Article

Maternal deaths databases analysis: Ecuador 2003-2013

Antonio Pino, María Albán, Alejandra Rivas, Erika Rodríguez
Pontifical Catholic University of Ecuador, Quito, Ecuador

Significance for public health

General agreement on maternal mortality reduction suggests that to reach the millennium target a health system must to be able to provide essential, and emergency obstetric care in a well allocate, geographic, ethnic, and socioeconomic distribution of resources. Patterns of inequity in health status, health care provision, and health risks are demonstrable in Ecuadorian maternal deaths, but at levels below of those three decades ago. However, a predominant factor seems unclear to explain the variable association found processing national databases. It could mean that every pattern of health systems development played a role in maternal mortality, but also that factors different than those registered by the statistics system may remain hidden and that some random influences are not even considered in an explanatory model yet. To use maternal mortality to assess health system development might contribute to a general improvement in system performance.

Abstract

Background: Maternal mortality ratio in Ecuador is the only millennium goal on which national agencies are still making strong efforts to reach 2015 target. The purpose of the study was to process national maternal death databases to identify a specific association pattern of variable included in the death certificate.

Design and methods: The study processed mortality databases published yearly by the National Census and Statistics Institute (INEC). Data analysed were exclusively maternal deaths. Data corresponds to the 2003-2013 period, accessible through INEC’s website. Comparisons are based on number of deaths and use an ecological approach for geographical coincidences.

Results: The study identified variable association into the maternal mortality national databases showing that to die at home or in a different place than a hospital is closely related to women’s socioeconomic characteristics; there was an association with the absence of a public health facility. Also, to die in a different place than the usual residence could mean that women and families are searching for or were referred to a higher level of attention when they face complications.

Conclusions: Ecuadorian maternal deaths showed Patterns of inequity in health status, health care provision and health risks. A predominant factor seems unclear to explain the variable association found processing national databases; perhaps every pattern of health systems development played a role in maternal mortality or factors different from those registered by the statistics system may remain hidden. Some random influences might not be even considered in an explanatory model yet.

Introduction

Maternal mortality reduction efforts around the world took shape during the 80s, and 90s when two milestone ideas emerged, the Three Delay Model (TDM) and the proposal of Essential Obstetric Care (EOC). The Safe Motherhood Initiative launched by World Health Organization (1987) developed a well-documented set of information resources, and a toolkit of intervention alternatives spread worldwide. In 2000 the millennium goals were stated, maternal mortality goal was to Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio. However, maternal mortality in Ecuador and many other Latin American countries is the only millennium goal on which national agencies are still making strong efforts to reach the 2015 target.

The foundation for those ideas was based on the hypothesis that health systems development to reach the capacity to provide essential obstetric care would be the rationale to fight against maternal mortality; a plausible approach at that time in an era where the non-developed world was more uniformly poor, socio-economically speaking, than it is nowadays. National efforts in many cases achieved important reductions; however, the intensity of the reduction in Ecuador has reached a level where additional decreasing seems to be a completely new challenge. The trend of maternal mortality ratio per 100,000 live births comparing 1990-2003 with 2004-2013 period shows a clear difference in slope inclination (t=5.03, P=0.00006345), to regain a sustained declining trend will require the use of alternative sources of information to made adjustments in the decision-making processes that have been in place for a long time.

Maternal mortality also has a clear socioeconomic relationship identified worldwide The risk of a woman in a developing country dying from a maternal-related cause during her lifetime is about 23 times higher compared to a woman living in a developed country. Maternal mortality is a health indicator that shows very wide gaps between rich and poor, urban and rural areas, both between countries and within them.

The purpose of the present study is to process the national maternal death databases that collect data for statistical purposes (not for research), to provide some empirical evidence on the relationship between the variables that are registered in the death certificate and annually published officially by the national statistics agency. The idea is to identify a specific pattern of associations in women’s characteristics that help to understand better if the rationale of the proposed health systems development to cope essential obstetric care as a strategy to reduce maternal mortality is still applicable today as it was in former times or some adjustments need to be explored. To improve the strength of this attempt to build possible variable associations TDM, EOC, and socioeconomic determinants were utilised as a framework. On the other hand, pregnancy-induced hypertension (PIH) has been the leading maternal mortality cause in Ecuador for a long period, then a comparison of PIH with all the rest of causes grouped was included.
in the analysis.

One clear limitation for building a model using data registered by the statistics national system is the fact that a cross-sectional/ecological design is only able to offer a relational level of association where only proxy plausible data bindings can be drawn while a causal model would require a different approach. It was not feasible for the investigators to pool other databases published by the Instituto Nacional de Estadísticas y Censos (INEC) (for example, birth register, health activities, etc.) neither the team had resources to perform spatial analysis using geographical frameworks and tools. It is an exploratory phase of research that hopefully will encourage institutional efforts to mine the huge amount of data available, which are regularly collected but remain underutilised in most non-developed countries. This endeavor is nowadays possible because data gathered are accessible for everybody.

**Design and methods**

The study processed mortality databases published yearly by the INEC. Databases (Excel format) were downloaded from INEC’s website in March 2015. It was exclusively those reporting maternal deaths [classified under the International List of Causes of Death (ICD) code O Chapter X], corresponding to the 2003 to 2013 period, which was already accessible through INEC’s website. The variables available for this study, in the INEC’s maternal death set of databases for the mentioned years, included: i) year of death; ii) place of death and place of residence: Ecuador is organised into three levels of administration; in descendent order: province, canton, and parish; for this study, data were re-coded as canton’s main town and countryside. Also, data are reported by area (urban/rural/peripheral); iii) age: re-coded for the present study in under 18 - over 35 years old, and 18 to 35 years old; iv) marital status: registered as common law partner, married, single, divorced, separated, widow. For comparisons were reclassified into two categories: No partner (separated, widow, divorced, single), and Partner (married, common-law partner); v) level of education: registered as None, Literacy Center, Elementary, High School, Basic Education, Middle level, Postsecondary cycle, High, Postgraduate, Ignored; vi) literacy: registered as Illiterate and Literate; vii) facility where death occurred: registered as Hospital or home/another place; viii) PIH. Differentiated between those classified with the ICE code O10-O16, and the rest of causes (000-099).

The only variable added to the INEC’s deaths database was the presence of Ministry of Health and Social Security hospital facility in the canton of residence. Place of residence and place of death were matched to identify those deaths occurred in the same canton of residence and those occurred in a different canton, considering that hospitals are located predominantly in canton’s main town. It is difficult to associate place of death and the presence of a health facility with availability or access to essential obstetric care by the population. Cultural issues are an important part of maternal mortality dynamics that must be taken into consideration when the topic is investigated. Although, an ethnic identification is not present in the data gathered by the certificate of death and is not included in the study.

The study was performed from March 2015 till January 2016, including variable definition standardisation to have a comparable study period. Variables were recoded to a dichotomic format grouping subcategories into two well-differentiated groups, which allow the building of 2×2 contingency tables to facilitate the processing and interpretation of statistical tests. The aim was to identify statistical associations between outcome variables (to die at home, canton of death, and presence of a hospital in the canton of death) with exposure variables (marital status, residence area, age groups, literacy PIH). The statistical tool used was a 2×2 contingency tables to calculate odds ratio and Chi-square. Logistic regression analysis was performed to adjust these bivariable calculations to the complete set of variables. Also, multidi-
mensional scaling analysis was used to provide evidence on the relation between the whole set of variables. Comparisons are based on number of deaths and not on maternal mortality ratio because the intention was to identify a model of variable association rather than an epidemiological distribution of risks. On the other hand, data corresponds to a nationwide registration of deaths system that uses the death certificate as the primary data source.

Data were processed using Statistical Package for the Social Sciences (PUCE license), initial drafts were written down, and several revisions were needed to reach the final version.

Results

Trend slopes for the number of maternal deaths classified under the ICD codes O10-O16, compared with the number of deaths classified under other causes, 2003-2013 (t=3.02 P=0.0026) shows statistically significant difference. The number of deaths classified as other than PIH had a clear tendency to increase (Slope=7.218, Standard Error=1.978), while PIH deaths had a stable trend slightly increasing (Slope=0.699, Standard Error=0.936). One explanation provided by national health officers is that since 2007 death register has been improving both logistically and technically.

A total of 1902 maternal deaths is included in the INEC’s databases between 2003 and 2013. Pregnancy induced hypertension coded O10-O16, stands for 599 cases, the remaining 1303 were classified using between 2003 and 2013. Pregnancy induced hypertension (PIH) deaths had a clear tendency to increase (Slope=7.218, Standard Error=1.978), while PIH deaths had a stable trend slightly increasing (Slope=0.699, Standard Error=0.936). One explanation provided by national health officers is that since 2007 death register has been improving both logistically and technically.

Table 2. Ecuador: comparison of number of maternal deaths at a home or other place than a hospital, related with socioeconomic variables and health facility presence, 2003-2013.

| Variables | Place of death | χ² (P) | OR* (IL-SL) |
|-----------|----------------|--------|-------------|
|           | Home or other (%) | Hospital |               |             |
| Marital status (n= 1823) |                  |         |             |
| No partner (separated, widow, divorced, single) | 210 | 474 | 1.4 (0.235) | 1.064 (0.833-1.36) |
| Partner (married, common-law partner) | 320 | 819 |             |             |
| Residence area (n=1893) |                  |         |             |
| Urban | 288 (23.0) | 966 | 80.09 (<0.001) | 3.6 (2.05-6.2) |
| Rural | 242 (42.2) | 332 |             | 4.6 (2.5-8.5) |
| Peripheral | 31 (47.7) | 34 |             |             |
| Age (n=1902) |                  |         |             |
| Under 18 and over 35 years old | 238 (32.7) | 490 | 5.79 (0.016) | 1.27 (0.995-1.62) |
| 18 to 35 years old | 323 (22.5) | 851 |             |             |
| Literacy (n=1836) |                  |         |             |
| Illiterate | 69 (46.9) | 78 | 23.82 (<0.001) | 1.385 (0.898-2.14) |
| Literate | 470 (27.8) | 1219 |             |             |
| Canton’s main town (n=1902) |                  |         |             |
| Main town | 356 (21.8) | 1275 | 323.7 (<0.001) | 0.07 (0.046-0.107) |
| Countryside | 205 (75.7) | 66 |             |             |
| Die in same canton of residence (n=1902) |                  |         |             |
| No | 97 (14.4) | 574 | 112.76 (<0.001) | 0.339 (0.253-0.45) |
| Yes | 464 (37.7) | 767 |             |             |
| MOH hospital in canton of death (n=1902) |                  |         |             |
| No | 84 (40.6) | 123 | 13.7 (<0.001) | 2.47 (1.7-3.38) |
| Yes | 477 (28.1) | 1218 |             |             |
| Pregnancy induced hypertension (n=1902) |                  |         |             |
| Yes | 120 (20.0) | 479 | 37.64 (<0.001) | 0.55 (0.42-0.72) |
| Others | 441 (33.8) | 862 |             |             |

*The logistic regression model had an omnibus P=0.001, a Nagelkerke R Square=0.124, and a Hosmer and Lemeshow Test=0.059.
in a different place than a hospital, had a greater chance to die in the same canton of residence, in a place where there is no a MoH hospital, and with a diagnostic different from PIH. It seems that socioeconomic characteristics of the mothers, cause of death and resources allocation are involved in a nationwide model of maternal mortality (Table 3).

In case a woman dying in a different canton than that of her residences, one possible explanation is because she and her family had to travel (by their initiative or referred by a health personnel) to procure a higher level of attention or the resolution capacity of the facility near home. The results showed no relationship between socio-demographic variables like the place of residence, marital status, and extremes of reproductive age. However, illiterate women tend to die in the same canton of residence. Whereas, dying in a hospital and dying in the canton’s main town, are clearly related to dying in a Canton different from the usual residence of the mother. Also, when the death was classified as due to PIH, the likelihood of moving out from the canton of residence was higher than the chance of dying in the same canton.

In a stratified analysis, the likelihood of dying in a hospital or canton’s main town (where hospitals are usually located) showed the same trend of moving out from the canton of residence to die in a different canton whether the mother was finally registered as dying for PIH or by any other cause (Table 4).

The absence of a MoH hospital was related to the probability of dying at home but showed no other plausible association with the rest of variables.

There is no proximity pattern between part or the complete set of variables included in the analysis which means the absence of a statistical model to explain any particular way to die beyond the dichotomic relationships described before. It is so, either at the national level (as shown in Figure 1 and Table 5) or for the mothers who died at home (Stress=0.058).

### Table 3. Ecuador: comparison of number of maternal deaths in the same canton of residence or in a different canton with socioeconomic variables and health facility presence, 2003-2013.

| Variables                  | Canton of death | χ² (P)                  | OR* (IL-SL) |
|----------------------------|-----------------|-------------------------|-------------|
|                            | Other than residence | Same than residence |             |
| Residence area             |                 |                         |             |
| Urban                      | 446             | 808                     | 2.82 (0.24) | 2.03 (1.2-3.5) |
| Rural                      | 196             | 378                     | 0.998 (0.6-1.8) |
| Peripheral                 | 29              | 36                      |             |
| Marital status             |                 |                         |             |
| No partner (separated, widow, divorced, single) | 247 | 437 | 0.184 (0.668) | 1.15 (0.93-1.42) |
| Partner (married, common-law partner) | 400 | 739 |             |             |
| Age                        |                 |                         |             |
| Under 18 and more than 35  | 248             | 480                     | 0.760 (0.383) | 0.97 (0.78-1.2) |
| 18 to 35 years old         | 423             | 751                     |             |
| Literacy                   |                 |                         |             |
| Illiterate                 | 35              | 112                     | 9.638 (0.002) | 0.72 (0.47-1.12) |
| Literate                   | 618             | 1071                    |             |
| Canton main town           |                 |                         |             |
| Main town                  | 651             | 980                     | 107.728 (<0.001) | 7.7 (4.5-13.3) |
| Countryside                | 20              | 251                     |             |
| Place of death             |                 |                         |             |
| Home or other              | 97              | 464                     | 112.76 (<0.001) | 0.34 (0.25-0.45) |
| Hospital                   | 574             | 767                     |             |
| Pregnancy induced hypertension |          |                         |             |
| Yes                        | 231 (38.6%)    | 368                     | 4.134 (0.042) | 1.05 (0.84-1.3) |
| Others                     | 440 (33.8%)    | 863                     |             |
| Ministry of Health hospital in canton of death (n=1902) | | | |
| No                         | 108             | 99                      | 29.04 (<0.001) | 3.16 (2.26-4.4) |
| Yes                        | 563             | 1132                    |             |

*The logistic regression model had an omnibus P=0.001, a Nagelkerke R Square=0.188, and a Hosmer and Lemeshow Test=0.283.

### Discussion

General agreement on maternal mortality reduction suggested that to reach the millennium target a health system must to be able to provide essential and emergency obstetric care in a well-allocated geographic, ethnic, and socioeconomic distribution of resources. The results of the present study identified variable association into the maternal mortality national databases showing that to die at home or in a different place than a hospital are closely related to socio-economic conditions and absence of public health facilities. Also, to die in a different place than the usual residence could mean that the health system is referring patients or women and families are searching for a higher level of attention when they face complications, perhaps too late to save a life. Cultural traditions and beliefs outstanding role in maternal mortality has been widely discussed; unfortunately, maternal mortality databases do not include variables related neither to cultural background nor their ethnic group.

Published evidence on current discussion on maternal mortality intervention approaches provides some orientation on comprehensive health systems development as the future to cope maternal mortality. Using the search engine Pubmed, there are no published jobs processing maternal death databases. The data visualisation tool from University of Washington shows the attributable risk of iron deficiency for maternal hemorrhage and maternal sepsis, and intimate partner violence for complications of abortion.

Only 28 out of 75 countries are on track to achieve Millennium Development Goal (MDG) 4 by 2015 and only 20 for MDG 5. Additionally, no Latin American countries are on track for MDG 5. It is necessary to adjust the targets for each country according to its economic and political order to evaluate its performance. On the other hand, the three
delay model suggests that maternal mortality is characterised by factors depending on both, the population and the health system. One of the major constraints women and their family face when complications arise during pregnancy and mainly during delivery is the decision-making process to seek for help and to arrive at a place where she could be treated. Addressing gaps in facility readiness and provider competencies for emergency obstetric care, alongside improving coverage of institutional deliveries, are critical to improving maternal outcomes.\textsuperscript{15} All in all, there is no standard formula – fast-track countries deploy tailored strategies and adapt quickly to change.\textsuperscript{16} Eichler and colleagues, assess the evidence on efforts to enhance health initiatives addressed to improve maternal health status, one conclusion is We found no direct evidence on the impact of performance-based incentives on neonatal health services or mortality of mothers and new-borns. A number of studies describe approaches to rewarding quality as well as increases in the quantities of services provided, although how quality is defined and monitored is not always clear.\textsuperscript{17} The present study results indicate socioeconomic characteristics of maternal deaths, the cause of death and resources allocation are involved in a nationwide model of deaths registered as occurred at home. In China, provincial maternal mortality surveillance systems showed that Provinces from remote regions had the highest risk of maternal mortality, followed by provinces from inland regions and coast regions.\textsuperscript{18} In a cross-sectional study in 29 countries in Africa, Asia, Latin America and the Middle East showed statistically significant relationship between low education levels and serious maternal outcomes, maternal near miss and death.\textsuperscript{19} In Burkina Faso, Cambodia, Indonesia, and Morocco, strategies to improve maternal and neonatal health have focused on the expansion of the network of health facilities with increased uptake of facility birthing, scaling up of the production of midwives, reduction of financial barriers, and late attention for improving the quality of care.\textsuperscript{20} World Health Organisation Multicountry Survey on Maternal and Newborn Health in 29 countries from Africa, Asia, Latin America and the Middle East showed Maternal near-miss cases were eight times more frequent in women with pre-eclampsia.\textsuperscript{21} Paraphrasing the Priorities in Health\textsuperscript{22} publication, income growth and technical progress, in the broadest sense, worked to […] reduce maternal mortality to levels not easy to imagine 30 years ago. Perhaps a new approach corresponds to the development level reached for some national health systems, where a mixture of interventions ranging from community-based initiatives to third level health care interventions could contribute to addressing the current situation. For example, the strategy used in the UK to reduce maternal morbidity and mortality is a warning system for early detection; they surveyed 205 obstetric anaesthetists who agreed with the six most important physiological parameters were: heart rate, respiratory rate, temperature, systolic and diastolic blood pressure and oxygen saturation.\textsuperscript{23} Considering that education, training, licensure and regulation of midwives improve the use of resources and outcomes, some strategies include preventive care, promotion of normal reproductive processes and emergency treatment available.\textsuperscript{24} The absence of commodities (especially misoprostol), limitations in the scope of practice for midwives, and gaps in the inclusion of maternal health indicators in the national data systems have impeded efforts to scale up programs nationally.\textsuperscript{25} The last argument means a new stage in health systems development. Nevertheless, the idea of local health systems has been in place for decades, but it is hard to find examples of such kind of development oriented to EOC. In Ecuador the attempt of the Health Authority is clear in this sense and governmental levels of the organisation have been explicitly issued in 2011.\textsuperscript{26}

The Patterns of Inequity in Health Status, Health Care Provision and Health Risks,\textsuperscript{22} are still demonstrable in Ecuadorian maternal deaths, but at levels below those two or three decades ago. It is hard to explain every death and subsets of deaths using national data, but it clearly shows that in-depth evaluation is needed. However, a predominant factor seems unclear to explain the variable association found processing national databases. It could mean that every pattern of health systems development played a role in maternal mortality, but also that factors different from those registered by the statistics system may remain

Table 4. Ecuador: comparison of number of maternal deaths in cantons where ministry of health hospitals are not available related with socioeconomic variables, 2003-2013.

| Variables                        | Ministry of health hospital available | $\chi^2$ (F) | OR* (IL-SL) |
|----------------------------------|--------------------------------------|-------------|-------------|
| Marital status                   |                                       |             |             |
| No partner (separated, widow, divorced, single) | 70                                   | 614         | 0.245 (0.620) | 0.9 (0.67-1.26) |
| Partner (married, common-law partner) | 125                                  | 1014        |             |             |
| Residence area (n=1893)          |                                       |             |             |
| Urban                            | 136                                  | 1118        | 0.001 (0.999) | 0.76 (0.34-1.7) |
| Rural                            | 62                                   | 512         | 0.94 (0.39-2.3) |             |
| Peripheral                       | 7                                    | 58          |             |             |
| Age (n=1902)                     |                                       |             |             |
| Under 18 and more than 35       | 90                                   | 638         | 2.66 (0.103)  | 1.25 (0.91-1.7) |
| 18 to 35 years old              | 117                                  | 1057        |             |             |
| Literacy (n=1836)                |                                       |             |             |
| Illiterate                       | 16                                   | 131         | 0.004 (0.95)  | 1.1 (0.63-1.9) |
| Literate                         | 181                                  | 1508        |             |             |
| Canton main town (n=1902)        |                                       |             |             |
| Main town                        | 177                                  | 1454        | 0.011 (0.915) | 0.93 (0.52-1.65) |
| Countryside                      | 30                                   | 241         |             |             |
| Place of death (n=1902)          |                                       |             |             |
| Home                             | 84 (15.0%)                           | 477         | 13.7 (<0.001) | 2.2 (1.67-3.5) |
| Hospital                         | 123 (9.2%)                           | 1218        |             |             |
| Pregnancy induced hypertension (n=1902) |                                       |             |             |
| Yes                              | 60                                   | 539         | 0.677 (0.411) | 0.92 (0.66-1.3) |
| Others                           | 147                                  | 1156        |             |             |

\*The logistic regression model had an omnibus F=8.001, a Nagelkerke R Square=0.301, and a Hosmer and Lemeshow Test=2.86.
hidden and that some random influences are not even considered in an explanatory model yet. Ideally, a national statistics system should permit a country to merge different databases and analyse data to explain reality effectively and to provide evidence for decision-making.

Table 5. Stress and fit measures.

| Variable                      | Value          |
|-------------------------------|----------------|
| Normalized Raw Stress         | 0.06449        |
| Stress-I                      | 0.25394^      |
| Stress-II                     | 0.73482^      |
| S-Stress                      | 0.16290^      |
| Dispersion Accounted For      | 0.93551        |
| Tucker’s Coefficient of Congruence | 0.96722   |

PROXSCAL minimizes Normalized Raw Stress. ^Optimal scaling factor = 1.049; ~Optimal scaling factor = 1.918

Figure 1. Ecuador: multidimensional scaling proximities representation of variables (dichotomic) in INEC’s databases for maternal deaths, 2003-2013.

References

1. Thaddeus S. Too far to walk: maternal mortality in context. Soc Sci Med 1994;38:1091-110.
2. United Nations Children’s Fund, World Health Organization, United Nations Found on Population Activities. Guidelines for monitoring the availability and use of obstetric services New York: United Nations Children’s Fund; 1997.
3. Islam M. The safe motherhood initiative and beyond. Bull World Health Organ 2007;85:735.
4. Impact toolkit: A guide and tools for maternal mortality programme assessment. Technical annexes on the use of evaluation tools. 2016. Available from: https://www.abdn.ac.uk/ahs/content-images/Module_5.pdf
5. United Nations. Millennium Development Goals and Beyond 2015. Available from: http://www.un.org/millenniumgoals/pdf/Goal_5_fs.pdf
6. Ministerio de Salud Pública del Ecuador. Rectificación: los índices de la mortalidad materna. El Universo; 2015. Available from: http://www.eluniverso.com/noticias/2015/10/08/nota/5172101/indices-mortalidad-materna
7. Hogan MC, Foreman KJ, Naghavi M, et al. Maternal mortality for 181 countries, 1980–2008: a systematic analysis of progress towards Millennium Development Goal 5. Lancet 2010;375:1609-23.
8. World health Organization. Global Health Observatory (GHO) data. Maternal Mortality. Available from: http://www.who.int/gho/materna l_health/mortality/maternal_mortality_text/en/
9. Instituto Nacional de Estadísticas y Censos (INEC). Nacimientos y defunciones. Available from: http://www.ecuadorencifras.gob.ec/nacimientos-defunciones/
10. Ministerio de Salud Pública del Ecuador. Cartera de Servicios Hospitalarios. Available from: http://www.salud.gob.ec/datos-de-hospitales/
11. Pino MA, Reacons N. Mortalidad materna en el Ecuador y aspectos culturales de la atención a la mujer embarazada. Rev Inst JC García 1991;1:33-55.
12. United States Agency for International Development. Essential Obstetric and Newborn Care (EONC). Available from: https://www.k4health.org/sites/default/files/EONC%20Program%20Implementation%20Guide%20v1.1.pdf
13. Freire WB, Ramirez-Luzuriaga MJ, Belmont P, et al. Tomo II: Encuesta Nacional de Salud y Nutrición de la población ecuatoriana de cero a 59 años. ENSANUT-ECU 2012. 1st ed. Quito: Ministerio de Salud Pública/Instituto Nacional de Estadísticas y Censos; 2014.
14. Ministerio de Salud Pública del Ecuador. GeoSalud 2.0. Available from: http://gis.saludpublico.gob.ec/geo_salud/geo_salud.php
15. University of Washington. GBD Compare. Available from: http://vizhub.healthdata.org/gbd-compare/
16. Cohen RL, Alfonso YN, Adam T, et al. Country progress towards the Millennium Development Goals: adjusting for socioeconomic factors reveals greater progress and new challenges. Global Health 2014;10:67.
17. Jayanna K, Mony P, Thomas A, et al. Assessment of facility readiness and provider preparedness for dealing with postpartum haemorrhage and pre-eclampsia/ecclampsia in public and private health facilities of northern Karnataka, India: a cross-sectional study. BMC Pregnancy Childbirth 2014;14:304.
18. Kuruvilla S, Schweitzer J, Bishai D, et al. Success factors for reducing maternal and child mortality. Bull World Health Organ 2014;92:533-44B.
19. Eichler R, Agarwal K, Askew I, et al. Performance-based incentives to improve health status of mothers and newborns: what does the evidence show? J Health Popul Nutr 2013;31:36-47.

20. Gan XL, Hao CL, Dong XJ, et al. Provincial maternal mortality surveillance systems in China. Biomed Res Int 2014;2014:187896.

21. Tuncalp O, Souza JP, Hindin MJ, et al. Education and severe maternal outcomes in developing countries: a multicountry cross-sectional survey. BJOG 2014;121:57-65.

22. Van Lerberghe W, Matthews Z, Achadi E, et al. Country experience with strengthening of health systems and deployment of midwives in countries with high maternal mortality. Lancet 2014;384:1215-25.

23. Abalos E, Cuesta C, Carroli G, et al. Pre-eclampsia, eclampsia and adverse maternal and perinatal outcomes: a secondary analysis of the World Health Organization Multicountry Survey on Maternal and Newborn Health. BJOG 2014;121:14-24.

24. Jamison DT, Breman JG, Measham AR, et al. Priorities in Health, Washington (DC): The International Bank for Reconstruction and Development/The World Bank; 2006.

25. Isaacs RA, Wee MY, Bick DE, et al. A national survey of obstetric early warning systems in the United Kingdom: five years on. Anaesthesia 2014;69:687-92.

26. Renfrew MJ, McFadden A, Bastos MH, et al. Midwifery and quality care: findings from a new evidence-informed framework for maternal and newborn care. Lancet 2014;384:1129-45.