available were excluded. We did not include Multiple Indicator Cluster Surveys as they are not integrated into the DHS website and do not routinely collect stillbirth data.

Procedure

We searched for surveys on the DHS program website (16) using the *Survey Search* function in November 2015 limiting the search to the inclusion and exclusion criteria. The STATcompiler tool (14) was used to generate summary tables of stillbirths, early neonate deaths, and perinatal mortality. Data available through STATcompiler is limited to surveys completed up to 2013, and indicators that are comparable across countries. We therefore manually collated data from published reports of surveys done after 2013 and where the method used to measure stillbirth and perinatal mortality were different, and may not have generated comparable data.

Data extraction and indicator selection

We developed a customised, pre-structured spread sheet to extract data from survey reports, questionnaires and STATcompiler-generated tables to allow for comparative assessment of data availability across countries and survey years. All DHS reports meeting the inclusion criteria were downloaded, reviewed and information abstracted into the customized database.

Survey Indicators/Measures assessed

Indicators were initially selected based on the DHS model questionnaires focusing on measures relevant for determining stillbirth estimates, known or potential risk factors for stillbirths, coverage of interventions known to prevent stillbirths, and capture of cause of death data (17, 18). We reviewed the methods/ instruments used to report pregnancy outcomes to determine the proportion of surveys that captured stillbirths, the method used to capture stillbirths, proportion of surveys with data on maternity (antenatal and delivery) care for stillbirths, maternal conditions/complications, and potential modifiable risk factors for stillbirth, and cause-of-death data. Due to the large variation in questionnaires from country adaptations and different phases of the DHS, additional indicators were added as they were identified in the surveys. We also noted if stillbirths were reported in the narrative report for the surveys.

Stillbirth and perinatal mortality capture

We reviewed the survey methodology used to ascertain stillbirths across the various surveys. DHS surveys generally complete either a live birth history or a full pregnancy history with all women of reproductive age to measure fertility in the reproduction section of the women's questionnaire. In addition to all the mother's live births, pregnancy histories record all non-live births including stillbirths, miscarriages and abortions, whereas birth histories do not. To generate perinatal mortality rates and stillbirth rates, a birth history must be supplemented with a reproductive calendar. The reproductive calendar captures a month-by-month retrospective history of all the mothers' reproductive events in the 60-month period prior to the interview including pregnancies, live births and terminations (stillbirths, miscarriages, abortions) in addition to documenting contraceptive use. Stillbirths and perinatal mortality can be calculated directly from a full pregnancy history without the need for a calendar. Additional methods used by some surveys incorporate a live birth history form with single questions about non-live births, or a separate table for recording details of non-live births (see Box 3 and Appendix 1a-d for examples from DHS questionnaires).

Generally DHS surveys apply the definition of a stillbirth as a fetal death in pregnancy that occurs at seven or more months gestation (19). This is in accordance with the WHO recommendation of reporting of stillbirths for international comparison as a late fetal death at 28 weeks or more gestation, or with a birth weight of 1000 g or more. However, in the DHS duration of pregnancy is only recorded in months, and 7 months may mean pregnancy duration is anywhere from 22 weeks to 30 weeks gestation. The majority of births in low-income countries occur at home, so birth weight is often unknown, and even with facility deliveries, stillborn babies are rarely weighed, making gestational age the main criteria by which stillbirths can be based upon.

The instruments used to capture pregnancy outcomes in the DHS/RHS surveys record the duration of the mother's pregnancies in months, and in most surveys stillbirths are determined by the analyst based on a gestational age cut off of 7 months or more. There are some exceptions in surveys that use full pregnancy histories or where single questions are used where the mother is asked directly about the outcome of her pregnancy and whether it resulted in a live birth, stillbirth, miscarriage or abortion instead of asking about the duration of each pregnancy. It is not clear in these cases what instruction is provided to the interviewer in defining each of these outcomes to the mother. Box 3 outlines in detail how stillbirths are determined using each of the instruments.

Maternity care data

We examined the surveys to identify the proportion that collected data on maternity care received during pregnancy and delivery for stillbirths. These indicators included mother's utilisation of ANC (number and timing of visits), content of ANC, details of delivery characteristics (use of skilled birth attendant, delivery location) and access to emergency obstetric care (caesarean section, planned or emergency, other procedures).

Coverage of specific ANC components in the standard DHS model questionnaire included whether during any ANC visits mothers had their blood pressure taken, a blood or urine test, if they received anti-helminths, were vaccinated against tetanus, received iron-folic acid supplements, were informed of pregnancy complications, maternal anthropometry measures assessed, and in malaria and HIV endemic countries, provision of anti-malarial drugs, and screening for HIV. Any additional ANC components identified were added to the form to highlight variations in country adaptations.

Maternal conditions or complications

We examined how many surveys captured data on antepartum conditions or complications a mother experienced during the pregnancy (severe headache, vaginal bleeding, blurred vision, seizures, fatigue, swelling of hands or feet, pale/anaemic) or during labour (i.e. prolonged labour, excessive bleeding, convulsions, fever with abnormal vaginal discharge, retained placenta). As these measures are not included in the DHS model surveys we included all possible complications mentioned in any DHS survey that did include these questions. Coverage of whether care was sought for complications and type of provider were also included.

Other modifiable risk factors for stillbirths

We examined all surveys for data availability on known, modifiable risk factors for stillbirth. We did not include maternal factors and other socio-demographic risk factors known to be routinely collected in all DHS surveys or could be calculated from the datasets (such as maternal age, parity, multiple pregnancy, pregnancy intervals, prior pregnancy termination, maternal education, and socioeconomic status). Risk factors were initially chosen based on what was available in the DHS model questionnaire, and based on known risk factors in the literature, we screened DHS surveys for coverage of any additional indicators. Risk factors included women's smoking status, exposure to indoor smoke, use of biomass fuel, use of iodised salt, short maternal stature, history of diabetes, history of high blood pressure, alcohol consumption, domestic violence during pregnancy, fistula, and female genital mutilation or cutting.

Verbal autopsies on stillbirths

We examined the proportion of DHS surveys that incorporated verbal autopsy tools to assess the causes of stillbirths.

Examination of datasets that capture maternity care data for stillbirths

We explored the 12 of the 15 datasets from the DHS surveys identified as having collected maternity care (ANC and delivery care) data on stillbirths to identify how well this data was collected, and for how many stillbirths data were available. Datasets for three RHS surveys were not available on the DHS website and so not included in the analysis. Datasets were downloaded from the DHS website, and using the data file from the women's questionnaire, a pregnancy outcome variable was generated using data collected from pregnancy histories to identify all live births, stillbirths, miscarriages, and abortions (if the datasets had not already included such a variable) in the five years preceding the survey. For data sets where a pregnancy outcome was not already available we defined stillbirths as a pregnancy loss (baby born dead or lost before birth) at 7 months or more gestation, with no signs of life (no movement or breathing) at birth. A miscarriage was considered a baby lost prior to 7 months gestation, while abortions were pregnancies losses where something was done to intentionally end the pregnancy. DHS surveys usually collect ANC data only for the mother's most recent birth, while delivery care indicators are collected on the last two, or occasionally last three births. We restricted the analysis to the mother's most recent birth and used descriptive statistics to summarise maternity care data availability for all birth outcomes. All statistical analyses were conducted using STATA/SE version 14.2.

Results

Characteristics of surveys included

Since 1985 the DHS program completed 373 surveys across 91 countries. We found 119 surveys across 70 countries that met our eligibility criteria. Five were subsequently excluded because they were specialised surveys focused on specific diseases (Mali 2010 Anaemia Prevalence Survey; Dominican Republic 2007 and 2013 HIV Prevalence Surveys; Rwanda 2011 Population Size Estimation Survey; Indonesia 2007 Special Young Adult Reproductive Survey). We further included six RHS surveys that provided perinatal mortality data to the DHS data repository. In total, 114 DHS and RHS surveys from 70 countries were identified and included in subsequent analysis (Figure 1). Table 1 summarises surveys by type, region, language, year and frequency. The majority (81.6%; n=93/114); were standard DHS surveys, nine were continuous DHS (7.9%; n=9/114), four were special surveys (3.5%; n=4/114), and six were RHS (5.3%; n=6/114) surveys.

Almost half (49.1%; n=56/114) of the surveys were conducted in the sub-Saharan African region, followed by Latin America and the Caribbean (19.3%; n=22/114); South and Southeast Asia (17.5%; n=20/114); and North Africa/West Asia/Central Asia/Europe (14.0%; n=16/114). About half of the countries (55.7%; 39/70) had one survey over the ten-year period, while 23 (32.9%; n=23/70) countries had two surveys each, and six countries (8.6%; n=6/70) had completed three surveys. Peru had done seven surveys, as it has been implementing yearly continuous DHS surveys.

Stillbirth and perinatal mortality capture

Table 2 summarises the various methods used to record mother's reproductive history in the selected DHS surveys. Of the 114 surveys, 96 (84.2%) used a live birth history and 16 (14.0%) used a pregnancy history. Of the 96 that used a birth history, 89 (78.1%) were accompanied by a reproductive calendar. Most that had done a pregnancy history also included the reproductive calendar. The 16 surveys that had implemented the pregnancy history represented 13 countries predominantly in Central and West Asia and South Asia (Appendix 3). Sixteen surveys from 12 countries had used a live birth history but no reproductive calendar or any other method or questions to capture stillbirths.

Of 114 surveys, 98 (86.0%) had collected stillbirth numbers adequately to determine a stillbirth rate either using the birth history supplemented with the reproductive calendar, or a pregnancy history. The 16 surveys from 12 countries that did not collect stillbirth data adequately to calculate stillbirths or perinatal mortality are listed in Table 3. Of these, most had a single pregnancy termination question (*Have you ever had a stillbirth, miscarriage or abortion?*) but stillbirths could not be differentiated or quantified as no time period was specified through follow-up question (i.e. how many such pregnancies have you had in your life?), and a reproductive calendar was not used (Appendix 3).

Availability of maternity (antenatal care and delivery care) data

Only 15 surveys (13.2%; 15/114) from 12 countries (17.1%; 12/70) captured ANC use, components of ANC received, and delivery care information for stillbirths (Table 4; Appendix 4). The majority of surveys appeared to capture this data only for live births.

All surveys were reviewed for ANC component measures to identify to what extent content and quality of antenatal care is captured particularly in relation to important factors that may affect stillbirth risk/pregnancy outcomes. The number and timing of the first ANC visit was routinely assessed in all surveys with some also capturing timing of last ANC visit. There was substantial variation in the collection of coverage of key components of ANC interventions (Table 5; Appendix

4). ANC components included in the DHS model questionnaire include blood pressure screening, and blood and urine tests. Assessment of maternal anthropometry varied across different DHS phases; weight was included in the Phase 5 (2003-2008) model questionnaire only, whereas height was never in the model questionnaire, yet several surveys have chosen to include it. Coverage of other ANC components in the model questionnaire included tetanus vaccinations, consumption of iron-folate, and being informed of pregnancy complications.

Almost all surveys assessed if women had blood pressure measured (96.5%; 110/114), a urine test (96.5%; 109/113), blood test (95.6%; 109/114), and been informed about pregnancy complications (93.0%; 106/114). Almost three-quarters of surveys (70.2%; 80/114) asked women if they were weighed, while 29.0% (33/114) asked if their height was measured. Several surveys included questions on other optional ANC components such as whether the mother had an ultrasound (12.3%; 14/114), offered a syphilis test (7.1%; 8/113), and if the fetal heartbeat was checked (15.0%; 17/113). Only 11 surveys (9.8%; 11/113) collected information on emergency preparedness and birth planning. Several inconsistencies were noted in the birth preparedness components, with variations in the format and response options across surveys (not shown).

Availability of data on maternal conditions or complications

Only 17 (14.9%; 17/114) surveys potentially captured data on maternal conditions or complications in the antenatal period, and of these, eight identified if subsequent care was sought (Appendix 5). Slightly more surveys included questions about delivery complications (19.3%; 22/114), most of which included details of the complications. Only four surveys asked if care was sought for delivery complications, and from which provider type or location. Of the 16 surveys that obtained information on maternal complications, only six included a pregnancy history that may allow linking of this information to stillbirths. Four surveys asked about complications without specifying if they were antepartum or intrapartum (2010 Afghanistan Mortality Survey, 2007 Ghana Maternal Health Survey and 2011-12 and 2005-06 Honduras DHS). We also found large variations in how questions were phrased – a comparison of selected countries is provided in Appendix 6. For many, the response options did not allow the interviewer to specify the time period complications occurred. Differences in response options for questions regarding complications varied across all surveys with no two surveys being similar. The India 2005-06 NFHS asked mothers about each symptom rather than asking an open question about what problems they experienced, thereby prompting responses.

There were also variations in whether either antepartum or delivery complications, or both were collected and varied within countries as well. The 2007 Bangladesh DHS included questions on delivery complications but not for antepartum conditions/complications while in the 2011 survey, the questions on complications were absent.

Assessment of other potential risk factors for stillbirth

The inclusion of questions about other potential risk factors for stillbirth was inconsistent across surveys. Table 6 summarises the proportion of all DHS/RHS surveys that include questions to capture other modifiable risk factors for stillbirth. Mothers' smoking status was captured in almost all surveys (86.8%; 99/114), while exposure to second-hand smoke in the home was only assessed by less than half (40.4%; 46/114). The type of fuel used for cooking was examined by most (96.5%; 110/114), and about three-quarters (74.6%; 85/114) determined exposure to smoke inside the home from cooking, and household consumption of iodised salt (69.3%; 79/114). Very few surveys assessed the prevalence of obstetric fistula (18.4%; 21/114) and female genital mutilation/cutting (27.2%; 31/114), and about half (55.3%; 63/114) had asked women if they had ever experienced violence while pregnant. Fewer than 20% of surveys asked mothers if they had ever been diagnosed with high blood pressure, diabetes or anaemia (Table 6).

Verbal autopsies on stillbirths

Only six of 114 surveys incorporated a verbal autopsy questionnaire, and of those 4 had a separate verbal autopsy module for stillbirths (Afghanistan 2010, Ghana 2008 DHS Nepal 2006 DHS, and Pakistan 2006-07 DHS). Two of these (Nepal 2006 DHS and Pakistan 2006-07 DHS) reported the timing (antepartum or intra-partum) of stillbirth in the report's narrative and one (Pakistan 2006-07) reported the cause of death, despite all four having collected this information. The Swaziland 2006-07 DHS survey had included a question about the timing of stillbirths in the main part of the women's questionnaire - "*Was this last stillbirth macerated or fresh? By macerated I mean the body may have started to decompose.*" - the results of these were not reported in the narrative DHS report.

Absence of reporting of stillbirth estimates in DHS narrative reports

Although the majority of countries had collected data on stillbirths according to their questionnaires, several had not reported results in the narrative DHS report. Of the 98 surveys that collected quantifiable still-birth data, 12 surveys (11.0%) from 10 countries (14.0%) had not reported these in their reports (Table 7).

Examination of selected DHS datasets for maternity care data on stillbirths

Upon examination of datasets from DHS surveys that potentially collected antenatal and delivery care received for non-lives births in addition to live births, we found that the data was not completely collected for all cases of stillbirths that they should have been. Table 8 summarises the findings from five of the datasets. In only two surveys (Ghana 2007 AMS and Afghanistan 2010 AMS) was the data available for all stillbirths if a mother's most recent pregnancy resulted in a stillbirth.

Discussion

This study systematically assessed data availability for stillbirths in nationally representative household surveys from LMICs over the last ten years highlighting variations in stillbirth capture and the limited data available to assess risk factors and causes of death for stillbirths both intra-country over time, or for cross country comparison. DHS surveys are an invaluable and often the only source of high quality population health data for many LMICs countries where routine data collection and reporting systems are inadequate or non-existent, and where utilisation of health facilities is low. In these contexts, DHS surveys have been a key data source to track global health indicators including the MDGs (8) and will be important for the upcoming SDGs. The global target set in 2014 to reduce stillbirths to 12 per 1000 births by 2030 (12) will require reliable data for monitoring progress and understanding risk factors to facilitate selection and prioritisation of interventions to reduce stillbirths. The DHS surveys provide an immediate opportunity to do so if they can provide quality and comparable data.

Our analysis has identified variations in the method used to ascertain if a mother had a stillbirth. To record a mother's reproductive history the majority of surveys use a live birth history supplemented with a reproductive calendar while full pregnancy histories have been carried out in less than 20% of surveys over the last ten years. A limitation of using live birth histories is that fetal deaths (including stillbirths) are excluded in later parts of the DHS questionnaire that capture data on mother's health service utilisation (ANC and delivery care) during her last pregnancy. Given the importance of ANC and emergency obstetric care in reducing stillbirth risk, this is a critical oversight in the data collection that should be addressed, and importantly, can lead to an underestimation of the importance of these interventions on pregnancy out-comes. The variation in use of birth history versus pregnancy histories has previously been highlighted as problematic, with a preference for pregnancy histories because they provide a more comprehensive description of all pregnancy outcomes and the option to link maternal conditions with those outcomes.

Pregnancy histories are used less frequently by the DHS but evidence suggests they produce better quality stillbirth estimates. An analysis of 168 DHS and RHS's compared the different instruments used to measure perinatal mortality and assessed the quality of stillbirth estimates using stillbirth to early neonatal death (SB: END) ratio. In low-income countries the number of stillbirths should be almost equal to or slightly higher than the number of early neonate deaths with expected ratios being around 1.2 (20). Pregnancy histories were superior in identifying more stillbirths, producing ratios closer to 1:2, although both methods underestimated stillbirths (21). A validity study comparing birth histories to pregnancy histories in Bangladesh in relation to completeness of reporting of infant deaths, also found that pregnancy histories were far better for estimating infant mortality (22). These results support the use of pregnancy history over birth history to improve the quality of stillbirth data, confirming previous research that stillbirths are underestimated using the reproductive calendar (3).

The 2006 and 2011 Nepal DHSs, 2006 Pakistan DHS, and 2008 and 2013 Philippines DHSs incorporated pregnancy histories, as did several central and west Asian countries including Ukraine, Kyrgyzstan and Kyrgyz Republic. The 2010 Afghanistan Mortality Survey also provides an alternative format. With several examples available, whether pregnancy histories could be implemented more widely should be explored and has been advocated by maternal and newborn health researchers (2, 6). Some possible disadvantages of using a pregnancy history over live birth history to note is that interview time would be increased and there would be fewer live births with antenatal, delivery and post-natal care data, which may require a slight increase in the overall sample size for DHS surveys which would have cost implications. Given the absence of adequate data for stillbirths the potential disadvantages should be weighed against the benefits of capturing much needed data for preventing these deaths.

Inclusion of a reproductive calendar is necessary for determining stillbirth and perinatal mortality rates in surveys that use a live birth history. Where reproductive calendars were not included, some countries incorporated single questions on how many stillbirths a mother had in the previous five years allowing the calculation of stillbirth rates. However, 16 surveys from 12 countries used only a birth history and no stillbirth data were available due to problematic the wording of the questions; some ask mothers if they have ever had a stillbirth, miscarriage or abortion but did collect how many of each, or specify a time period, reducing the usefulness of the data. These discrepancies could be easily addressed to ensure these countries, some of which are known to be high burden countries (2), have adequate and comparable still-birth data. Inconsistencies between surveys for the same country also exist; for example, the 2011 Cameroon DHS did not include a reproductive calendar, yet in 2004 it did, so no stillbirth data are available in the most recent survey. Calendar

estimates are not ideal, but until all surveys collect women's reproductive histories in the same manner, they will continue to be the main but low quality source of stillbirth data. The recent update to the DHS model women's questionnaire (Phase 7) incorporated a short non-live birth history table that follows the birth history to document pregnancy losses, capturing when the loss occurred and how many months pregnant the mother was - similar to what the reproductive calendar records. The reason for its introduction may be a step towards moving away from the use of the calendar, yet it still excludes stillbirths and other non-live births from being included in later parts of the women's survey where mothers are asked about health service utilisation during their pregnancy.

The availability of data in relation to access to and quality of antenatal and intrapartum care for stillbirths was almost absent. Even in those surveys with pregnancy histories where these data should have been available, they were incomplete and not all stillbirths were included when they should have been, suggesting that more clarity on which births should be included in the maternity care section is required. If full pregnancy histories were implemented and all births (instead of only live births) were included in the maternity care section of the women's questionnaire it would be possible to capture this information, allowing for a greater understanding of the country-specific patterns and impact of these interventions. ANC visits provide an opportunity to target mothers with key interventions including blood pressure monitoring, iron supplementation, tetanus vaccination, and education on complications in pregnancy, and to identify women with complications or conditions that might adversely affect the pregnancy. The variability in content and components of ANC captured across DHS surveys makes assessment of this challenging.

There is the potential for differential bias in the responses to the maternity care questions for live births vs. stillbirths and more efforts will be needed to minimise this through adequate interviewer training. In many LMICs, stigmatisation, abuse and rejection are frequently experienced consequences for mothers with stillborn babies (23-25), which may discourage disclosure and reporting of stillbirths and may also influence responses provided for births that did not result in a live birth. Haws et al (2010) explored the potential effect of stigma associated with stillbirths on stillbirth mortality measures in Tanzania emphasising the importance of considering local concepts, meaning and consequences of perinatal loss during survey instrument design (26). The extent of under-reporting or misreporting as a result of this is not known and the variations across different cultures have not been explored in depth.

Globally recommended interventions for ANC visits based on the WHO's focused ANC model (includes measurement of weight, height, BP, urine and blood tests, counselling breast-feeding, danger signs and birth planning) are not comprehensively and routinely included in DHS surveys, which are generally limited to blood pressure measurement, blood and urine testing, and informing

mothers of pregnancy complications. Assessment of anthropometry measures varied considerably, yet data on these will be important to avoid adverse pregnancy outcomes, given that maternal under nutrition and short maternal stature are important risk factors for stillbirths (27). Birth and emergency preparedness is part of the WHO's recommended focused ANC model and demonstrated to be effective for reducing neonatal and maternal mortality through its effect on improving skilled birth attendance and facility deliveries (28, 29), yet DHS coverage of birth planning interventions was low, and components of birth planning assessed also varied. Birth planning was one of eight interventions with high quality evidence supporting its effectiveness in prevention of stillbirths (30), therefore ensuring its implementation as part of ANC packages will be important to monitor. Although not part of routine ANC in LMICs, coverage of ultrasound or fundal height measurement was also rarely collected. Selected surveys included other indicators, but the reason for their inclusion and whether they generated any useful data is not clear. Improved standardisation of key components to assess coverage of ANC components is needed to ensure that essential data is collected across all countries and surveys and to avoid collecting unnecessary information.

Ensuring quality ANC is critical for preventing antepartum stillbirths. ANC attendance rates are high in some contexts where neonatal mortality remains high, pointing to the need to assess the content, quality and timing of visits, not only the number. Assessment of coverage of core components of ANC can provide a proxy for quality of ANC, however no standard index exists for determining what quality ANC entails in low-income settings, with various studies generating their own measures that incorporate not only assessment of service provision, but also patients satisfaction with care received (31-34). Marchant et al. (2015) considered having received all eight components of ANC based on WHO's focused ANC model as a measure of "high quality" in their study in Africa and India and found that the highest proportion of high quality ANC contacts was only 11% in Nigeria (35), suggesting that quality of ANC requires better monitoring.

Identification and screening for complications/conditions during the antepartum period or during childbirth are critical for reducing the risk of stillbirth (36), yet these questions are not included in the model DHS questionnaires. As questions are not standardised, several inconsistencies were found in capturing data on maternal conditions including not specifying whether complications were ante- or intra-partum, or measuring only one or the other. Response options also varied, with most responses based on mother's recall while in other surveys prompting was used, thus limiting cross-survey comparisons. DHS surveys are based on a standardized model questionnaire and countries may modify questions and include additional modules relevant to the country context. Although beneficial, this creates challenges for comparability across indicators, countries and over time as this study has demonstrated. Several studies have examined DHS surveys

for data availability related to specific indicators, availability of disaggregated data or for subgroups such as adolescents, and identified that adaptation of response options and other inconsistencies have made international comparisons challenging (37-40). To enable improved understanding of maternal conditions associated with stillbirths, ensuring and standardising their measurement in DHS surveys could assist with prioritising preventive interventions to detect and manage these conditions.

The need for verbal autopsies to establish cause of death is critical, as up to 70% of stillbirths in LMICs remain unexplained (41). We found only four surveys completing verbal autopsy for stillbirths over the ten-year period examined, and none in the last five years, despite recommendations for increasing their frequency (4, 42). Given that results from the verbal autopsies were not published in the narrative DHS reports raises questions about the utility of the data generated.

Understanding the timing of stillbirths is important for identifying where the major burden lies, and which interventions would be most effective. Intrapartum stillbirths are linked to quality of obstetric care, while antepartum stillbirths are related to maternity care received during pregnancy; therefore differentiating between them is important to provide useful programmatic information to inform interventions, but DHS surveys currently do not include the timing in the model questionnaires. The verbal autopsy questionnaires assess the baby's skin condition at birth to determine when the stillbirth occurred, so this question could potentially be incorporated in the women's questionnaire, although the reliability of this method has been questioned (43). Further testing and validation of questions that would yield the most reliable results are needed.

Standard DHS surveys are designed to be carried out every five years, but only 30 of the 70 countries examined were at least two surveys done in the ten-year period. The infrequency of surveys is a major limitation to their usefulness and ensuring greater regularity will be particularly important for countries where maternal and newborn health outcomes are poor. Implementation of DHS surveys is dependent on USAID funding, and each country's willingness to conduct them. It may be worthwhile assessing where bottlenecks for implementation exist for more regular and frequent implementation. Peru and Senegal have successfully done continuous DHS surveys every year, however, some difficulties with analysing the data have been raised (10). A key aim of DHS surveys is to generate quality data to inform policy and program planning and for monitoring and evaluation purposes. They are a primary source of reproductive and maternal and child health data accessible to policy makers, yet several surveys that collected stillbirth data did not include the results in the report's narrative.

Third trimester fetal deaths are frequently combined with early neonatal deaths in the measure of perinatal mortality, which is reported by the majority of surveys (in LMICs) due to difficulties in distinguishing between the two outcomes (44). Misclassification between stillbirths and early neonatal deaths can be a challenge in low-income settings where deliveries are often conducted in the home by untrained traditional birth attendants due to lack of knowledge, socio-cultural reasons or other perceived benefits or disadvantages associated with not disclosing a stillbirth (3, 6).

The DHS program clearly acknowledges the problem surrounding underreporting, omission and misclassification of stillbirths and early neonate deaths, and consequently reports the perinatal mortality. However the importance of reporting these two outcomes independently is critical for drawing attention to stillbirths, as well as understanding the burden and targeting of public health interventions. The inclusion of the confirmatory question on whether there were any signs of life and whether the baby moved, cried or breathed after birth in the pregnancy history module certainly helps with distinguishing between stillbirths and early neonate deaths and may explain why data from these pregnancy histories may have better reporting of stillbirths compared to the calendar data.

DHS survey data is increasingly utilised to understand risk factors for maternal, child and neonatal mortality with results disseminated through peer-reviewed publications which ensures greater access to information for policy and program decision makers (10); however, we identified only one publication using DHS data that examined perinatal mortality (45) as an outcome, and one with stillbirth as an outcome (46) – most likely due to the limitations associated with the data outlined in this paper. Two other publications were also identified – one using the 2011 Ethiopia DHS data (47) and another using the 2013 Nigeria DHS data (48) to examine determinants and risk factors for stillbirths, which included health care utilisation variables for stillbirths. Given our study findings, these data are not available in these two datasets as these surveys only included a live birth history and so only live births could have been included in the maternity care section of the survey. This further supports our argument for better and clearer data availability for stillbirths in household surveys such as the DHS.

This objective and systematic assessment of data availability for stillbirths in DHS surveys over the last decade is a key strength of this paper. Importantly, it outlines limitations restricting the utility of DHS data for understanding stillbirths. A key limitation is that we only included surveys available on the DHS program website. Several surveys for countries in the Asia-Pacific region were identified through internet searches and were available through national government websites but not on the DHS program website. These varied in the technical assistance received from DHS - some were carried out without DHS involvement at all, or the DHS program did not have rights to

distribute the data (personal communication, DHS program, 25 Feb 2016). It is unlikely that their inclusion would have changed our study findings.

Conclusion

This study has provided evidence on the limitations on the use of DHS data for understanding stillbirths, with key recommendations for practical changes that can be incorporated to improve the data outlined in Box 4. Stillbirth data in household surveys has shown little improvement over the last decade despite several global calls to action (7). A large proportion of stillbirths are preventable with known interventions and preventive measures identified (17). If the circumstances around these deaths can be better understood within each country context, it would allow for the prioritisation and translation of key interventions into health care delivery systems to prevent these deaths from occurring. Stillbirths are closely correlated with neonatal and maternal mortality (49) and so addressing stillbirths would also contribute to improved maternal and newborn survival.

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Box 1. Key Messages

- Substantial variation exists across DHS surveys in the method used to document mother's reproductive history and capture stillbirths.
- There is an absence of data available on antenatal and intrapartum care for stillbirths in DHS surveys, limiting the scope to investigate stillbirths in relation to mothers' health service utilization.
- Measures of maternity care indicators particularly for components of ANC show substantial variation across surveys due to country adaptations and lack of available standards to assess quality of antenatal care. This is important for potential examination of stillbirths, as well as other health outcomes.
- Screening for maternal conditions or complications during pregnancy and delivery are not routinely assessed in DHS surveys. These measures are included in selected surveys but not part of the model DHS questionnaires yet are important for understanding the most common conditions and complications predisposing mothers to stillbirths.
- There are variations and inconsistencies in assessment of other potential modifiable risk factors for stillbirths across surveys.
- There is a dearth of information collected on the causes of stillbirths with only four countries having included a verbal autopsy questionnaire on stillbirths to establish cause of death over the ten-year period examined.
- There is an absence of assessment of timing of stillbirths and whether the death was

anteartum or intrapartum. Timing of stillbirths is important to identify as risk factors for anteartum vs. intrapartum stillbirths can differ requiring different programmatic interventions.

- The infrequency of DHS surveys, country-specific adaptations of questions and response options, and the absence of reporting of stillbirth rates in published reports even when data is collected, are some key challenges.
- The DHS surveys provides an opportunity to generate improved, globally comparative data for better understanding of the true burden, trends and risk factors for stillbirths in LMICs.

Box 2. Description of different DHS and RHS survey types examined

Standard DHS surveys are nationally representative household surveys carried out approximately every five years, and permit comparisons to be made over time. Sample sizes ranges from 5000-30,000 households. They consist of core questionnaires, which cover demographic, and health measures such as fertility, family planning, reproductive health and child health as well as optional questionnaires or modules on special topics such as maternal mortality, anaemia testing, anthropometry, domestic violence. Countries may choose to include modules as relevant for the country context.

Interim DHS surveys are shorter versions of the DHS survey that focus on key performance monitoring indicators and are done between rounds of standard DHS surveys. They generally have smaller sample sizes than standard DHS surveys, and often do not capture mortality indicators.

Continuous DHS surveys were initially developed to replace the five-yearly surveys and arose from interest from countries to produce health information on a more regular basis. They are done at more frequent intervals (yearly or semi-annually). Currently only Peru and Senegal conduct continuous DHS surveys and have a permanent DHS program office located in-country (15).

Special DHS and Special Surveys are additional surveys done in between standard DHSs that collect specialised population-level information. This includes surveys done specifically on maternal mortality, reproductive health, malaria and anaemia prevalence surveys, or may focus on specific sub-populations such as adolescent reproductive health.

Reproductive Health Surveys (RHS) undertaken in predominantly Latin American and Eastern European countries and conducted by the Centres for Disease Control and Prevention (CDC)

however the questionnaires are based on the DHS core questionnaires and the data are comparable to DHS surveys (13).

Box 3. Summary of methods used by DHS and RHS to capture mothers' reproductive history to determine stillbirths and perinatal mortality

<p>a. Live birth history supplemented with a reproductive calendar</p> <ul style="list-style-type: none">• Both live birth history and reproductive calendar are needed to calculate stillbirth rates.• The birth history asks mothers about all live births she has ever had including whether the pregnancy was single or multiple, the birth date, sex, if the baby was still alive and if not, their age at death (see Appendix 1a for example from Uganda 2011 DHS).• The reproductive calendar records all the mothers' reproductive outcomes in the previous five years. This includes all live births and non-live births/terminations (stillbirths, abortions, miscarriages) and records the length of gestation for each pregnancy in months.• Stillbirths are determined from calendar based on the duration of the pregnancy when it ended. Any pregnancy loss that occurred during the seventh month onwards is defined as a stillbirth.
<p>b. Pregnancy history</p> <ul style="list-style-type: none">• The pregnancy history alone allows determination of stillbirths and perinatal mortality without the need of a reproductive calendar, however many surveys with a pregnancy history also include the reproductive calendar and published stillbirth numbers in the reports are predominantly based on the calendar data for comparative purposes.• The pregnancy history records the result of all the mothers' pregnancies in her lifetime. Similar questions to the birth history are included, with the addition of questions about any non-live births, such as when the pregnancy ended and how many months pregnant the mother was when it ended.• Surveys vary in terms of whether the interviewer gathers the information beginning with the mother's first pregnancy or her most recent (last) pregnancy, and if the pregnancy outcome is determined by the mother by asking her whether each pregnancy resulted in a live birth, miscarriage, stillbirth or abortion (see Appendix 1b for example; used by several Central Asian and Eastern European countries i.e. Armenia, Ukraine, Azerbaijan, Moldova and Kyrgyz Republic), or by the analyst based on questions on whether the baby was born alive, born dead or lost before birth, the duration of the pregnancy when it ended (see Appendix 1c for example; used by Nepal, Pakistan, Philippines, Ghana and Afghanistan). In some cases the latter method also includes a question on whether the baby cried, moved or breathed after birth to differentiate between a stillbirth and early neonate death.• Variations exist on the information captured for non-live births; many do not ask about the gender and whether the pregnancy was a multiple or single pregnancy.
<p>c. Live birth history with separate section/table on non-live births</p> <ul style="list-style-type: none">• Live birth history is done first and is followed by a separate section/table with questions for the non-live births capturing information on when the birth occurred, and how many months pregnant the mother was. It does not include whether the birth was a multiple pregnancy or the gender of the stillbirth as is done for the live birth history.• Stillbirths are determined based on the duration of the pregnancy when the pregnancy ended. Surveys that use this particular method usually also include a reproductive calendar.• This method is similar to a pregnancy history, however as non-live births are in a separate table, they remain excluded from the maternity care section in the later part of the woman's questionnaire. This method has been

adapted for the most recent Phase 7 DHS model questionnaire provided by DHS for surveys conducted from 2013 onwards and has also been used in the Albania 2008-09 DHS and Zimbabwe 2010-11 DHS (see Appendix 1e for example from Zimbabwe 2010-11 DHS).

d. Live birth history and separate single questions for non-live births

- Includes a live birth history plus additional single questions are incorporated into the women's questionnaire to establish how many pregnancies a mother had which did not result in a live birth, including how many were stillbirths, miscarriages and abortions. Single questions may or may not include miscarriages or abortions (see Appendix 1d for example from Pakistan 2006-07 DHS; used in RHS surveys including Nicaragua 2006 and Paraguay 2008).
- This may or may not include when the births occurred, or how many months pregnant the mother was. In most cases this is not included, but could be determined from the reproductive calendar if one was included.

Box 4. Recommendations for changes to DHS surveys to improve data availability for stillbirths

- 1. Replace live birth histories with full pregnancy histories across all DHS surveys** for ascertaining mother's reproductive history to improve quality of stillbirth data.
 - If single stillbirth questions are to be used for counting stillbirths ensure time period is specified (i.e. last 5 years)
 - Include reproductive calendars for countries where stillbirth estimates are absent and only live birth histories are done.
- 2. Include all non-live births especially stillbirths in the antenatal, delivery and post-natal care (maternity care) section of the model DHS women's questionnaire** to allow comprehensive understanding of the impact of quality of care on pregnancy outcomes.
- 3. Standardise measurement of coverage of ANC and intrapartum care components** and identify a minimum set of indices to determine quality of ANC and intrapartum care.
- 4. Standardise capture of maternal conditions and complications** during pregnancy and labour and pre-existing conditions that increase stillbirth risk for inclusion in DHS model questionnaire.
- 5. Include capture of the timing of stillbirths** to better quantify the burden of antepartum and

intrapartum stillbirths at a national level to inform prioritization of programmatic interventions.

6. **Improve measurement of coverage of evidenced-based effective interventions** known to prevent stillbirths

7. **Improve reporting of stillbirths in narrative DHS reports:** ensure countries that collect stillbirth rates report results in the narrative and executive summaries of published DHS reports to ensure visibility to key policy and programme decision makers

Table 1. Summary of DHS surveys completed between 2005 and 2015 meeting inclusion and exclusion criteria

Survey Characteristic	No. Surveys	
	n	%
N=114 (unless otherwise stated)		
Total number of surveys (2005-2015)	114	-
Total number of countries	70	-
Survey Type		
Standard DHS	93	81.6
Continuous DHS	9	7.9
Reproductive Health Surveys (RHS)	6	5.3
Special**	4	3.5
Interim DHS	2	1.8
Region		

Sub-Saharan Africa	56	49·1
Latin America and Caribbean	22	19·3
South and South-east Asia	20	17·5
North Africa/West Asia/Europe	14	12·3
Central Asia	2	1·8
Language of Report		
English	66	57·9
Other^	48	42·1
DHS Phase Model Questionnaire Used		
V (2003-2008)	43	40·6
VI (2008-2013)	54	50·9
VII (2013-2018)	4	3·8
NA	5	4·7
Year of Survey (N=113)		
2005	12	10·6
2005-06	4	3·5
2006	6	5·3
2006-07	4	3·5
2007	9	8·0
2007-08	2	1·8
2008	8	7·1
2008-09	6	5·3

2009	5	4.4
2009-10	1	0.9
2010	10	8.8
2010-11	2	1.8
2011	8	7.1
2011-12	5	4.4
2012	11	9.7
2012-13	3	2.7
2013	9	8.0
2013-14	3	2.7
2014	5	4.4
Number of surveys per country in time period (N=70)	N (No. of countries)	
1	39	55.7
2	23	32.9
3	6	8.6
4	1	1.4
5	-	-
6	-	-
7	1	1.4

**Special surveys included: 2010 Afghanistan Mortality Survey in 2010; 2007 Ghana Maternal Health Survey; Ghana in 2007; 2012 Indonesia Adult Reproductive Survey; and 2011-12 Laos Social Indicator Survey.

^Other languages included French, Portuguese and Spanish

Table 2. Instruments used in DHS/RHS surveys to record mother's reproductive history and capture pregnancy outcomes for calculation of stillbirths and perinatal mortality

Method/instrument included in DHS survey to record mother's reproductive outcomes	No. Surveys (N=114)		No. Countries (N=70)	
	n	%	n	%
Reproductive calendar included	89	78.1	56	80.0
Live birth history	96	84.2	59	84.3
Full pregnancy history (live + non-live births)	16	14.0	12	17.1
Live birth history + separate non-live birth history table	2	1.8	2	2.9
Full pregnancy history + reproductive calendar included	12	10.5	10	14.2
Live birth history only (no reproductive calendar)	16	14.0	12	17.1

Table 3. Countries and surveys where stillbirths could not be quantified based on review of questionnaires

Country	Year	Survey type
Cambodia	2005	Standard DHS
Cameroon	2011	Standard DHS
Congo Brazzaville	2011-12	Standard DHS
Congo Brazzaville	2005	Standard DHS
Congo DRC	2011-12	Standard DHS
Congo DRC	2007	Standard DHS
Cote d'Ivoire	2011-12	Standard DHS
Dominican Republic	2013	Standard DHS
Dominican Republic	2007	Standard DHS
Gabon	2012	Standard DHS
Guinea	2012	Standard DHS
Haiti	2012	Standard DHS
Haiti	2005-06	Standard DHS
Laos	2011-12	Special Survey (SIS)
Rwanda	2007-08	Standard DHS

Togo	2013-14	Standard DHS
16 surveys, 12 countries		

DHS- Demographic and Health Survey, DRC- Democratic Republic of Congo, SIS - Social Indicator Survey

Table 4. Countries and surveys where ANC and delivery care data captured for all births (live births & stillbirths) based on assessment of questionnaires

Country	Year	Survey Type
Afghanistan	2010	Special Survey (AMS)
Armenia	2010	Standard DHS
Armenia	2005	Standard DHS
Azerbaijan	2006	Standard DHS
El Salvador	2008	RHS
Georgia	2005	RHS
Ghana	2007	Special Survey (MHS)
Jamaica	2008-09	RHS
Moldova	2005	Standard DHS
Nepal	2011	Standard DHS
Nepal	2006	Standard DHS
Pakistan	2012-13	Standard DHS
Philippines	2008	Standard DHS
Philippines	2013	Standard DHS
Ukraine	2007	Standard DHS
15 Surveys, 12 countries		

AMS- Afghanistan Mortality Survey; DHS- Demographic and Health Survey; RHS- Reproductive Health Survey; MHS- Maternal Health Survey

Table 5. Availability of ANC and delivery care coverage indicators in DHS/RHS surveys done between 2005-2015

Measurement of coverage of ANC/delivery care indicators (N=114 unless otherwise indicated)	Surveys that measured coverage of indicator	
	n	%
Coverage of ANC		
Received any ANC	112	98.2
Provider of ANC	112	98.2
Place of ANC	110	96.5
Months pregnant at first ANC visit	110	96.5
Months pregnant at last ANC visit [^]	28	24.6
Total number of ANC visits received	111	97.4
Components/content of ANC		
Blood pressure measured*	110	96.5
Weight measured ^{^*}	80	70.2
Height measured ^{^*}	33	28.9
Urine test* (n=113)	109	96.5
Blood test*	109	95.6
Informed signs of pregnancy complications*# (n=113)	106	93.0
Informed of where to seek care for complications [^] (n=113)	61	53.5
Birth planning and birth preparedness done ^{^*} (n=113)	11	9.7
Ultrasound done [^]	14	12.3
Fetal heartbeat was checked [^] (n=113)	17	15.0
Uterine height measured [^]	19	16.7
Stomach was examined [^]	10	8.8
Counselled on breast-feeding ^{^*} (n=113)	6	5.3
Offered a syphilis test [^] (n=113)	8	7.1
Other ANC components		
Received tetanus vaccination	107	93.9
Received iron supplementation	110	96.5
Took calcium supplementation during last pregnancy	4	3.5
Took anti-helminths during last pregnancy	79	69.3
Malaria prophylaxis	60	52.6
Assessed for vitamin A deficiency	50	43.9
Offered and tested for HIV/AIDS during ANC	79	69.3
Counselled on HIV/AIDS during ANC	70	61.4
Delivery/intrapartum care indicators		
Skilled attendance at delivery	112	98.2
Place of delivery	113	99.1
Referral for delivery [^]	5	4.4

Use of safe delivery kit [^]	6	5.3
Caesarean section done	112	98.2
Timing of Caesarean section (planned or emergency)	6	5.3
Reason for Caesarean section [^]	4	3.5
Other procedures done during delivery (vacuum, forceps, blood transfusion) [^]	5	4.4
Availability of ANC and delivery care data for stillbirths		
Surveys with mother's ANC utilisation available for stillbirths	15	13.2
Surveys with delivery care data available for stillbirths	14	12.3

[^]Indicator not included in DHS model questionnaire

*Considered one of the 8 components of WHO's focused ANC package

No longer included in DHS model questionnaire as of last phase (Phase 7)

Table 6. Availability of data on potential modifiable risk factors and preventive interventions for stillbirths in DHS/RHS surveys conducted between 2005-2015

Potential modifiable risk factor for stillbirth (N=114 unless otherwise specified)	DHS surveys with data available	
	n	%
Mother's smoking status	99	86.8
Mother's consumption of alcohol/drugs	15	13.2
Type of fuel used for cooking	110	96.5
Exposure to indoor smoke from cooking	85	74.6
Exposure to second-hand smoke from other members in the household smoking	46	40.4
Consumption of iodised salt*	79	69.3
Female genital mutilation/circumcision [^]	31	27.2
Ever had fistula [^]	21	18.4
Domestic violence during pregnancy [^]	63	55.3
Ever been diagnosed with diabetes [^] (n=113)	19 [#]	16.7
Ever been diagnosed with high BP or hypertension [^] (n=113)	23 ⁺	20.2
Ever been diagnosed with anaemia [^] (n=113)	5	4.4
Household possession of mosquito nets [^] (n=113)	69	60.5

Households use of insecticide treated mosquito nets [^] (n=113)	59	51.8
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[^]These are optional modules in DHS and not included in DHS model questionnaire

*Assessed by testing of salt at time of survey

includes 4 surveys that collect this only for women aged over 35 years or over 40 years of age

+ includes 3 surveys that collect this only for women aged over 35 years or over 40 years of age

Table 7. Countries/surveys that collected stillbirth data[^] but did not publish results in the DHS narrative report

Country	Year	Survey Type
Benin	2011-12	Standard DHS
Benin	2006	Standard DHS
Burkina Faso	2010	Standard DHS
Cambodia	2010	Standard DHS
Comoros	2012	Standard DHS
Jamaica	2008-09	RHS
Madagascar	2008-09	Standard DHS
Mali	2012-13	Standard DHS
Mali	2006	Standard DHS
Niger	2006	Standard DHS
Paraguay	2008	RHS
Rwanda	2010	Standard DHS
12 surveys, 10 countries		

[^]According to questionnaire included in appendix of published DHS narrative report

Table 8. Completeness of maternity care data availability for stillbirths in five selected DHS surveys using pregnancy history data

	Pakistan 2012-13 DHS	Nepal 2006 DHS	Azerbaijan 2006 DHS	Ghana 2007 MHS	Afghanista n 2010 AMS*
Number of stillbirths in the last 5 years captured by DHS survey					
Unweighted counts	363	144	29	141	387
Weighted counts	424	134	35	143	405
Number of stillbirths that were a mothers' most recent pregnancy (and should have been included in maternity care section)					
	155	75	14	81	208
Number of stillbirths in survey with maternity care data					
	74	29	5	81	208
Percentage of stillbirths in survey with maternity care data (%)					
	47.7%	38.7%	35.7%	100.0%	100.0%

*Excludes the South Zone of Afghanistan

AMS – Afghanistan Mortality Survey; DHS- Demographic and Health Survey; MHS – Maternal Health Survey

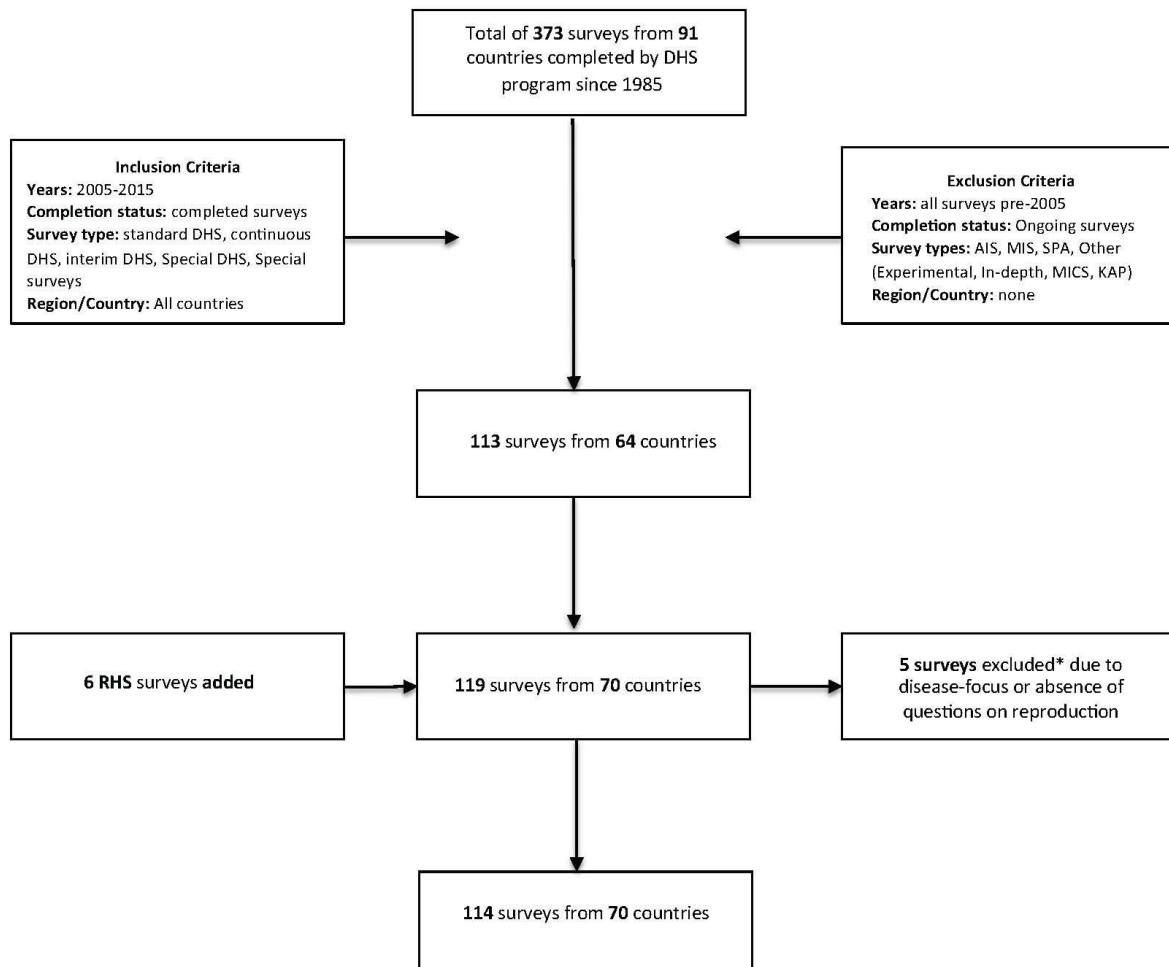


Figure 1. Flowchart summarising selection of surveys for inclusion

*Surveys excluded: Mali 2010 Anaemia Prevalence Survey; Dominican Republic 2007 and 2013 HIV Prevalence Surveys; Rwanda 2011 Population Size Estimation Survey; Indonesia 2007 Special Young Adult Reproductive Survey

AIS- AIDS indicator Survey; KAP – knowledge attitudes practices; MICS- multiple indicator cluster survey; MIS- malaria indicator surveys; RHS- Reproductive Health Surveys; SPA- Service Provision Assessment