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CRVS technical guide

How to assess the quality and policy utility of birth registration data: a step by step approach

October 2020

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Contents

Acronyms and abbreviations

ASPBF	Age-Sex-Parity-Birthweight Fraction (ASPBF)
ASFR	age-specific fertility rate
ANACONDA	ANAlysis of National Causes of Death for Action
CBR	crude birth rate
CRVS	civil registration and vital statistics
DHS	Demographic and Health Surveys
GBD	Global Burden of Disease
IHME	Institute of Health Metrics and Evaluation
LBW	low birth rate
SGA	small for gestational age
SRB	sex ratio at birth
TFR	total fertility rate
UN	United Nations
VSPI	Vital Statistics Performance Index
WPP	World Population Prospects

How to assess the quality and policy utility of birth registration data: a step by step approach

This *CRVS technical guide* provides step-by-step guidance to assess the quality and policy utility of birth registration data. By assessing the quality of birth registration data, countries will derive essential information to inform data quality improvement interventions and enhance the policy utility of recorded data.

Introduction

Investments to strengthen civil registration and vital statistics (CRVS) systems in much of the world are based on the expectation that these data will increasingly be used as a routine source of summary fertility and mortality statistics. Given this situation, it is imperative that users of registration data are readily able to assess its quality to understand its limitations in providing evidence for policy and to identify areas in which data quality can be improved. For death registration, the University of Melbourne-developed ANACONDA (ANAlysis of National Causes of Death for Action) software tool enables users to assess the quality of all-cause and cause-specific mortality data. ANACONDA is designed around 10 steps based on mortality data quality assessment principles.[1, 2, 3]

This *CRVS technical guide* provides guidance to assess the quality of **birth registration data**. Based on experience thus far with ANACONDA, this guidance will increase capacity in countries to assess the quality of birth registration data, and hence, derive essential intelligence to improve the quality and policy utility of the data.

Birth registration has a role in not only facilitating rights for individuals (such as legal entitlements, citizenship and voting rights, access to health and education services and social security benefits) but is also a key source of fertility statistics for use in population projections to inform government monitoring, evaluation and planning for health and social services, schooling, and other requirements.[4] This is reflected by Sustainable Development Goal 16.9, that aims, by 2030, to achieve legal identity for all, including birth registration.[5] Although global completeness of birth registration is estimated to be higher than death registration, it is estimated that at least one-quarter of children aged five years or younger have not had their birth registered, with the true figure probably somewhat higher.[6]

The quality of reporting of characteristics of the birth or persons directly involved in the birth, such as age of the mother, sex of the child, birth order and birth weight, also impact the accuracy of fertility statistics and, therefore, their policy utility.

This guide begins with a description of the basic characteristics of the assessment of birth registration data, including a summary of the steps, the country birth data to be assessed and a description of and comparator data used. Next, the steps are described in detail, as well as the “rules” used to assess data quality, rationale for their inclusion, and examples of their application using data from Ecuador and Colombia.[7] Primarily, this document focuses on promoting utilisation of national data quality assessments, given the easier access to comparator data at this level. Brief reference is also made to its potential application to subnational data.

1 Abouzahr C et al, 2010, *Mortality statistics: a tool to improve understanding and quality*

2 Mikkelsen L, Lopez AD, 2017, *Guidance for assessing and interpreting the quality of mortality data using ANACONDA*

3 Mikkelsen L, Moesgaard, K, Hegnauer, M, Lopez AD, 2020, ANACONDA: a new tool to improve mortality and cause of death data, *BMC Medicine*, 18: 61

4 Setel PW, Macfarlane SB, Szreter S, Mikkelsen L, Jha P, Stout S, et al. A scandal of invisibility: making everyone count by counting everyone. *Lancet*. 2007;370(9598):1569–77.
University of Queensland Health Information Systems Knowledge Hub (HISHub). *Strengthening civil registration and vital statistics for births, deaths and causes of death. Resource kit*. Geneva. Switzerland: World Health Organization; 2013.
Yaya Y, Data T, Lindtjørn B. Maternal mortality in rural South Ethiopia: outcomes of community-based birth registration by health extension workers. *PLoS One*. 2015;10(3):e0119321.

5 UN-Department of Economic and Social Affairs. Sustainable Development Goals [Internet]. 2016. Available from: https://sustainabledevelopment.un.org/sdg16

6 UNICEF (2019). *The State of the World’s Children 2019. Children, Food and Nutrition: Growing well in a changing world.* UNICEF, New York.

7 Ecuador: Instituto Nacional de Estadistica y Censos (INEC). Nacimientos – Bases de Datos 1992–2007, 2009–10 [Internet]. Available from: http://www.ecuadorencifras.gob.ec/nacimientos-bases-de-datos/. Colombia: Departamento Administrativo Nacional de Estadística (DANE). Nacimientos 1998–2014 [Internet]. Available from: https://www.dane.gov.co/index.php/estadisticas-por-tema/salud/nacimientos-y-defunciones/nacimientos

Birth registration assessment: Steps and data required

Overview of steps

This guidance is predicated on the assumption that the two most important pieces of information affecting the utility of the data for policy and planning are: (1) completeness of birth registration, and (2) the quality of reporting of characteristics of the birth or persons directly involved in the birth. Steps outlined for the birth registration assessment are all derived from the recommended core topics for birth statistics in the United Nations' (UN) *Principles and Recommendations for a Vital Statistics System, Revision 3*, with the exception of gestational age.[8] We believe these items are the minimal essential information for guiding health and social policy in relation to fertility and maternal and child health.

The following eight steps outline the process of comprehensively investigating the quality of birth statistics and why each is important for policy. These are divided into six primary steps, which are essential to assess data quality, and two supplementary steps that are useful, but not critical, to investigate.

Primary Steps

Step 1: Crude birth rate and all-age completeness of birth registration
The completeness of birth registration is the most important component of the quality of birth registration data; if data are incomplete, then basic measures of fertility based on registration data will be under-estimated. The crude birth rate (CBR) measures fertility relative to the size of a population, and when based on birth registration data, is the most elementary indicator of completeness.

Step 2: Age-specific fertility rates and age-specific completeness of birth registration
Accurate age of mother data is important to precisely measure age patterns of fertility and to calculate the total fertility rate. Age-specific completeness of birth registration identifies which births to mothers of specific ages are most likely to be unreported. This information helps to target interventions to improve birth registration, and also helps to identify likely biases in age-specific fertility rates.

Step 3: Sex ratio at birth and sex-specific completeness of birth registration
Accuracy of sex of child data is important to identify if there is an unusually high sex ratio at birth (SRB), which suggests a son preference.

Step 4: Birth order
Birth order is an important fertility characteristic that is used to provide a detailed understanding of fertility behaviour and hence the level and age pattern of fertility rates.

Step 5: Birth weight and gestational age
Birth weight is an important health indicator of newborns. Gestational age provides information on antenatal medical care, and can distinguish between prematurity and other causes of low birthweight.

Step 6: VSPI-Births
The Vital Statistics Performance Index for Births (VSPI-Births) a summary index of the quality of birth registration data, and is based on data available in Steps 1 to 5.

8 UN, 2014, *Principles and Recommendations for a Vital Statistics System, Revision 3*: 18-19

Supplementary Steps

Step 7: Time since last birth

The time since last birth (birth interval) is a significant determinant of the level of fertility and maternal and child health. In many countries couples are encouraged to space births to help lower fertility and to lower the risk of maternal and infant mortality.

Step 8: Site of delivery

The site of delivery (facility or non-facility) can provide important information about the completeness of birth registration data according to where the birth took place, and help inform targeted interventions to improve completeness.

Data required

To use this guidance, users are required to have country birth data, population data and comparator data.

Country birth data

The country birth data to be assessed in this guidance can be any routine source of birth data; this primarily would be birth registration but could also include ministry of health reporting of births. Throughout this document we often refer to "birth registration data", but it can refer to other sources of routine birth data.

The country birth data to be assessed include:

- Live births[9]
- Births with timely registration. Exclude late registrations (commonly more than 12 months after occurrence) prior to assessment
- Births reported by year of occurrence, not year of registration
- For subnational areas, births should only include those to mothers who are usual residents of the population for which the estimates are being made.

Table 1 presents the basic birth data to be analysed, including the categories of each data item. The total number of births for each variable in Table 1 should be the same (i.e. the total number of registered births for that year), except for "time since last birth" which excludes first births.

9 Still births are not included

Table 1: Categories of each data item to be assessed

Age of mother (years)	**Birth weight**
Less than 15	<2500 g
15-19	2500-3499 g
20-24	3500+ g
25-29	Unspecified
30-34	**Gestational age**
35-39	*Single months*
40-44	Unspecified
45-49	**Time since last birth (non-first births)**
50+	*Single months*
Unspecified	Unspecified
Sex of child	**Site of delivery**
Male	Facility
Female	Home
Unspecified	Unspecified
Birth order	
1	
2	
3	
4	
5	
6	
7	
8+	
Unspecified	

Some steps in the assessment require cross-tabulations of the data. This is detailed where relevant.

Population data

Population data (both national and subnational population estimates) should be readily available from a country's national statistics office, or from the Global Burden of Disease (GBD) Study or United Nations World Population Prospects (UN WPP) (national estimates).[10, 11] When assessing the quality of birth registration data, users should be familiar with the population age structure of their population, which is strongly influenced by long-term trends in fertility. A country with a high proportion of younger people compared with older people (a distinct pyramid when represented graphically) would be expected to have had high fertility over the long-term. In contrast, a country where the population is largest in adult ages, would be expected to have had a long-term *decline* in fertility.

In the population pyramids in **Figures 1** (Ecuador) and **2** (Colombia), women of reproductive age (15 to 49) is highlighted, because they are the denominator used in fertility rates in Steps 1 and 2. It is therefore important that users are familiar with the relative size of this population compared with the rest of the country. If the number of women of reproductive age is unusually large compared with other age groups or males of the same age, it indicates a problem with the quality of population data. In both Ecuador and Colombia, the population data are of sufficient quality. Ecuador has a higher proportion of its population at younger ages than Colombia, so it is likely to have lower fertility levels.

10 Vollset SE, Goren E, Yuan CW et al. Fertility, mortality, migration, and population scenarios for 195 countries and territories from 2017 to 2100: a forecasting analysis for the Global Burden of Disease Study. *Lancet* 2020 https://doi.org/10.1016/S0140-6736(20)30677-2. Data located at http://ghdx.healthdata.org/record/ihme-data/global-population-forecasts-2017-2100.

11 UN World Population Prospects, https://population.un.org/wpp/DataQuery/

Figure 1: Population pyramid, Ecuador 2010 (women of reproductive age darker shade)

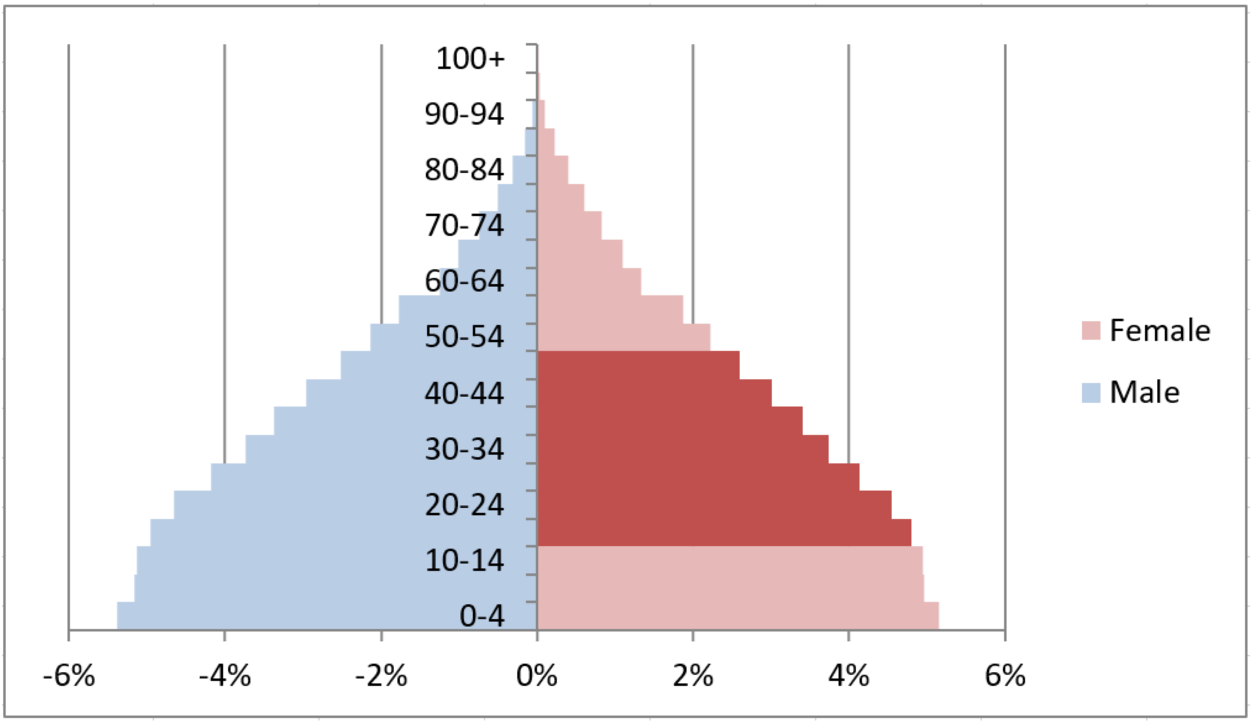
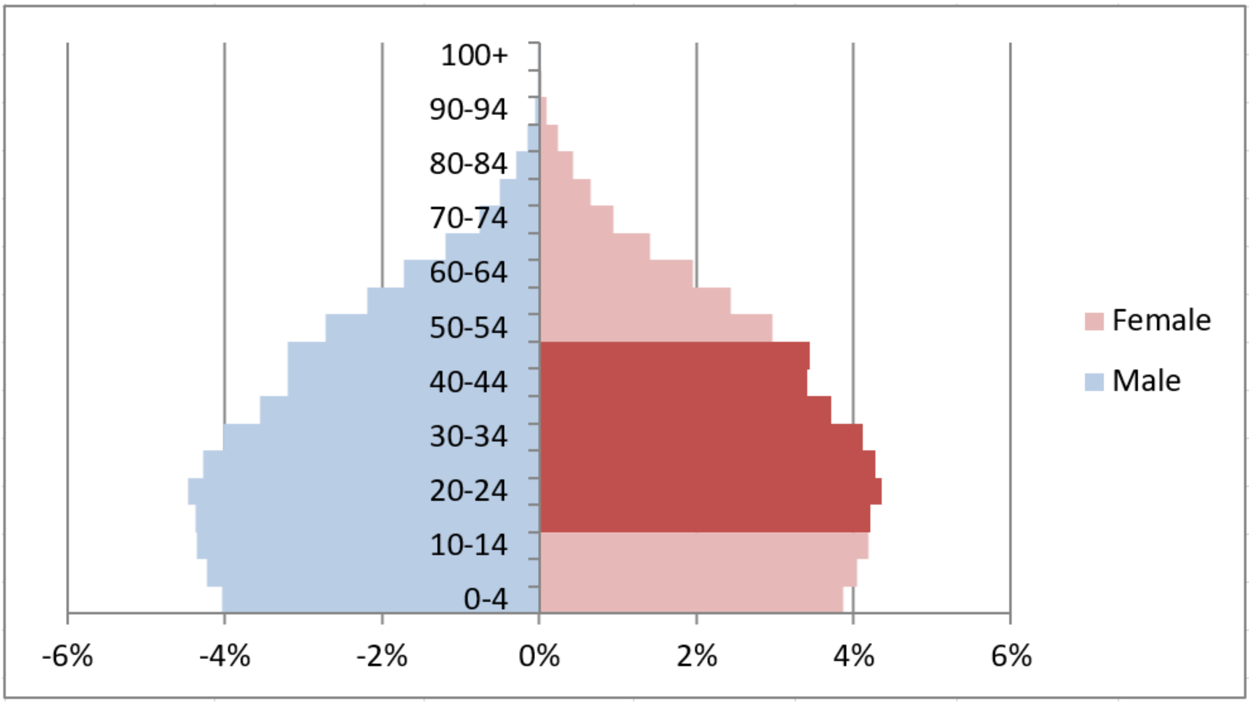


Figure 2: Population pyramid, Colombia 2014 (women of reproductive age darker shade)



Comparator data

Independent comparator data can be used to assess the plausibility of the national statistics and the quality of each country's birth registration data, as done in ANACONDA. National-level comparator data can either come from the GBD Study or UN WPP fertility estimates;[12, 13] each provides the number of live births by year and age of mother. At the subnational level, demographic and health survey data of the total fertility rate, along with population data of women of reproductive age, can be used to estimate total births.

For site of delivery, Demographic and Health Surveys (DHS) or other reliable surveys with these data have been chosen as the comparator at the national level. Site of delivery data would also be available at the subnational level from a demographic and health survey, although the sampling error around such estimates would vary.

Primary Steps

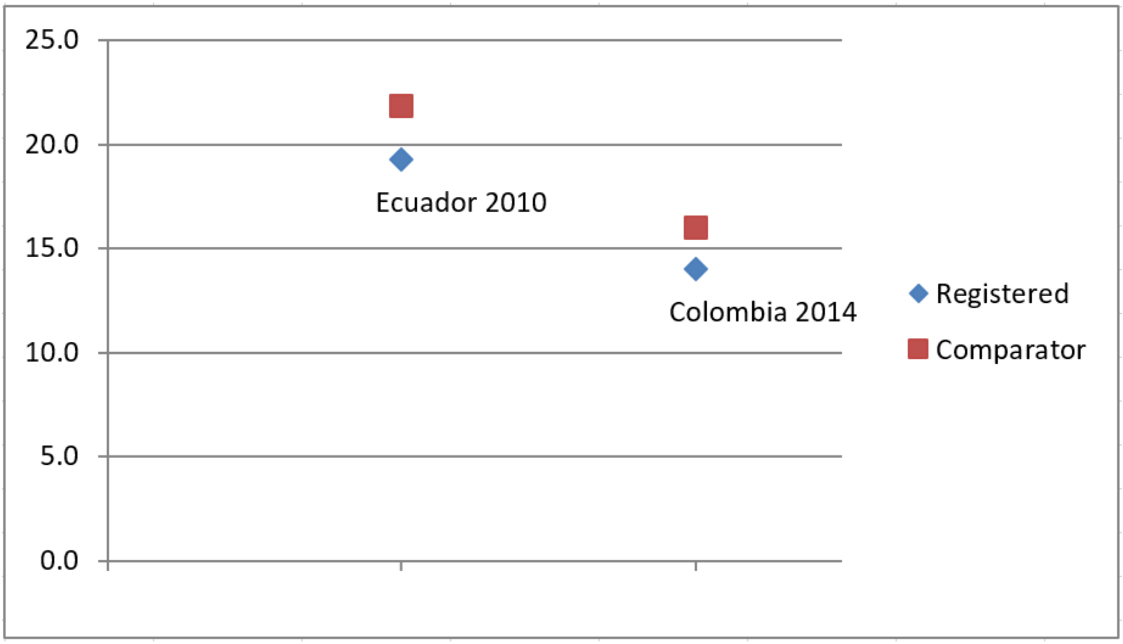
The presentation, assessment and interpretation of each sub-step are described below. Certain "rules" for birth data quality are shown in bold. Examples from Ecuador 2010 and Colombia 2014 are included to demonstrate the operation of each step.

Step 1: Crude birth rate and all-age completeness of birth registration

Step 1.1: Crude birth rate
The CBR is the number of registered births divided by the total population multiplied by 1000. The CBR of the input data is compared with the CBR of the comparator data; if it is lower, then the data are very likely to be incomplete.

The CBR from the input data also should not be below seven; the lowest CBR in the world (in Portugal) is 7.5.
In both Ecuador and Colombia, the reported CBR is below that of the comparator data, suggesting the data are not complete (**Figure 3**).

Figure 3: Crude birth rate (per 1000), registered biths and comparator data, Ecuador 2010 and Colombia 2014



12 Vollset SE, Goren E, Yuan CW et al. Fertility, mortality, migration, and population scenarios for 195 countries and territories from 2017 to 2100: a forecasting analysis for the Global Burden of Disease Study. *Lancet* 2020 https://doi.org/10.1016/S0140-6736(20)30677-2. Data located at http://ghdx.healthdata.org/record/ihme-data/global-population-forecasts-2017-2100.

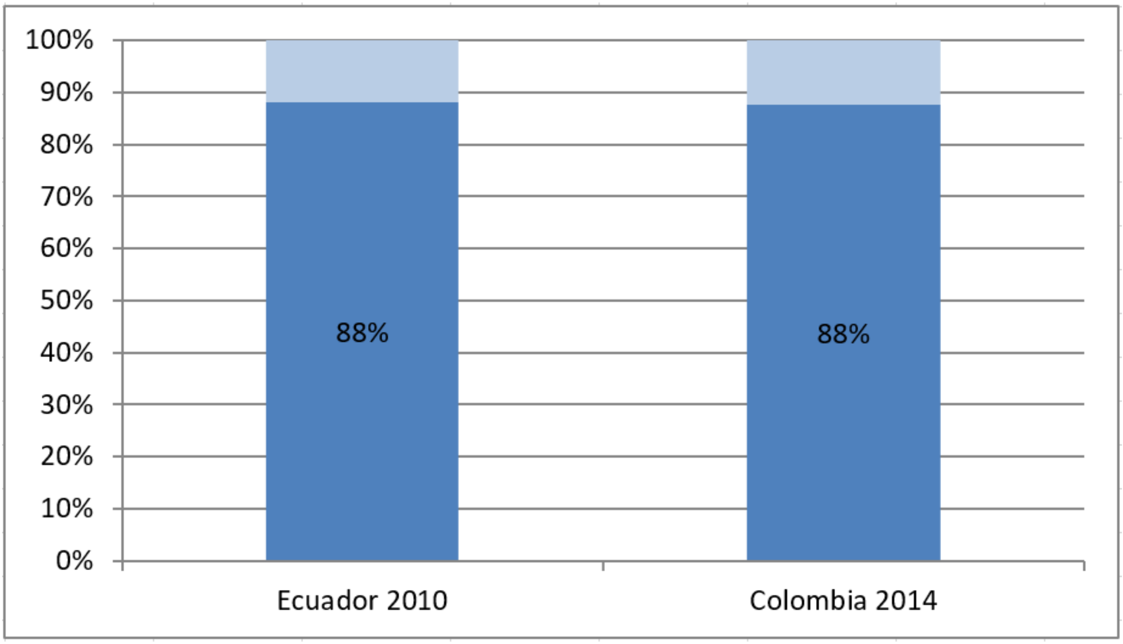
13 UN World Population Prospects, https://population.un.org/wpp/DataQuery/

Step 1.2: Completeness of birth registration

The completeness of birth registration is calculated as the CBR according to the registration data divided by the CBR for that year according to the comparator data.

Figure 4 shows that both Ecuador 2010 and Colombia 2014 have 88 per cent completeness of birth registration according to the comparator data.

Figure 4: Completeness of birth registration (%), Ecuador 2010 and Colombia 2014



Step 2: Age-specific fertility rates and age-specific completeness of birth registration

Step 2.1: Summary of age of mother data

The first component of Step 2 shows the percentage of births at each age of the mother, including unspecified age. This is conducted to identify any unusual patterns in the distribution of births by age of mother. Generally, there should be more births that occur among mothers aged 20 to 39 years than at younger or older ages. There should be very few births at ages 50 and above and less than 15 years. **The percentage of births with unspecified age should be minimal (less than about one to two per cent),** because otherwise the true age pattern of fertility may be masked.

Data from Ecuador and Colombia do not show any significant issues (**Figures 5** and **6**).

Figure 5: Registered births by age of mother (% of all births), Ecuador 2010

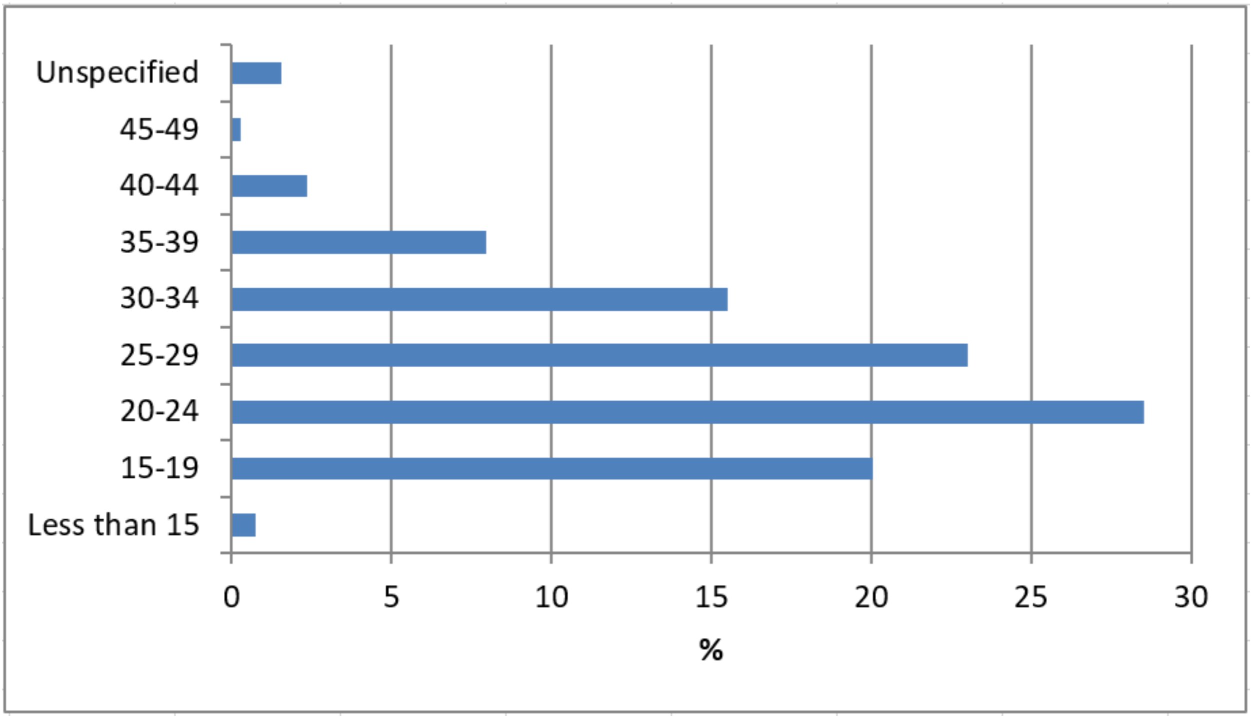
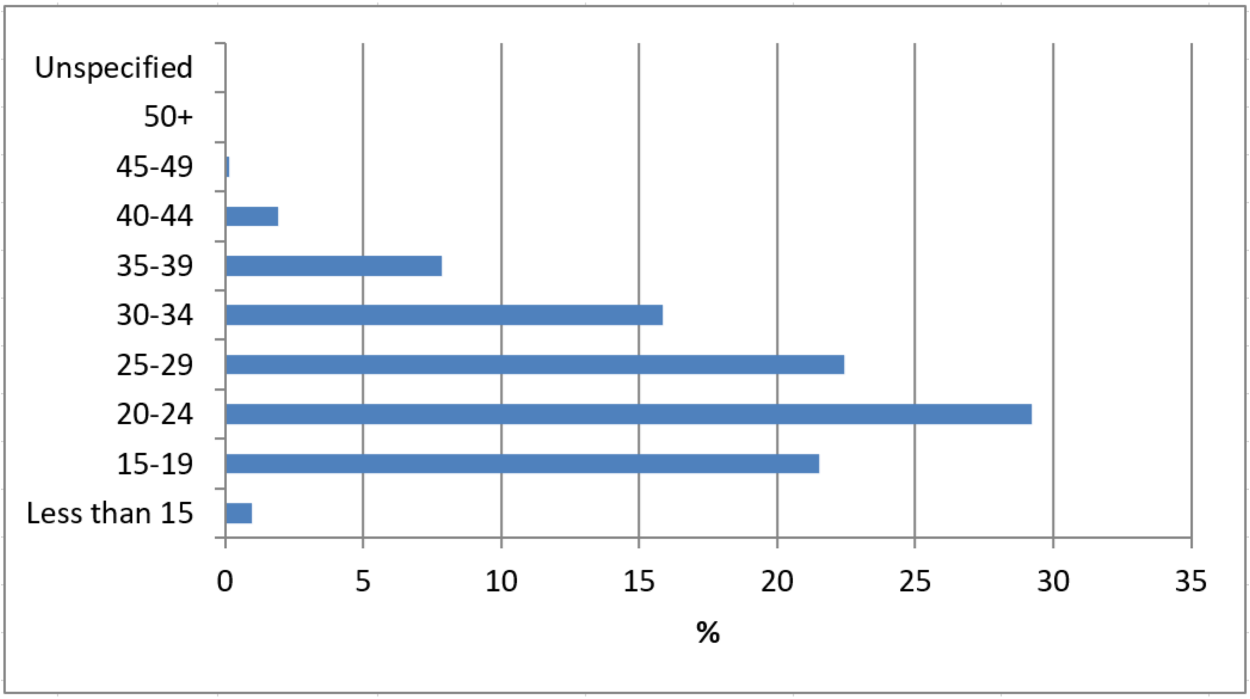


Figure 6: Registered births by age of mother (% of all births), Colombia 2014

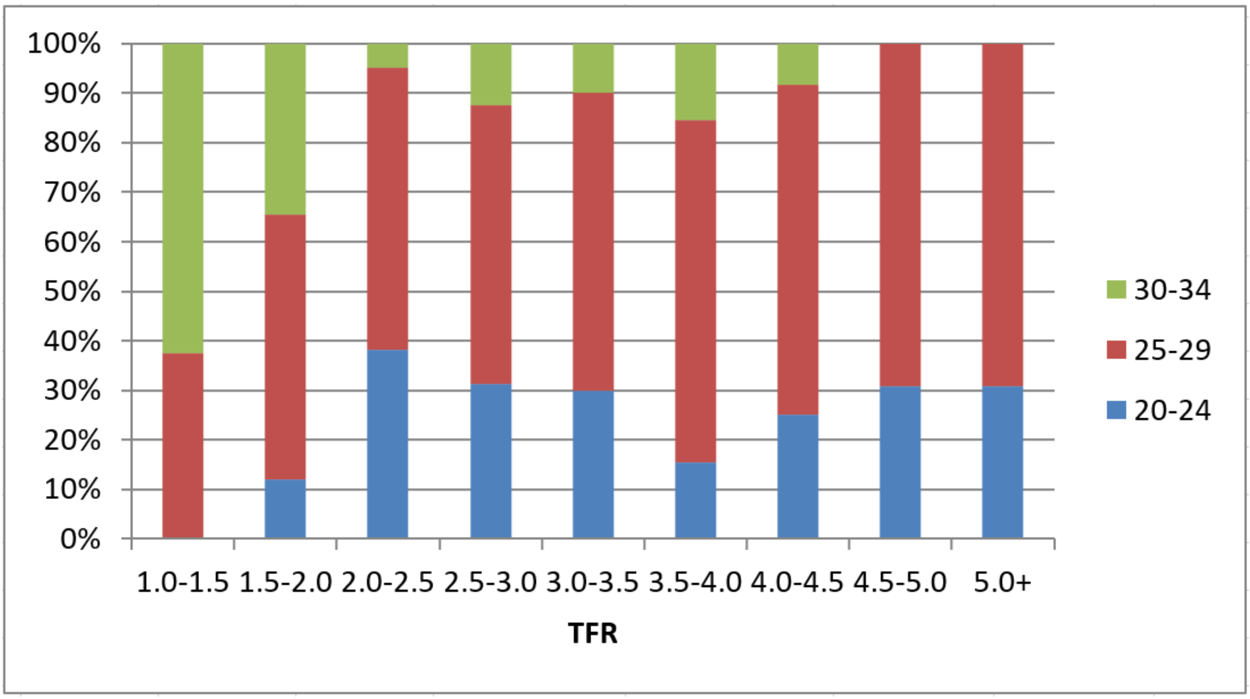


Step 2.2: Age-specific fertility rates and total fertility rate

The plausibility of age-specific fertility rates (ASFRs; births by five-year age of mother divided by population of women in each age group and multiplied by 1000) would first be assessed by their age pattern. According to UN WPP fertility data, **in all populations ASFRs peak at age 20 to 24, 25 to 29 or 30 to 34 years**, with a higher likelihood of the peak being at older ages when fertility rates are lower (**Figure 7**).[14] As shown below, **if the total fertility rate** (TFR, as measured by comparator data, the average number of children women would give birth in their life based on current age-specific fertility rates) **is at least 4.5, 30 to 34 should not be the highest ASFR**. Similarly, if the **TFR is below 1.5, 20 to 24 should not be the highest ASFR**.

If the age pattern of birth data is not plausible, if may be due to incompleteness or poor-quality age reporting. It should be kept in mind that economic or social "shocks" such as the COVID-19 pandemic can cause couples to delay their childbearing to later ages, which would affect the regularity of these age patterns.

Figure 7: Peak ASFR by level of TFR (%), UN WPP data



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In both Ecuador and Colombia, the peak ASFR is at age 20 to 24, which is consistent with their level of TFR (**Figures 8** and **9**). However, for a country of Colombia's level of TFR, the UN data suggest ASFRs are more likely to peak at age 25 to 29.

Figure 8: Age-specific fertility rates, Ecuador 2010 (TFR=2.67)

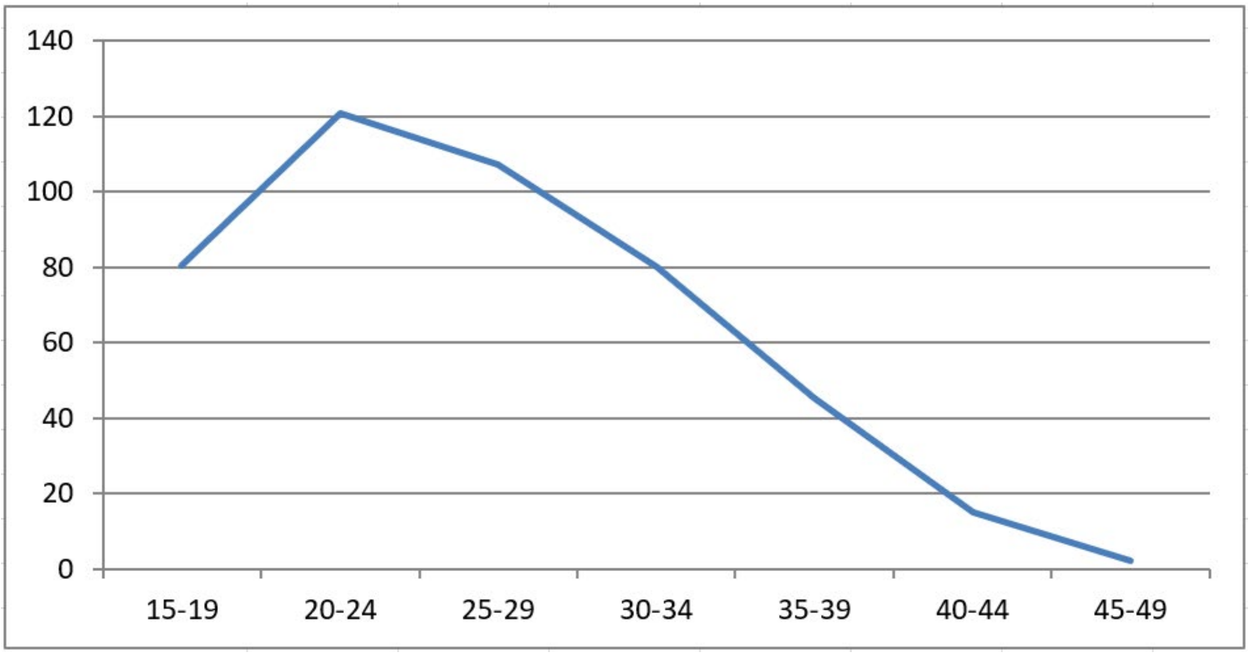
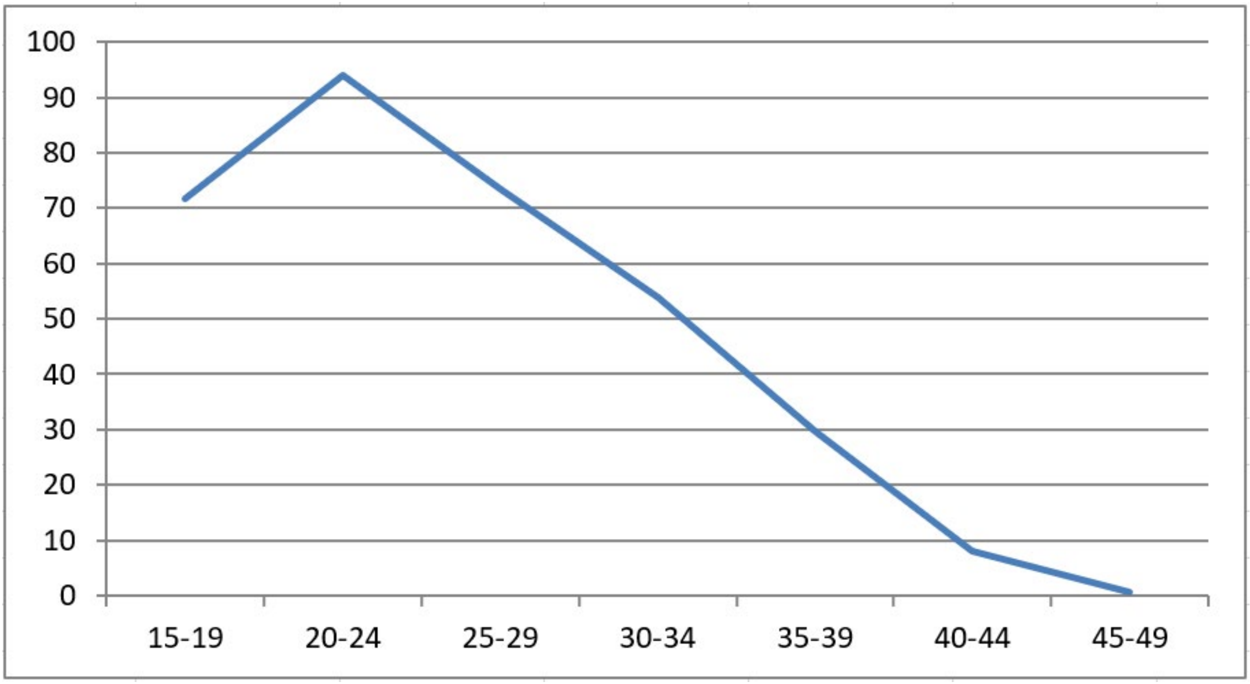


Figure 9: Age-specific fertility rates, Colombia 2014 (TFR=1.93)



Step 2.3: Age-specific completeness assessment

The completeness of birth registration by age is presented according to the comparator data. It is calculated as the ASFR according to the birth registration data, divided by the ASFR according to the comparator data. Variations in age-specific completeness may be due to other factors that are related with the age of mother; for example, lower completeness among younger and older mothers may be because these mothers are more likely to be from lower socio-economic backgrounds or reside in areas where registration is more difficult. If completeness is above 100 per cent for some age groups, it may be that the comparator data underestimates births for women of that age, that the age reporting of women is incorrect, that the data may include registrations of births that occurred in an earlier time period than the period for which the estimates relate to, or that they may include births of women who reside in another population.

In both Ecuador and Colombia, completeness of birth registration exceeds 100 per cent at ages 15 to 19, is between 75 and 86 per cent in ages 20 to 39, and is much lower at 40 to 44 and especially 45 to 49 years (**Figures 10** and **11**).

Figure 10: Age-specific completeness of birth registration, Ecuador 2010

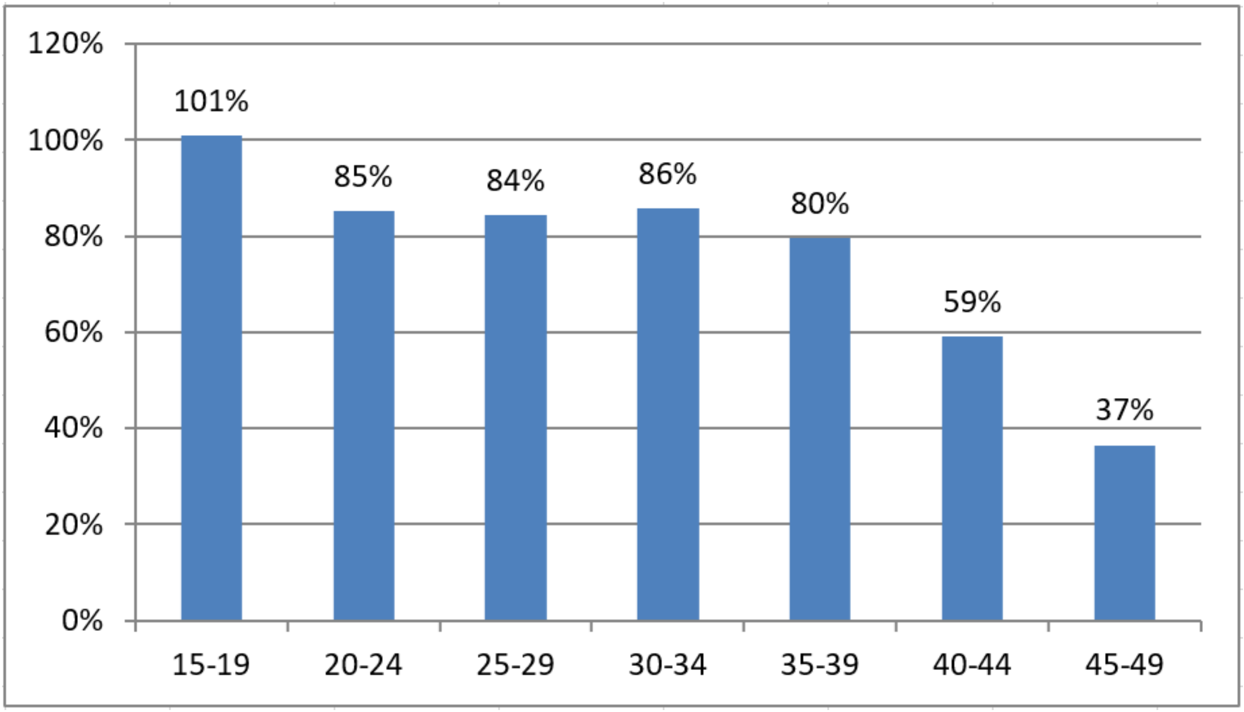
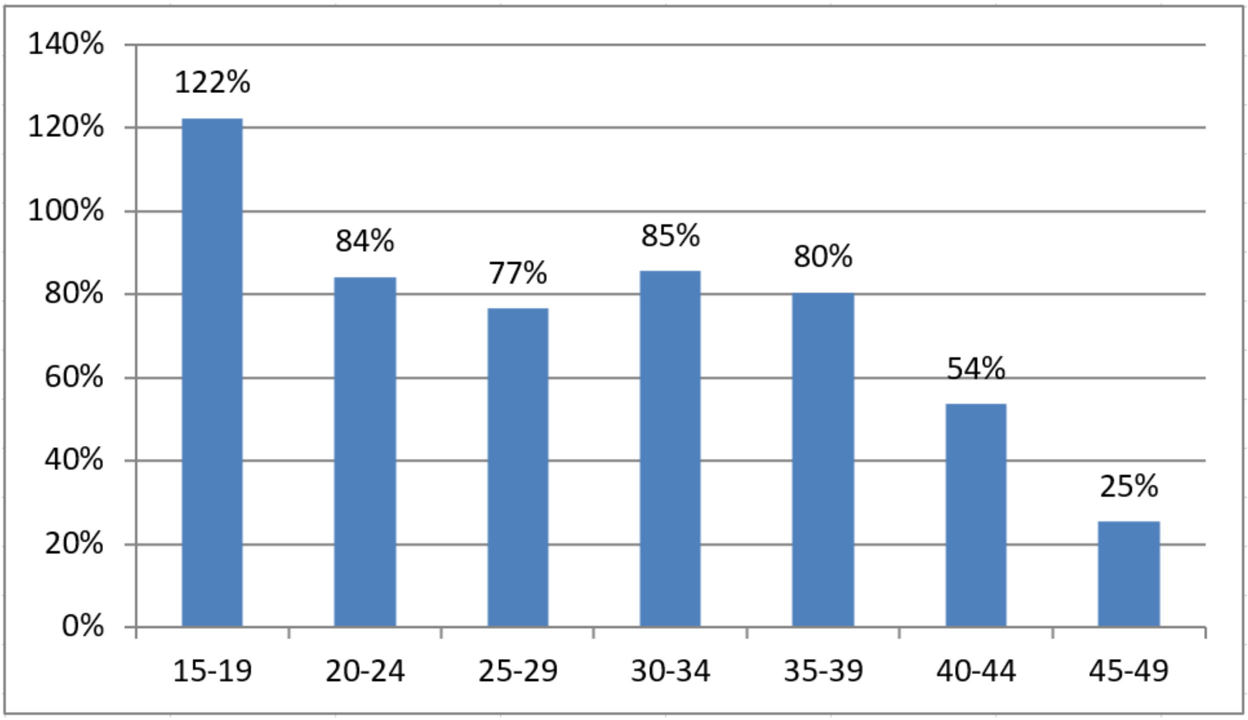


Figure 11: Age-specific completeness of birth registration, Colombia 2014



Step 3: Sex ratio at birth and sex-specific completeness of birth registration

Step 3.1: Summary of sex of child data and sex ratio at birth
The first component of Step 3 shows the percentage of births of each sex, including unspecified age. Again, **unspecified sex should be minimal**, because it may mask the true sex ratio.

The sex ratio at birth (SRB; the number of male births per 100 female births) should be in the range of 103 to 107. Globally, five countries have a SRB of below 103, and 12 countries have a SRB of above 107.[15] If the SRB is above 107 or lower than 103, then it is likely the result of poor quality data if there is no evidence of the country having son preference. In both Ecuador and Colombia, there are no births with unspecified sex and the SRB is within the range of 103 to 107 (**Figures 12** and **13**).

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Figure 12: Registered births by sex (%), and SRB of registered births, Ecuador 2010

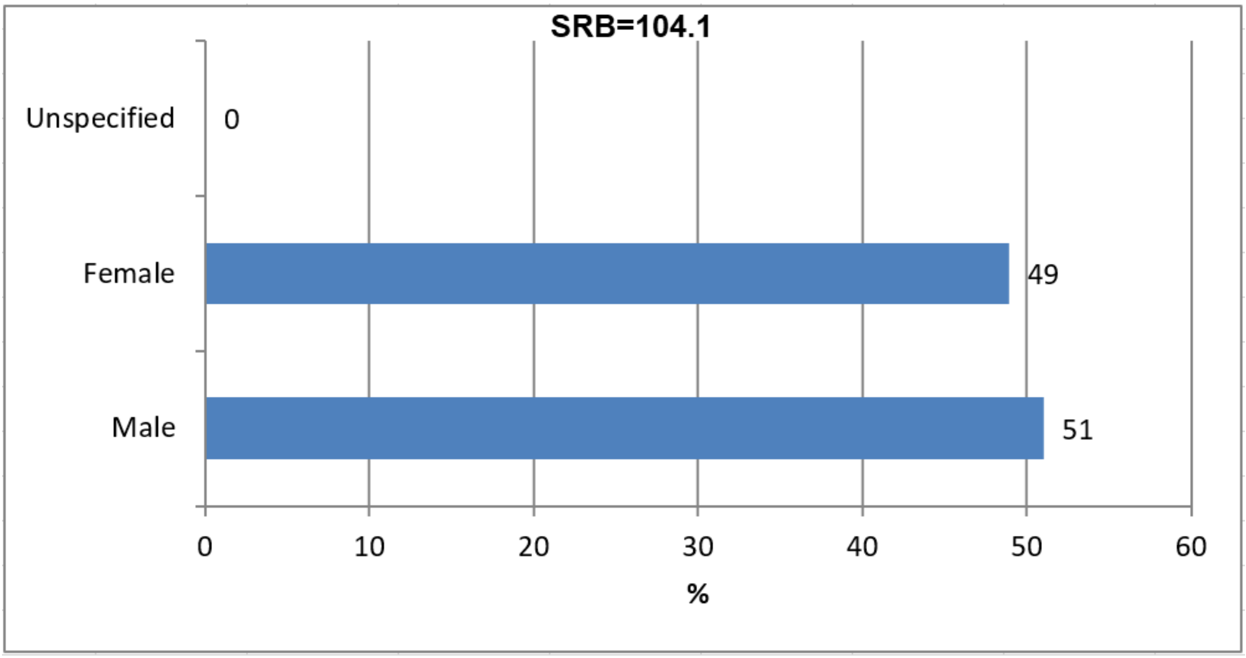
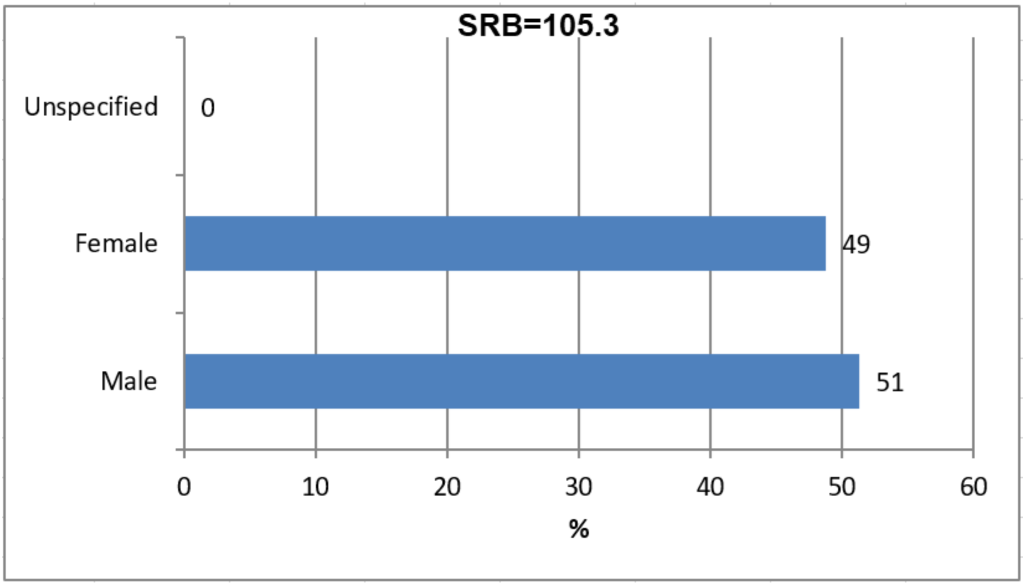


Figure 13: Registered births by sex (%), and SRB of registered births, Colombia 2014



Step 3.2: Sex-specific completeness

The completeness of birth registration by sex of child according to the comparator data is shown in Step 3.2. Any significant difference may indicate preference by parents of registering births of one sex over another. Analysis of DHS in sub-Saharan Africa reveals that boys are more likely to have a birth certificate than girls.[16] In both Ecuador and Colombia, completeness of birth registration is almost identical between males and females (**Figures 14** and **15**).

Figure 14: Sex-specific completeness of birth registration, Ecuador 2010

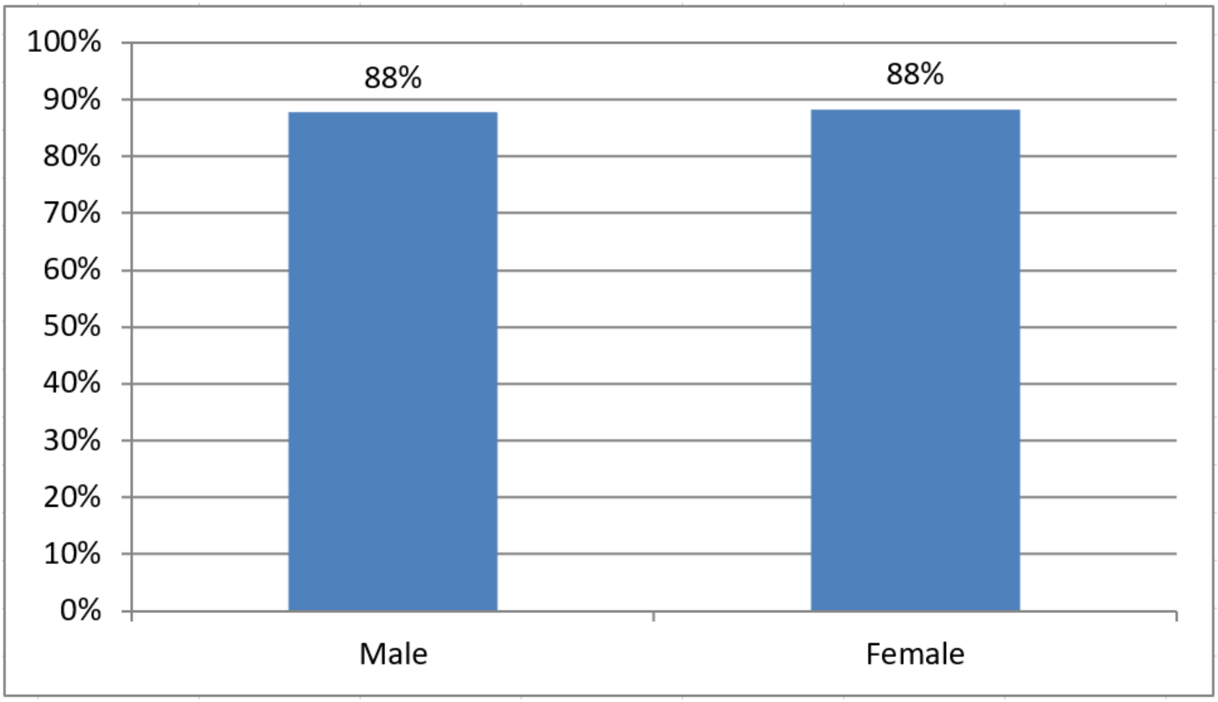
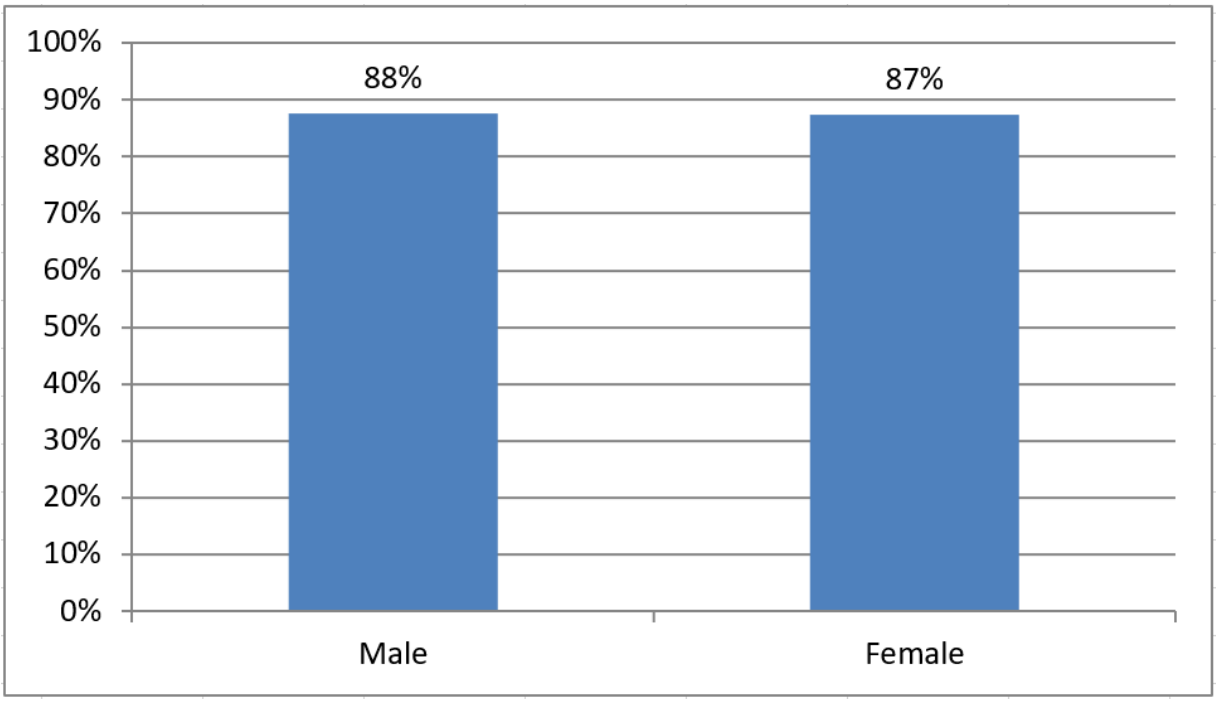


Figure 15: Sex-specific completeness of birth registration, Colombia 2014



16 Koolwal, Gayatri. 2016. T*he gender dimensions of birth registration in Sub-Saharan Africa: What can the data tell us?* Draft report to the UN Foundation under the Data2X program. Washington, DC (June).

Step 4: Birth order

Step 4.1: Summary of birth order

The first component of Step 4 shows the percentage of births of each birth order, including unspecified birth order (**Figures 16** and **17**). Birth order should count all previous live births of the mother, irrespective of whether they were in the current marriage/ relationship. Again, **unspecified birth order should be minimal**, otherwise it may hide the true birth order of the population.

Figure 16: Registered births by birth order (%), Ecuador 2010

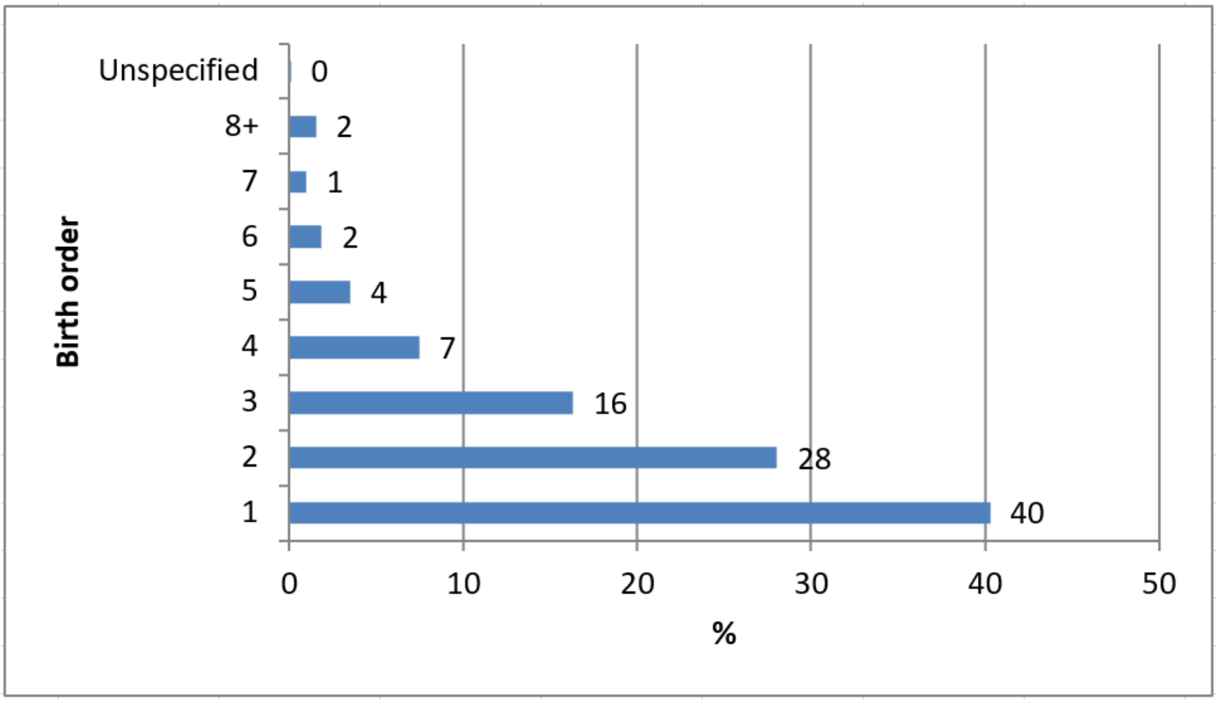
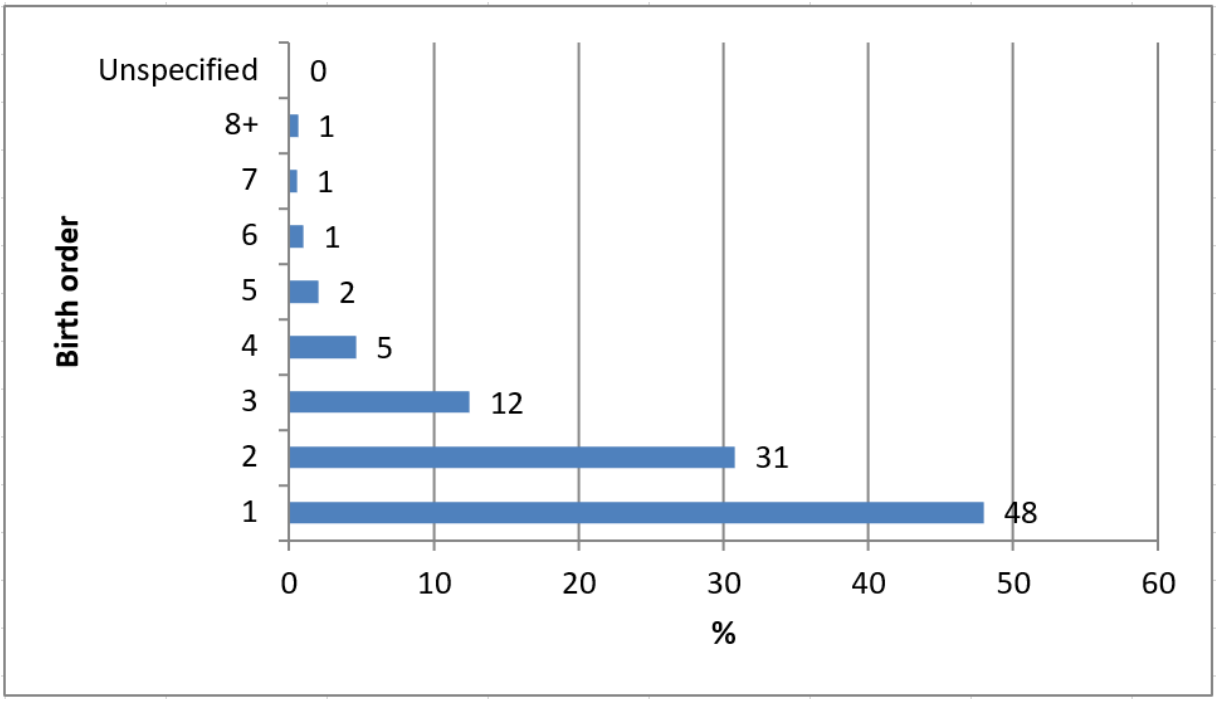


Figure 17: Registered births by birth order (%), Colombia 2014



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Step 4.2: Birth order by age of mother

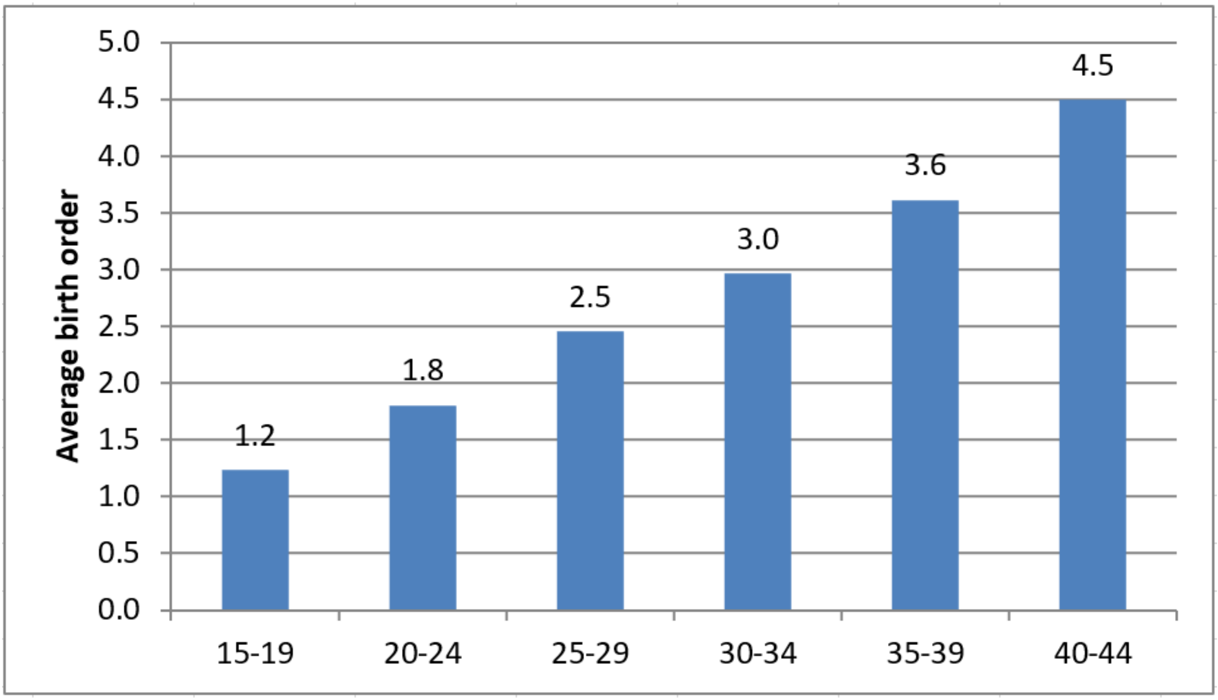
The plausibility of birth order data is assessed using age of mother; these data should be consistent with each other. Implausible birth order for each age group can be measured using the rule of thumb that **a woman can have a maximum of one birth every 18 months from the age of 12 (rounded down to the next integer): i.e. ages 15 to 19 up to five births, and ages 20 to 24 up to eight births**.[17] In Ecuador in 2010, only 0.1 per cent of births in the 15 to 19 and 20 to 24 age groups have an implausibly high birth order. In Colombia, the respective figures are less than 0.1 per cent.

Average birth order should be higher with older age of mother; according to analysis of 211 DHS, **average birth order increases in every five-year age group from 15 to 19, to 35 to 39** in each survey.[18] If birth order does not increase linearly with the age of mother, it would indicate that fertility has been changing at a non-constant rate; however, birth order should still increase with age (even at a non-constant rate). If birth order does not increase with the age of mother, it is likely to be the result of poor-quality data. If there is declining birth order with older age of mother, long-term fertility trends should be investigated to see if there has been an increase in fertility in recent decades (going back further back in time if at older ages).

When calculating average birth order for each age of mother, ensure that the number of births for each age of mother is the same as that used in Step 2 – i.e. there is a birth order value for every birth for which there is an age of mother.

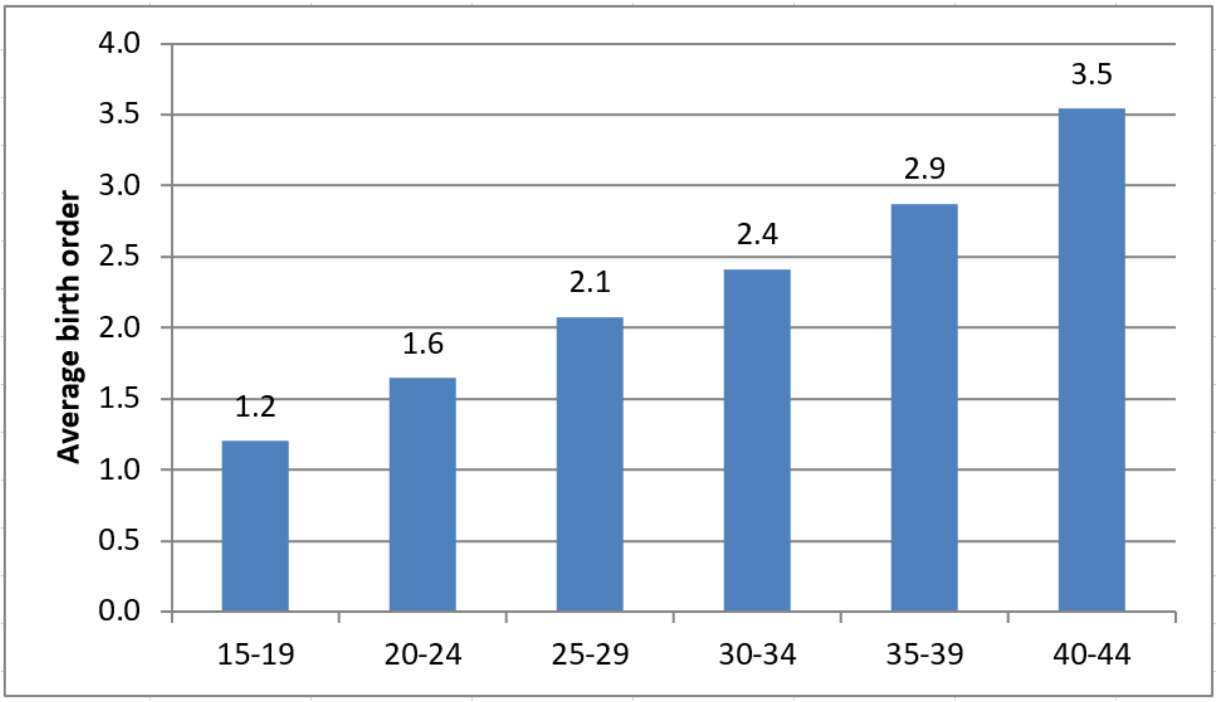
In Ecuador and Colombia, average birth order increases with each age (**Figures 18** and **19**).

Figure 18: Average birth order by age of mother, Ecuador 2010



17 Moultrie, T., 2011, Evaluation of fertility data, in *Tools for Demographic Estimation*, http://demographicestimation.iussp.org/
18 ICF, 2015. *The DHS Program STATcompiler.* Funded by USAID. http://www.statcompiler.com

Figure 19: Average birth order by age of mother, Colombia 2014



Step 4.3: Birth order by TFR

There should be consistency between the average birth order of an age group of mothers and the comparator TFR. Although birth order is a measure of lifetime fertility of women who have given birth in the defined time period, and TFR is a measure of fertility simply in the defined time period (and therefore can be distorted by significant changes in fertility levels over time), empirical evidence from 202 DHS shows a strong relationship between the two (**Table 2**).[19] **Average birth orders that lie outside plausible values for a specific TFR are almost certainly due to poor-quality data**; only in rare exceptions would data be of good quality because there has been a significant change in TFR (likely a decline). Using the above results for Ecuador and Colombia, the average birth orders for each country are comfortably in the specified range given their level of TFR.

Table 2: Plausible average birth order for each age of mother and range of TFR, based on 202 DHS[20]

Average birth order	TFR		
Age of mother	**1.8-2.4**	**2.5-4.0**	**4.0+**
20-24	1.2 to 2.0	1.4 to 2.5	1.5+
25-29	1.7 to 3.2	2.0 to 3.4	2.4+
30-34	2.0 to 3.5	2.5 to 4.0	3.0+

19 ICF, 2015. The DHS Program *STATcompiler*. Funded by USAID. http://www.statcompiler.com
20 Ibid.

Step 5: Birth weight and gestational age

Step 5.1: Summary of birth weight and gestational age

The first component of Step 5 shows the percentage of births of each category of birth weight, including unspecified birth weight, and the percentage of births at each gestational age, again including unspecified gestational age.

The highest proportion of births should be in the 2500 to 3499 grams birth weight. If the proportion of births of less than 2500 grams (low birth weight; LBW) is higher than 20 per cent, there should be concern regarding data quality.

Unspecified birth weight should be minimal, because it may obscure the true distribution of birthweight. Unspecified birth weight is often quite high.

In Ecuador, a high proportion of births (16 per cent) have an unspecified birth weight (**Figure 20**). In Colombia, however, the birth weight data are of much better quality (zero per cent unspecified) (**Figure 21**).

Figure 20: Registered births by birth weight (%), Ecuador 2010

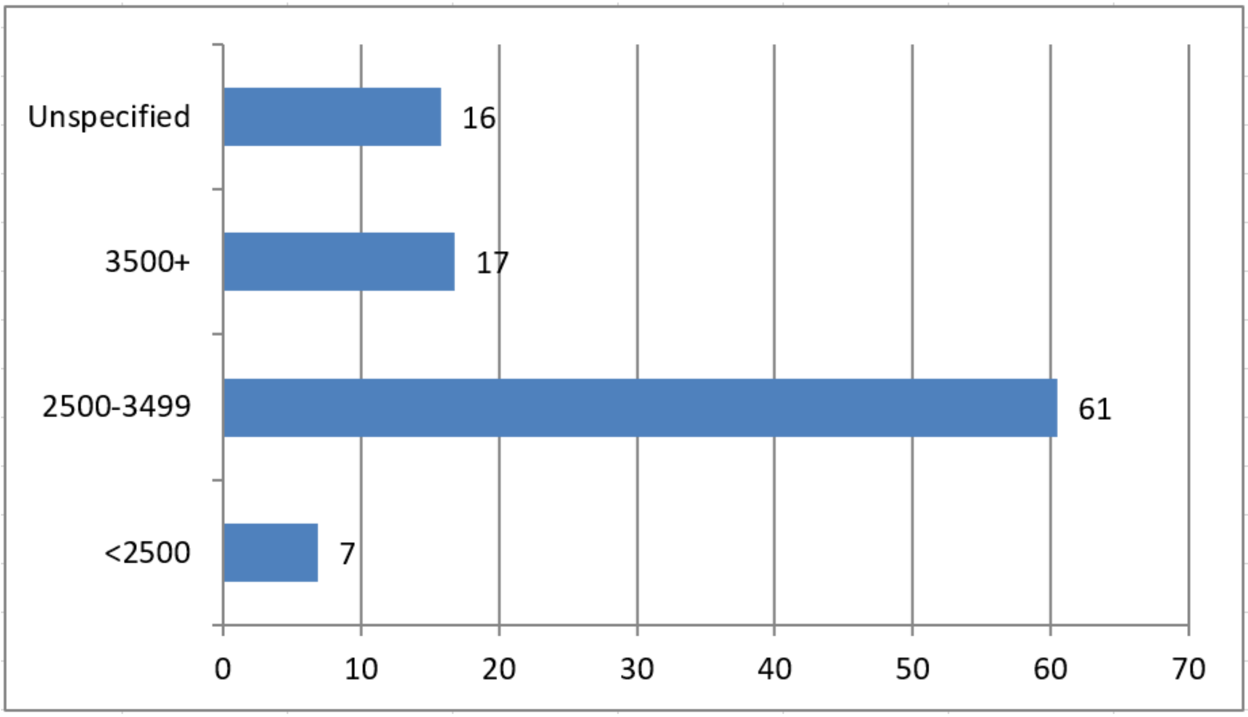
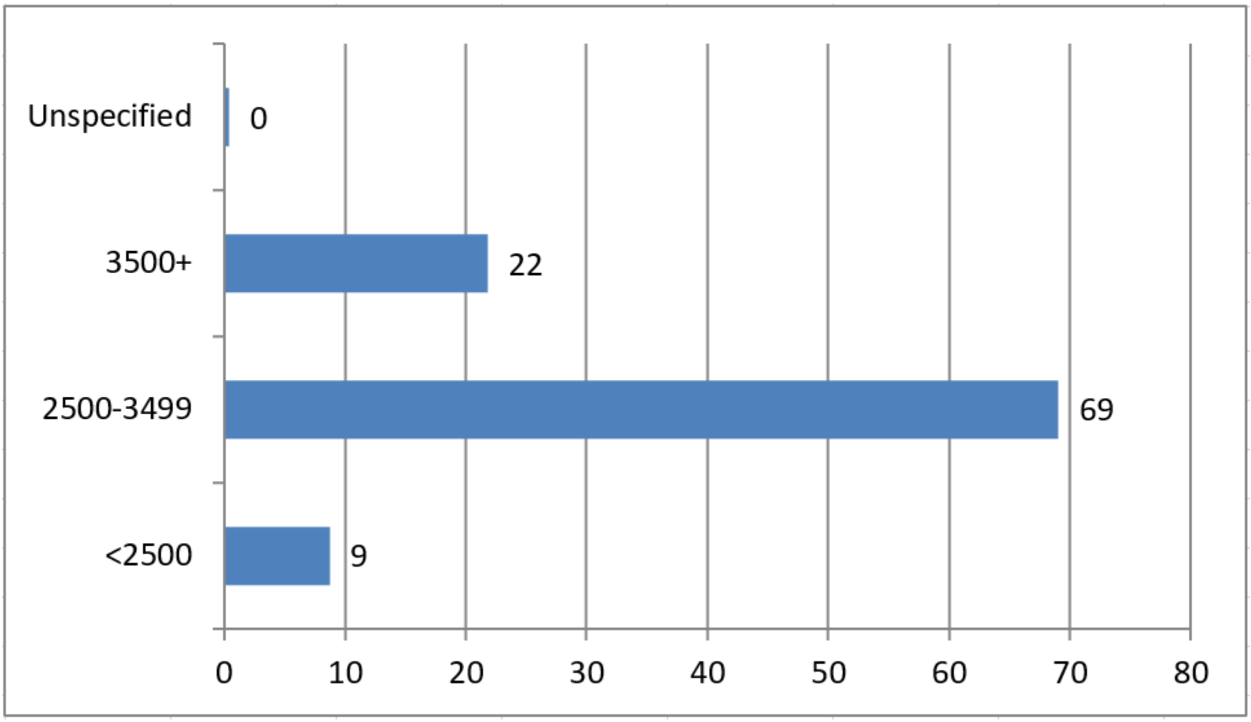


Figure 21: Registered births by birth weight (%), Colombia 2014



Gestational age should be above 36 weeks in the vast majority of births. A gestational age of less than 28 weeks is very rare.

Over one-quarter of registered births in Ecuador have unspecified gestational age (**Figure 22**). The range of gestational ages of other births is within the plausible range. About nine per cent of births with a gestational age report it as above 36 weeks. In Colombia, zero per cent of births have an unspecified gestational age, and 80 per cent have a gestational age above 37 weeks, again within a plausible range (**Figure 23**).

Figure 22: Registered births by gestational age (%), Ecuador 2010

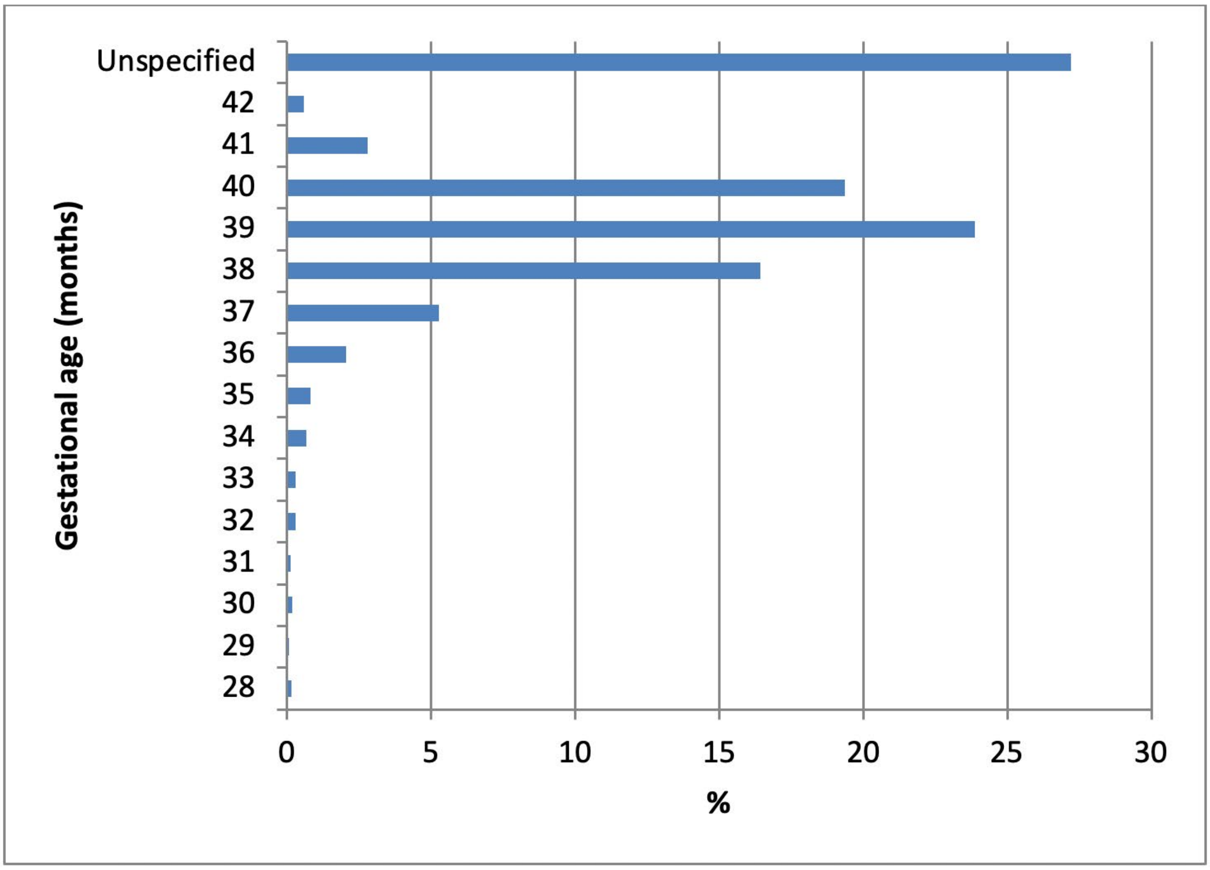
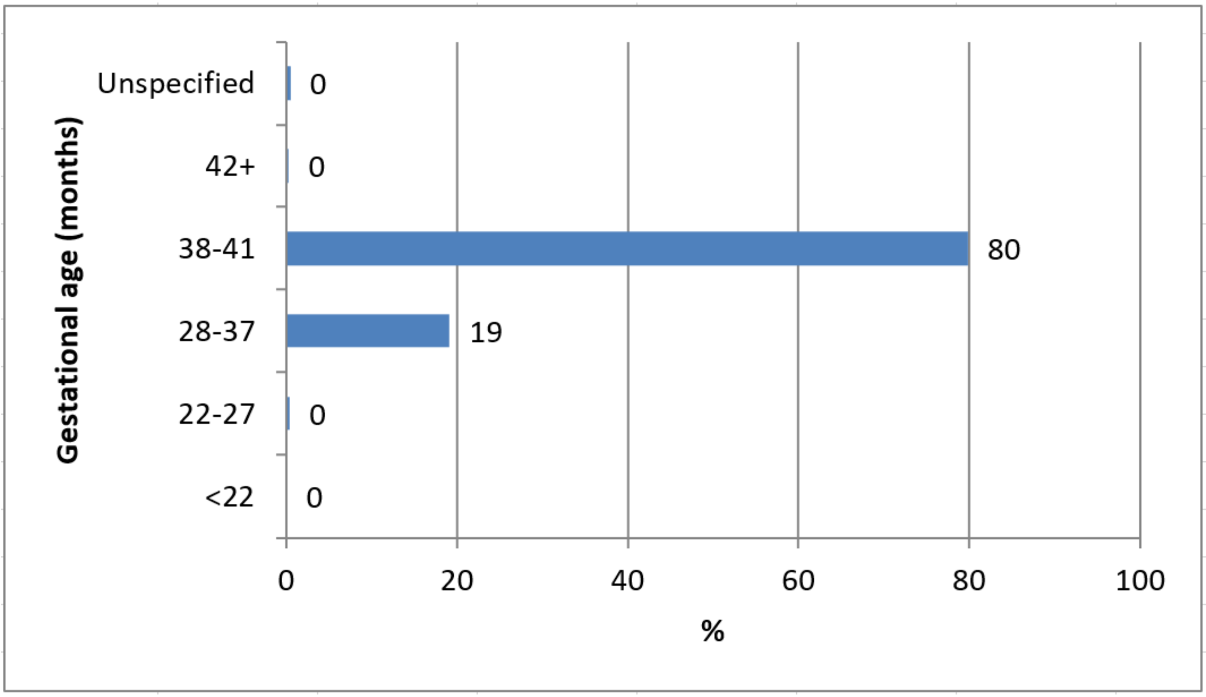


Figure 23: Registered births by gestational age (%), Colombia 2014



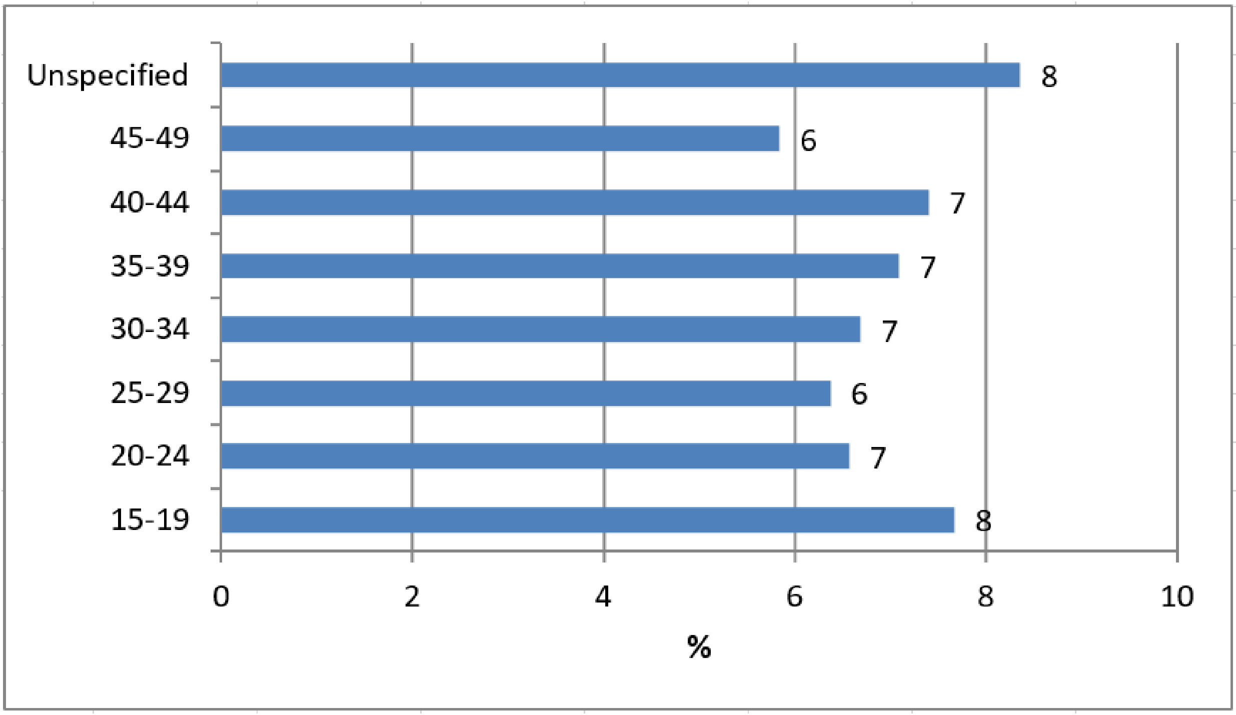
Step 5.2: Birth weight by age of mother

LBW births are most common in younger and older mothers, because women who give birth at these ages are more likely to be in poorer health or of low socio-economic status than women giving birth at other ages. Analysis of 211 DHS shows that in only six per cent of country-years does the proportion of LBW births peak in ages 20 to 34.[21] Therefore, the **proportion of births with LBW is very unlikely to be highest in the 20 to 34 age groups.**

When calculating average birth weight for each age of mother, ensure that the number of births for each age of mother is the same as that used in Step 2 – i.e. there is a birth weight value for every birth for which there is an age of mother.

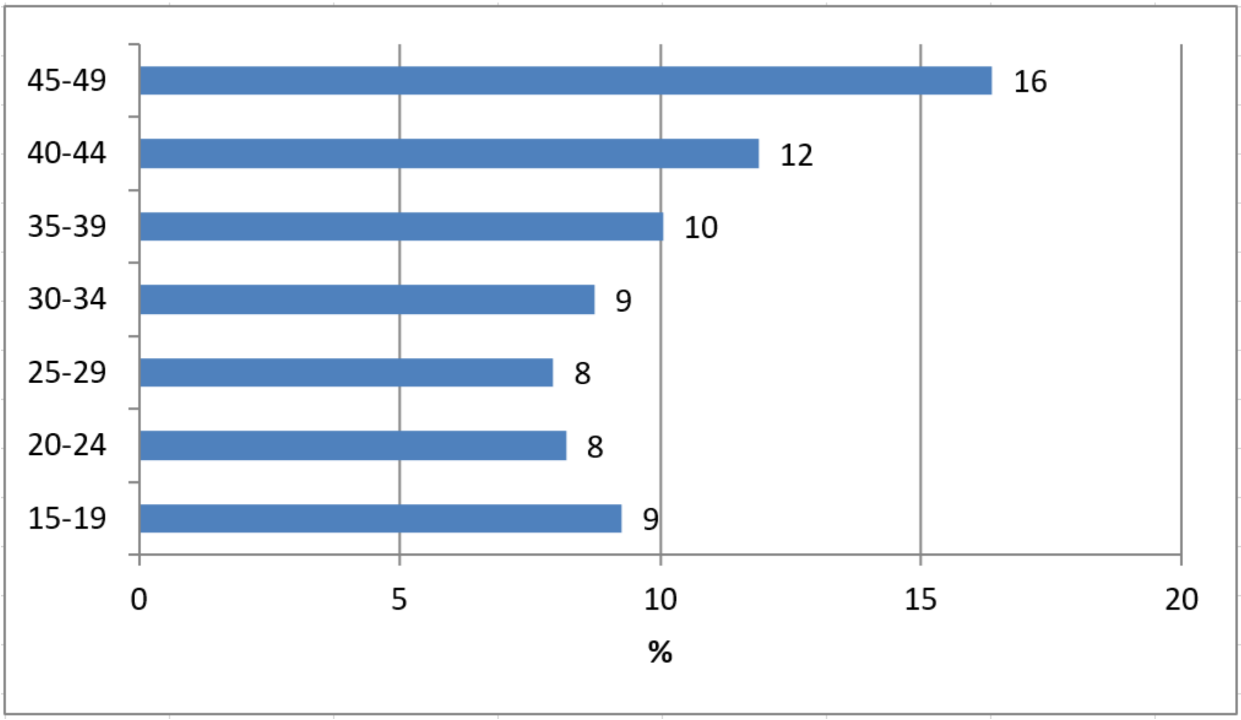
In Ecuador, the 15 to 19 age group has the highest proportion of LBW births, however, there is a very small difference in percentages (**Figure 24**). In Colombia, the 45 to 49 and 40 to 44 age groups have the highest proportion of births of LBW (**Figure 25**).

Figure 24: LBW births by age of mother (% of registered births), Ecuador 2010



21 ICF, 2015. *The DHS Program STATcompiler*. Funded by USAID. http://www.statcompiler.com

Figure 25: LBW births by age of mother (% of registered births), Colombia 2014



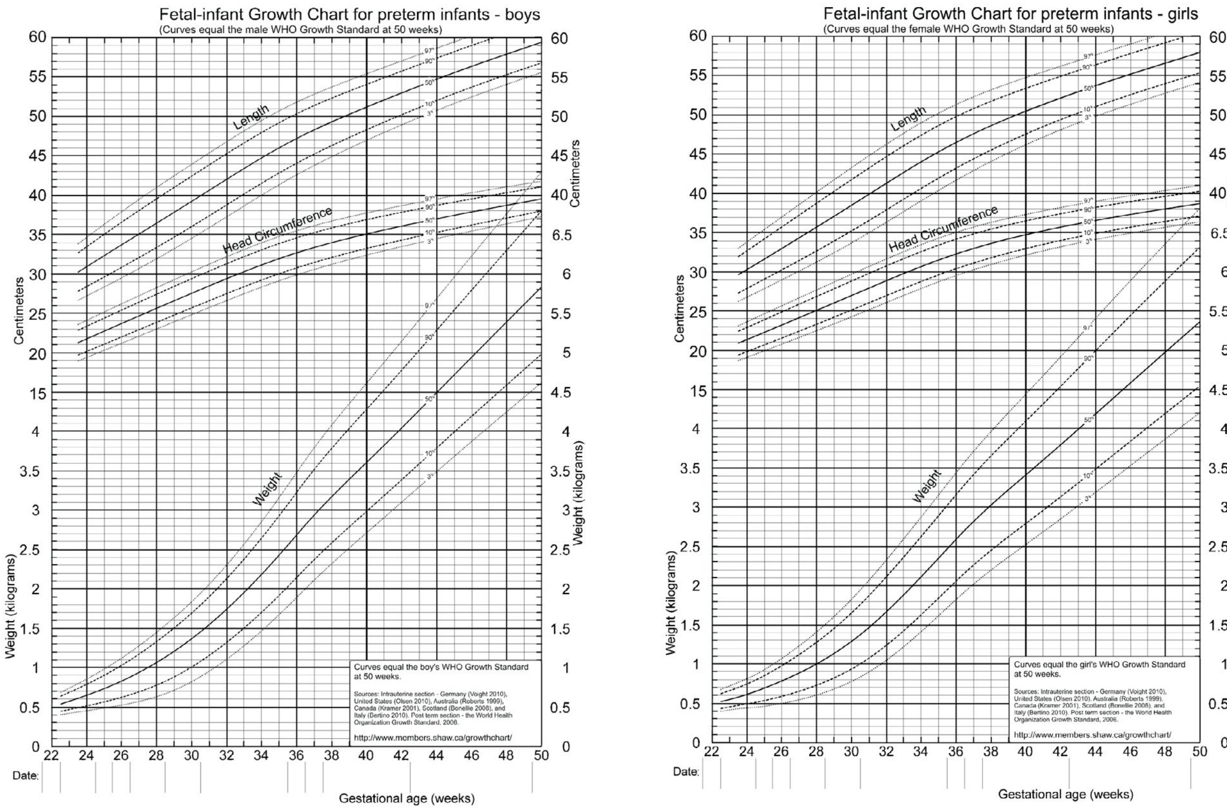
Step 5.3: Birth weight by gestational age

The level of birth weight at a given gestational age is another indicator of birth data quality.[22] The Fenton Growth Charts measure appropriate birth weight given gestational age; small for gestational age (SGA) is birth weight below the 10th percentile of a population (**Figure 26**). A measure of data quality is the percentage of births that are SGA at each month of gestational age, which can be calculated based on the charts in **Figures 26** to **28**. **If significantly more than 10 per cent of births are SGA, then it may be due to data quality, although if LBW is relatively high in a country then it may not be a true reflection of birth weight.**

A separate data quality measure is that **median birth weight should increase with gestational age.**

22 Gestational age is measured from the date of the last normal menstrual period of the mother.

Figure 26: Birth weight (g) percentiles by gestational age, males and females, Fenton Growth Chart[23]



In Ecuador, between 10 and 15 per cent of births are SGA (i.e. below the 10 per cent threshold), indicating good data quality (**Figures 27** and **28**). There is also a linear increase in median birth weight with gestational age. In Colombia, a similar analysis could not be conducted because birth weight and gestational age data are only available in broad categories. The minimum birth weight in the Ecuador data is 1000 grams, so there can be no births SGA for gestational age 30 weeks.

23 Fenton, T & Kim, J, 2013, *A systematic review and meta-analysis to revise the Fenton growth chart for preterm infants*, BMC Pediatrics, 13: 59. Further information on growth charts can be found here: https://ucalgary.ca/resource/preterm-growth-chart/preterm-growth-chart

Figure 27: Median birth weight, SGA threshold and % births SGA, by gestational age, male births, Ecuador 2010

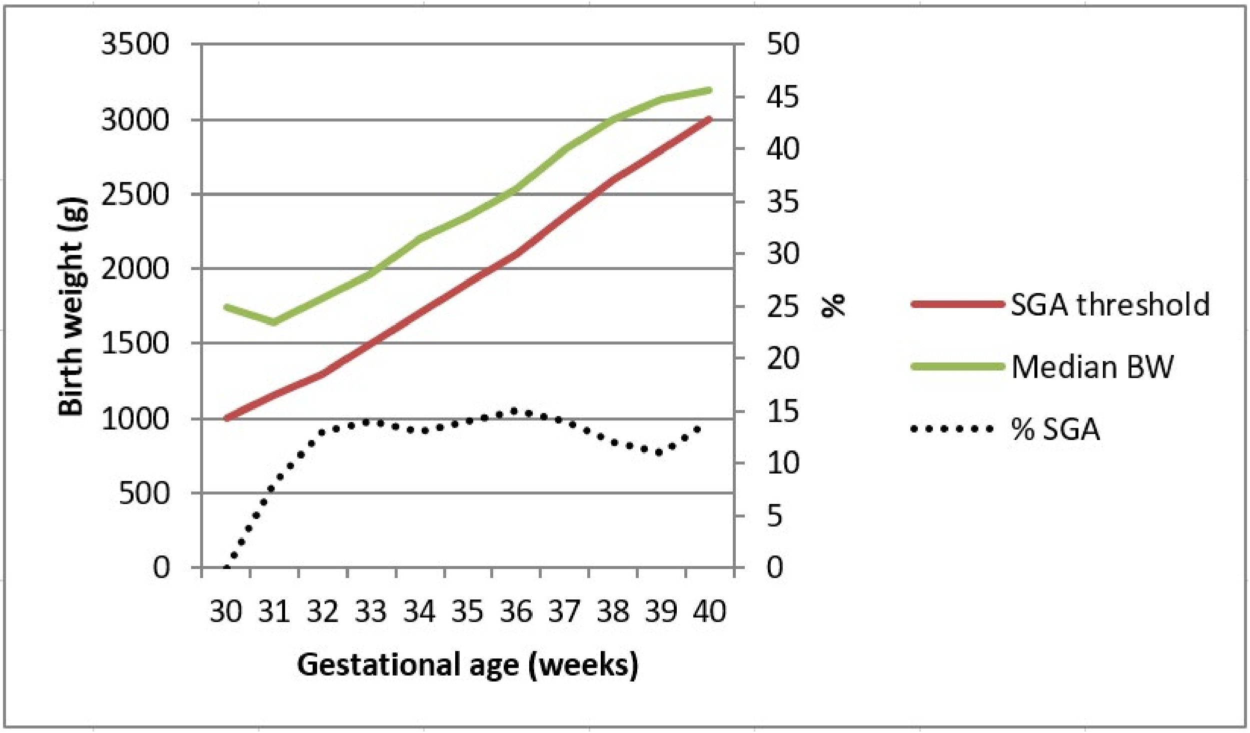
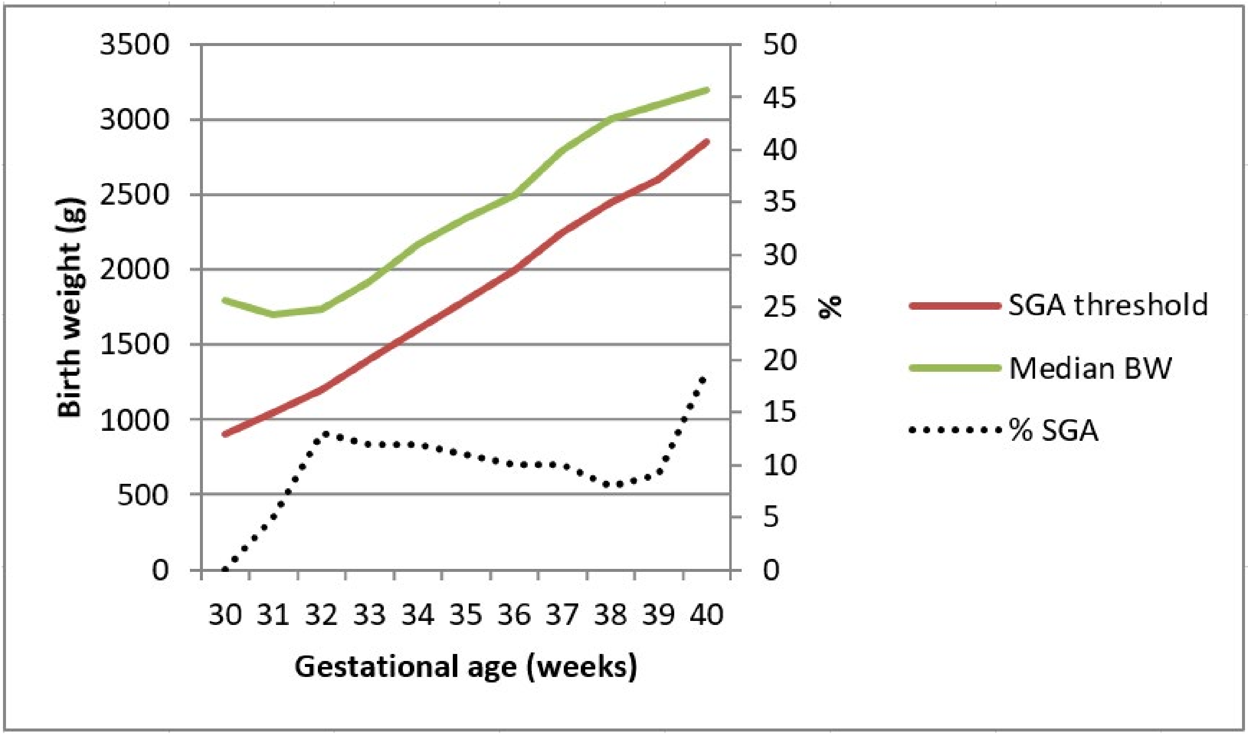


Figure 28: Median birth weight, SGA threshold and % births SGA, by gestational age, female births, Ecuador 2010



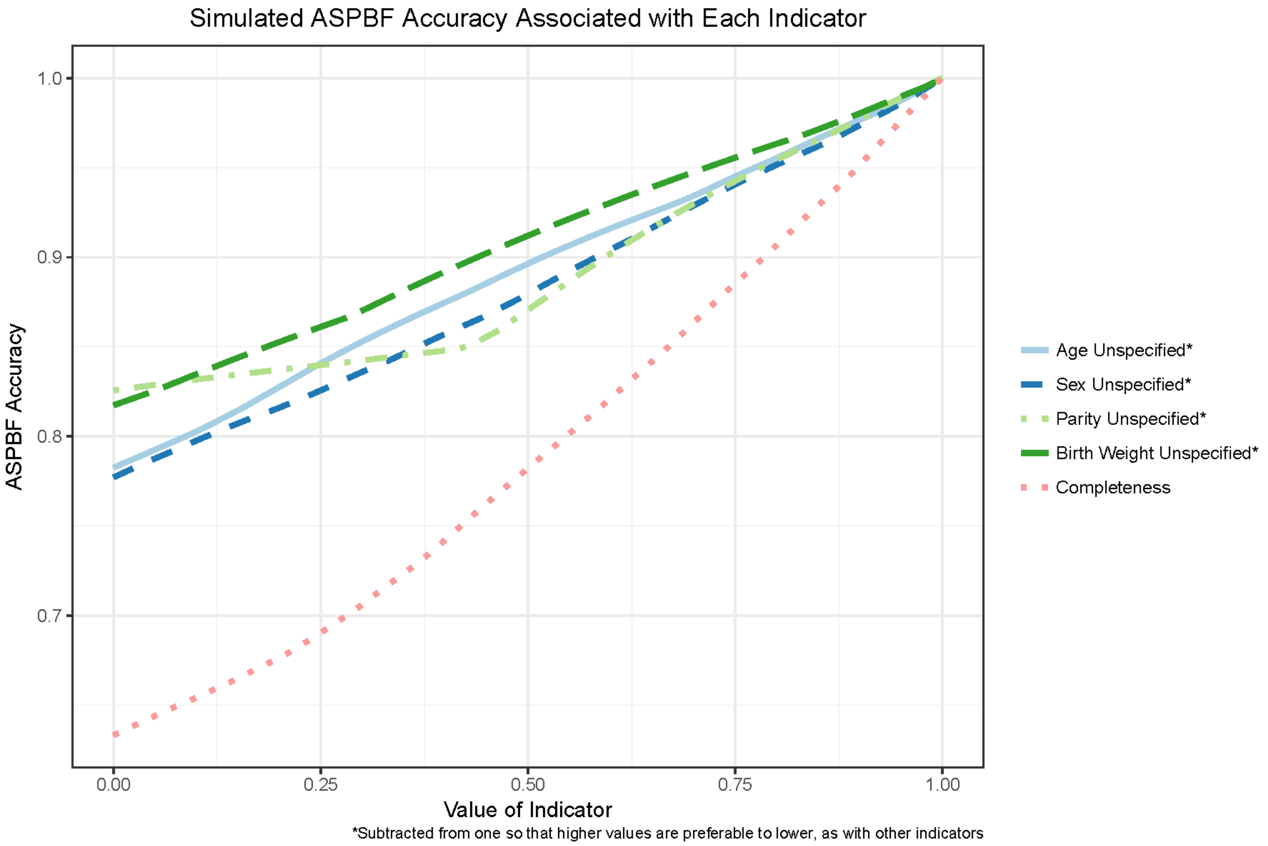
Step 6: VSPI-Births

The VSPI-Births has been developed in collaboration with the Institute of Health Metrics and Evaluation (IHME) to be a summary index of the quality of birth registration data, similar to the VSPI-Deaths.[24] The VSPI-Births is calculated from the input data using the following components which are considered to be the most important measures of birth data quality:

- Completeness of birth registration (Step 1.2)
- % of births with unspecified age of mother (Step 2.1)
- % of births with unspecified sex of child (Step 3.1)
- % of births with unspecified birth order (Step 4.1)
- % of births with unspecified birth weight (Step 5.1)

The VSPI-Births is calculated by using the chart in **Figure 29** to convert the value of each VSPI component on the horizontal axis into an "ASPBF Accuracy" score on the vertical axis, and then multiplying all five indicators together.[25] This will result in a VSPI-Births figure that can range from zero to 100, with the higher score indicating better quality birth data.[26]

Figure 29: Simulated Age-Sex-Parity-Birthweight Fraction Accuracy Associated with Each Indicator[27]



24 Phillips DE, Adair T, Lopez AD. *How useful are registered birth statistics for health and social policy? A global systematic assessment of the availability and quality of birth registration data. Popul Health Metr* 2018; 16.

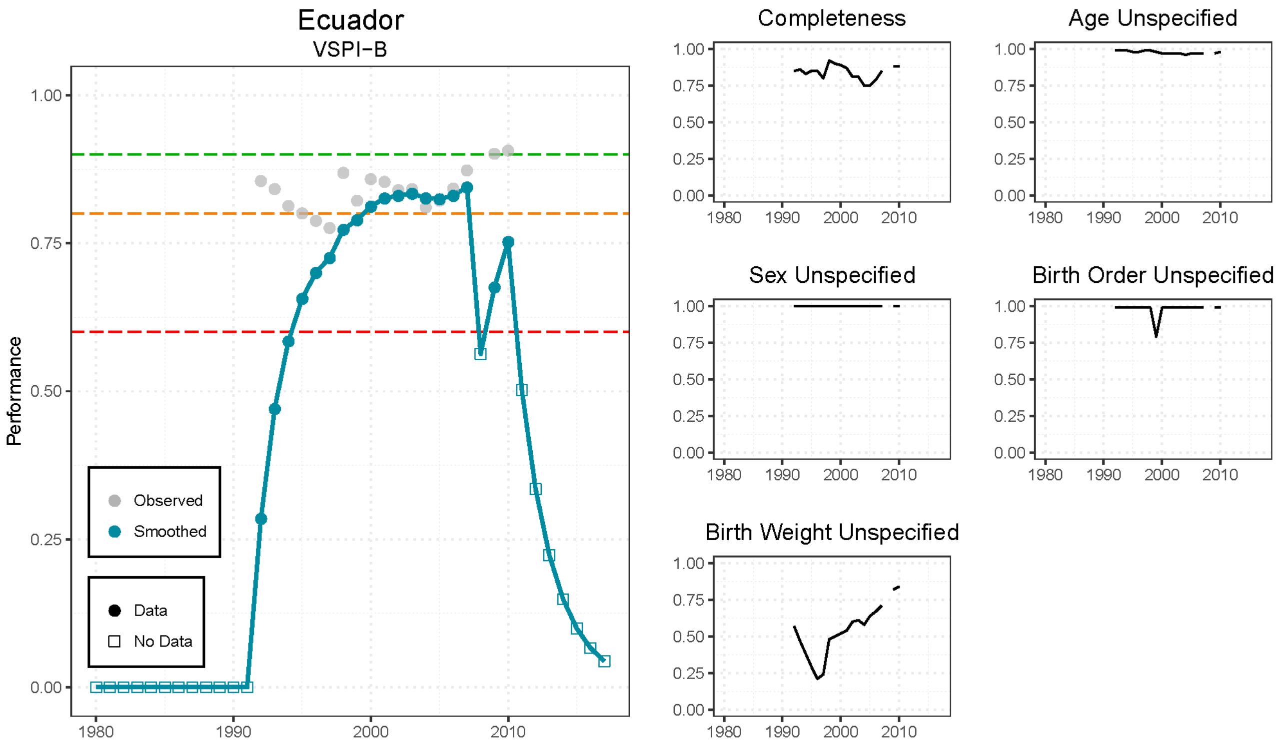
25 Age-Sex-Parity-Birthweight Fraction (ASPBF) Accuracy is a measure of the accuracy of each indicator. It was calculated based on a procedure whereby a simulation dataset was used to calculate Age-Sex-Parity-Birthweight Fractions, and different levels of each indicator were simulated to measure the impact of each level on these Fractions. The results of the simulation are presented in Figure 29. The respective line for each indicator shows the ASPBF Accuracy score at each level of that indicator. This score is also used to calculate the VSPI-Births.

26 This will result in a calculation of VSPI-Births that excludes the exponential smoothing algorithm used by Phillips et al. However, this will still result in an estimate of VSPI-Births that is a good measure of the quality of routine birth data. Assistance regarding calculation of the VSPI-Births can be sought from crvs-info@unimelb.edu.au

27 Phillips DE, Adair T, Lopez AD. *How useful are registered birth statistics for health and social policy? A global systematic assessment of the availability and quality of birth registration data, Additional File 3*. Popul Health Metr 2018; 16.

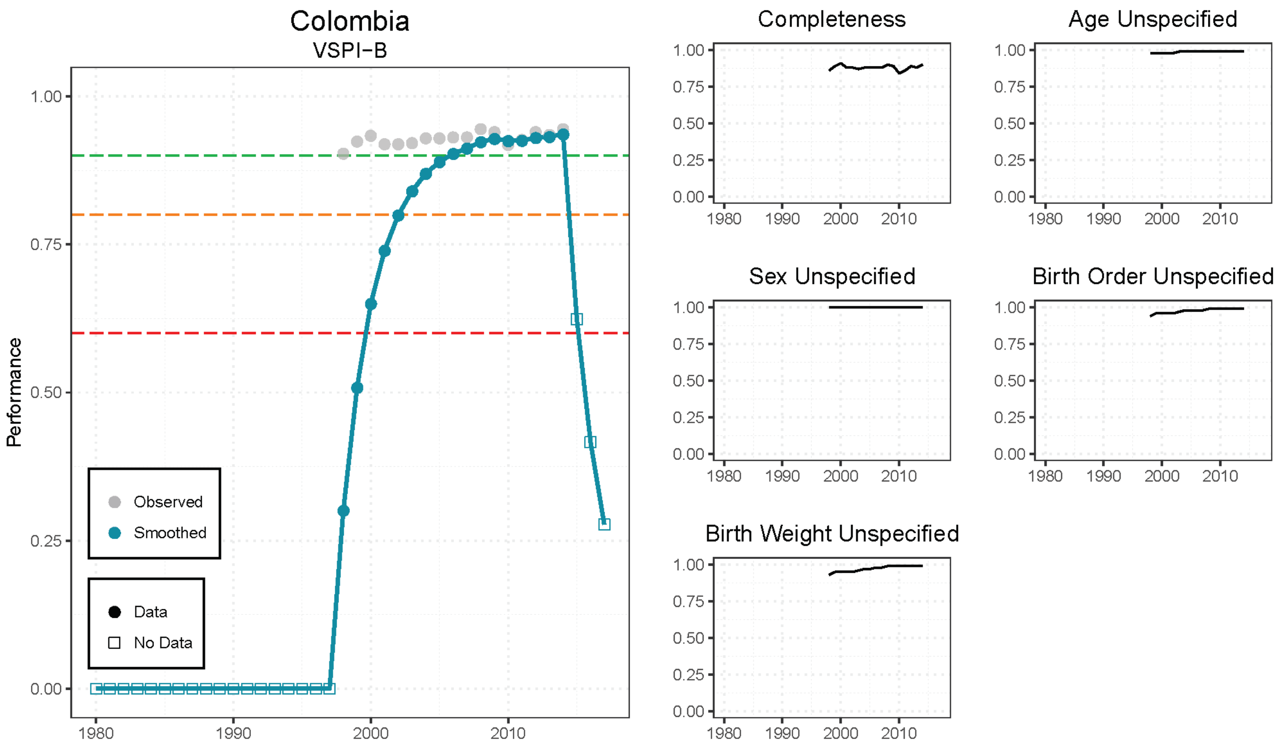
The **VSPI-Births** in **Ecuador is 75** and in **Colombia is 87**. This difference can largely be explained by differences in the percentage of births with unspecified birth weight, which is higher in Ecuador (**Figures 30** and **31**). There is also a high proportion of births with unspecified gestational age in Ecuador (although not measured in the VSPI-Births). The only other significant data quality issue in each country is that completeness of registration is below 90 per cent.

Figure 30: VSPI-Births and components, Ecuador[28]



28 Phillips DE, Adair T, Lopez AD. *How useful are registered birth statistics for health and social policy? A global systematic assessment of the availability and quality of birth registration data, Additional File 3*. Popul Health Metr 2018; 16.

Figure 31: VSPI-Births and components, Colombia[29]



Supplementary Steps

Step 7: Time since last birth

Step 7.1: Summary of time since last birth

The first component of Step 7 shows the percentage of non-first births[30] at each time since last birth, including unspecified time since last birth. **Unspecified time since last birth should be minimal.**

An interval of 18 months or shorter from birth to pregnancy is associated with higher risk of infant, neonatal and perinatal mortality, low birth weight, small size for gestational age, and pre-term delivery.[31] **Only a small proportion of individual births should have time since last birth of below 18 months**. Analysis of DHS shows that, on average, nine per cent of births have a previous birth interval of less than 18 months.[32]

The lowest median time since last birth recorded in a DHS is 24 months.[33] **Median time since last birth should not be below 24 months.**

In Ecuador, this indicator is not collected. In Colombia, only those with unspecified time since last birth can be measured (the measurement of date of previous birth is unclear), which is 0.06 per cent of all non-first births.

Step 7.2: Time since last birth and TFR

Analysis of DHS shows that there should be consistency between median birth interval and TFR; a median birth interval of above 40 is highly unlikely where the TFR is above five, and above 50 is unlikely where TFR is above three.[34]

29 Ibid.
30 Assessment of time since last birth is undertaken of non-first births.
31 WHO, 2007, *Report of a WHO Technical Consultation on Birth Spacing, Geneva, Switzerland, 13–15 June 2005* http://apps.who.int/iris/bitstream/10665/69855/1/WHO_RHR_07.1_eng.pdf
32 ICF, 2015. *The DHS Program STATcompiler*. Funded by USAID. http://www.statcompiler.com
33 Ibid.
34 Ibid.

A median birth interval should not be above 40 where the TFR is above five, and should not be above 50 where TFR is above three.

Step 8: Site of delivery

Step 8.1 Summary of site of delivery data

The comparator data used in this step are from the DHS, which measures births by place of delivery for the three years preceding the survey. A DHS with births in a period within three years of the year of registration is preferable to ensure the comparator data are relevant. Site of delivery is classified as “facility” and “other”, to be consistent with the comparator data of the DHS which measures it in this way. This step is optional, as not every country would have reliable comparator data.

The first component of Step 8 shows the percentage of births of each category of site of delivery, including unspecified site of delivery. In Ecuador, 87 per cent of registered births occur in a facility, and 13 per cent outside a facility, with less than one per cent of registered births having an unspecified site of delivery (**Figure 32**). In Colombia, 99 per cent of registered births occur in a facility, compared with 97 per cent according to the DHS for 2012 to 2015 (**Figure 33**). Less than one per cent of registered births have an unspecified site of delivery.

Figure 32: Registered births by site of delivery (%), Ecuador 2010

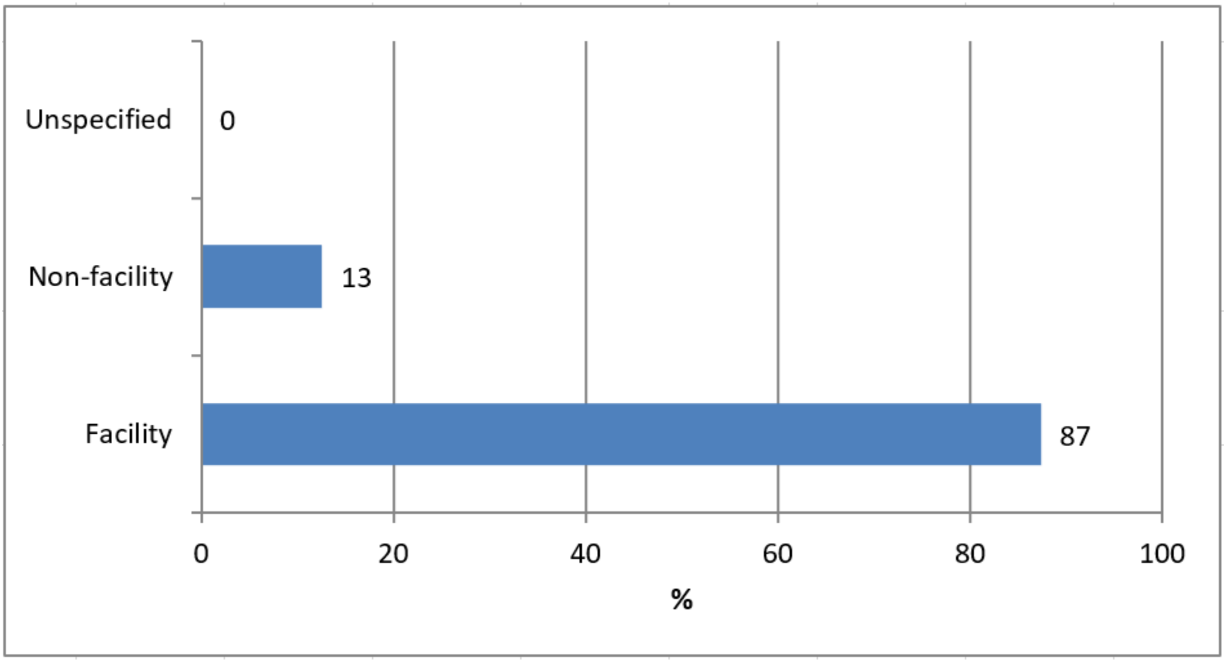
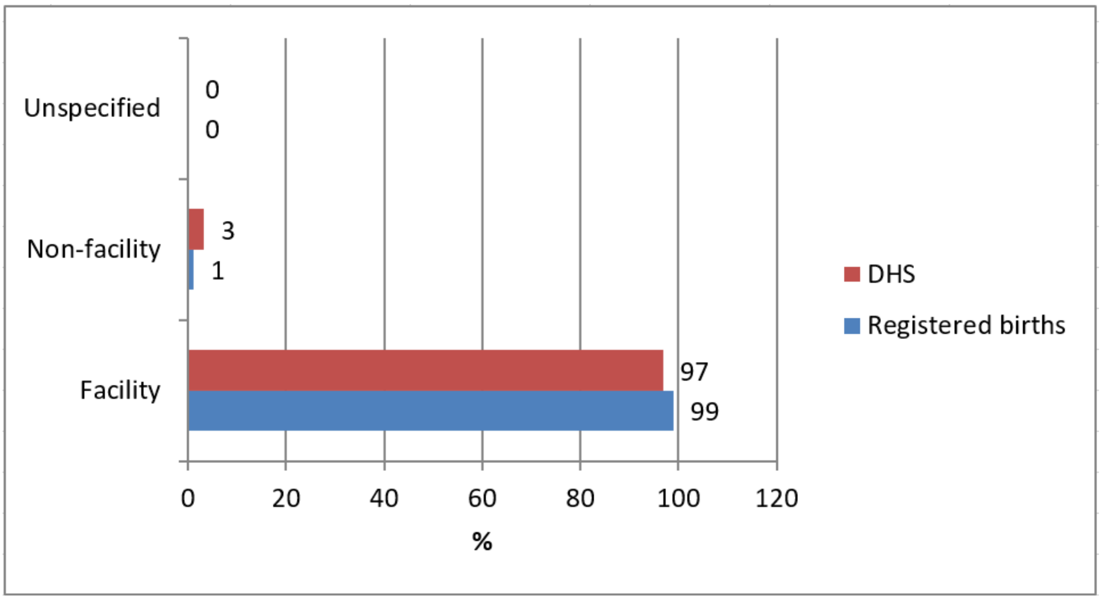


Figure 33: Registered births and DHS births by site of delivery (%), Colombia 2014[35]

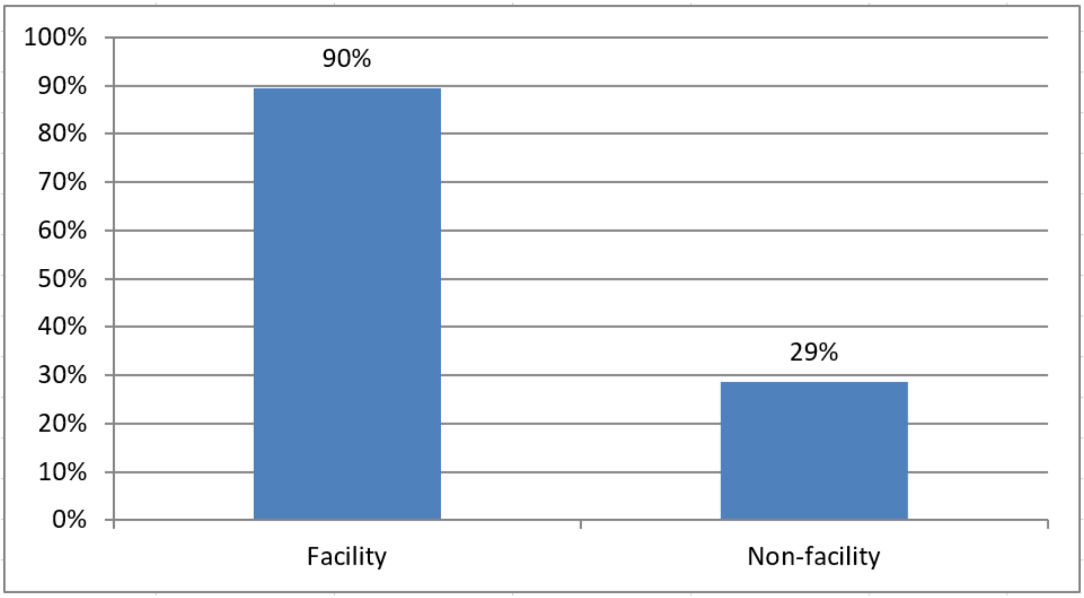


Step 8.2: Site of delivery-specific completeness assessment

As previously mentioned, measurement of completeness of birth registration according to site of delivery can help target interventions to improve completeness. For example, if facility births are close to 100 per cent complete but non-facility births are only 70 per cent complete, then interventions to improve completeness should be targeted at non-facility births. Generally, completeness of facility births should be higher, because they often have existing reporting mechanisms to a ministry of health or registration authority, and home births are more likely to occur in more remote areas where registration levels are lowest.

In Colombia, 90 per cent of facility births are estimated to be registered, compared with only 29 per cent of non-facility births (**Figure 34**).[36] However, non-facility births comprise only three per cent of all births, according to the DHS. No DHS data with site of delivery are available for Ecuador.

Figure 34: Completeness of birth registration by site of delivery (%), Colombia 2014



35 ICF, 2015. *The DHS Program STATcompiler*. Funded by USAID. http://www.statcompiler.com

36 Ibid.

The program partners on this initiative include: The University of Melbourne, Australia; CDC Foundation, USA; Vital Strategies, USA; Johns Hopkins Bloomberg School of Public Health, USA; World Health Organization, Switzerland.

Civil Registration and Vital Statistics partners:

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