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Awareness of obstetric warning signs in Ecuador: a cross-sectional study

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ABSTRACT

Objective: In Ecuador, the reported maternal death rate was 45.71 per 100,000 live births in 2013. This may be partly due to a lack of maternal knowledge of obstetric warning signs during pregnancy, delivery and the post-partum period. This study sought to evaluate awareness of obstetric warning signs among pregnant women in relation to individual demographic and area-level socio-economic indicators.

Study design: We conducted a cross-sectional analysis of data collected by Ecuador's Ministry of Health at the conclusion of a national maternal health campaign (2014–2015). A nationally representative sample of 3435 pregnant women from the nine administrative zones completed surveys regarding basic demographics and their awareness of obstetric warning signs.

Methods: We defined eight obstetrical warning signs according to the literature and Ecuadorian practice that could occur during pregnancy, delivery and the post-partum period (severe headache, strong abdominal ache, bleeding or presence of malodorous secretion, rupture of the amniotic sac, high fever, abnormal presentation of the baby, decrease in baby's movements and delayed labour). A woman was considered 'aware' if she recognised at least four of the eight warning signs and stated she would seek immediate healthcare at their presentation. For each administrative zone, four socio-economic indicators (poverty, illiteracy, unemployment and subemployment) were obtained from the National Institute of Statistics and Census. Correlates of awareness of the obstetric warning signs were evaluated using hierarchical logistic models clustered by the administrative zone.

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Results: Nationally, 86.9% of women were 'aware' of obstetric warning signs. After adjustment for age, socio-economic indicators and clustering, indigenous participants were 59% less likely to be aware of obstetric warning signs than mestizos (odds ratio [OR] = 0.41, 95% confidence interval [CI] = 0.28–0.59). For every 1% increase in area poverty, participants had a 5% decreased likelihood of being aware of obstetric warning signs (OR = 0.95, 95% CI = 0.93–0.96), adjusting for age, ethnicity and other socio-economic indicators. The most effective source of campaign information about obstetric warning signs was personal communication with a healthcare professional, as opposed to mass media advertisements (OR = 1.90, 95% CI = 1.34–2.71).

Conclusions: A majority of Ecuadorian pregnant and post-partum women are aware of obstetric warning signs. Indigenous ethnicity and area-level poverty are associated with a lack of awareness. Personal communication with a healthcare professional was the most effective source of information. These findings have implications for improvement of maternal awareness of warning signs.

Introduction

Pregnancy, delivery and the post-partum period are times of physiologic changes that carry innate risks and may result in death for the mother and infant. Despite efforts to reduce them, maternal and infant mortality continue to be major issues worldwide. According to the World Health Organization, 830 women die every day around the world due to preventable causes related to pregnancy and delivery.[1]

Furthermore, the vast majority of these deaths occur in developing countries, especially in rural areas and low-income communities where families struggle to access basic healthcare services.[2] The maternal mortality ratio (MMR) in developing regions is approximately 20 times higher (239/100,000 live births) than that in developed regions (12/100,000 live births) and accounted for approximately 99% of the estimated global maternal deaths in 2015.[1] Even though most cases occur in sub-Saharan Africa (546/100,000 live births), Latin America and the Caribbean also bear a significant burden with an MMR of 67/100,000 live births and a lifetime risk of maternal mortality estimated at 1 in 670.[1] A substantial 80% of these maternal deaths are due to haemorrhage, sepsis, hypertensive diseases of pregnancy, prolonged or halted delivery and unsafe abortion.[3] Because such cases are preventable and identifiable, efforts to raise awareness of these issues among the general population are of utmost importance.[4]

Reduction of maternal mortality and morbidity was one of the Millennium Development Goals adopted by the international community in 2000. In South America, three countries have shown a significant reduction in MMR.[3] From 1990 to 2013, Uruguay experienced a 67% reduction in MMR; Peru, a 64% reduction; and Ecuador experienced a 44% total reduction. In Ecuador, the last data available in 2015 noted an MMR of 64 [57–71] per 100,000 live births.[4,5]

Studies in developing countries have shown that up to 80% of women do not know about specific 'warning' signs during pregnancy, delivery and the post-partum period.[6,7] These signs indicate possible infection, onset of and/or complicated labour and eclampsia, the major causes of maternal morbidity and mortality.[8] Lack of knowledge about these warning signs is associated with demographic and socio-economic factors[6] including young age, low educational level, lack of prenatal care and women with no or few prior pregnancies and deliveries.[7]

Utilisation of healthcare services is a complex public health issue that is influenced by a diversity of factors: accessibility, availability, accommodation, affordability and acceptability.[9] Accessibility generally refers to the spatial relationship between healthcare services and the location of communities.[10,11] Availability of healthcare services is associated with the number and distribution of healthcare services in a territory as well as the timely provision of the healthcare service.[10,12] Accommodation refers to the availability of sufficient healthcare resources, and affordability is related to the cost of accessing the service in relation to the income of the population it serves.[9] Finally, acceptability is a critical issue for utilisation of healthcare services because it is related to people's behaviours, beliefs and attitudes toward providers and services.[9,12,13]

In this context, we consider that awareness of obstetric warning signs is crucial for maternal access to healthcare services. A woman with proper potential accessibility to healthcare services (e.g. confidence in a healthcare provider located near her place) but without knowing how to identify critical obstetric warning signs and immediately seek healthcare services as a response is at risk of death if she does not get timely medical treatment. In addition to logistic obstacles for women to access basic health services, many Ecuadorian women live in communities where sexual and reproductive education is almost non-existent. Thereby, education of prospective mothers is one of the major modifiable risk factors to target in order to reduce maternal mortality. With this in mind, the Ecuadorian Ministry of Health conducted a nationwide campaign 'Ecuador Free of Maternal Deaths' in 2014. The campaign described eight warning signs of concern during pregnancy, delivery and postpartum and

advised women to seek immediate medical attention as a response.

The objective of this study was to evaluate the level of 'awareness' regarding these obstetric warning signs. We defined 'awareness' as recognition of at least half of the eight obstetrical warning signs and the commitment to seek immediate medical attention for the signs after the conclusion of the 'Ecuador Free of Maternal Deaths' campaign. Because precampaign data were not collected, we cannot make inferences on the effectiveness of this campaign. Instead, this study aimed to identify individual demographic and area-level socio-economic correlates of warning sign awareness that can inform future campaigns.

Methods

'Ecuador Free of Maternal Deaths' campaign

A cross-sectional study was conducted using survey data collected by the Ecuadorian Ministry of Health between 2014 and 2015 regarding awareness of warning signs during pregnancy, delivery and the post-partum period. Data were collected after the national campaign 'Ecuador Free of Maternal Deaths' concluded in 2014. This campaign consisted in the nationwide diffusion of information regarding eight critical warning signs of concern during pregnancy, delivery and the post-partum period. The message from the campaign identified eight warning signs and encouraged women to seek immediate medical attention at their presentation. These signs were selected according to international literature and Ecuadorian obstetrical practice (severe headache, strong abdominal ache, bleeding or presence of malodorous secretion, rupture of the amniotic sac, high fever, abnormal presentation of the baby, decrease in baby's movements and delayed labour).[6,8,14,15] This information was distributed using posters in healthcare and community centres, through healthcare personnel, and through television, radio and internet messages. The Ministry of Health did not collect any baseline data before the campaign; therefore, only postcampaign data were available. The working database for the current analysis had no identifiable information from the participants.

Ecuadorian health maternal healthcare system

There are over 2000 primary care centres distributed across the nine administrative zones of Ecuador, and they represent the first level of healthcare for each community. These administrative zones are the unit of analysis for healthcare organisation and policies. Services provided by primary healthcare centres are free of charge to everyone, and it is estimated that 51% of the Ecuadorian population relies on them for basic medical attention.[16] Despite improvements in healthcare delivery since the Constitution of 2008 made health a human right, there are still many challenges and inefficiencies, including a limited range of services and long waits, faced by the Ecuadorian healthcare system.[10,17]

Study population

To obtain a nationally representative study sample from the nine administrative zones, sample size calculations were performed considering the estimated population of pregnant women per zone, availability of healthcare personnel at each primary care centre, a confidence level of 1.96 and a margin of error of 1% and 5% non-response rate. Thus, the final recommended sample size was 3528 subjects. The study included pregnant women in any stage of their pregnancy, as well as during the post-partum period who were in the waiting room of community primary care centres. Data collection was conducted by healthcare personnel from the primary healthcare centres who read the survey to each study participant individually and recorded her answers.

Outcome definition

The survey asked participants to state how they would respond to each of the eight warning signs. Answers included for each question were 'seek immediate medical care', 'wait and see' or 'try alternative home treatments or remedies'. For this study, 'seek immediate medical care' was the only correct answer and was assigned a value of 1. All other options were coded as 0. Using a method similar to the one previously reported,[14] a woman was considered 'aware' of obstetric warning signs if she recognised and would seek immediate medical attention for four of the eight warning signs.

Covariates

In addition, the survey enquired about exposure to the 'Ecuador Free of Maternal Deaths' campaign and the woman's main source of information regarding obstetric information (including the warning signs). Age and self-identified ethnicity were the only personal information collected in the survey. To investigate patterns of awareness response across the nine administrative areas of the country, four socio-economic indicators were obtained for each zone from the National Institute of Statistics and Census in 2013: poverty, illiteracy, unemployment and subemployment.[5] The socio-economic indicators used in this analysis were calculated using data from the Encuesta Nacional de Empleo, Desempleo y Subempleo (ENEMDU).[18] This is a yearly survey of households at a national level that collects information about the level of employment among the economically active population, income and formal education. The four socio-economic indicators used in this article are commonly used measures of economic well-being in Ecuador collected on a yearly basis that cover different aspect of socio-economic well-being. The socio-economic indicators are defined as follows: (a) Percent poverty: proportion of people whose monthly income per capita is below the poverty line ($83.79 in December 2015);[19] (b) Illiteracy: proportion of people older than 15 years who cannot read, write or understand a simple text;[20] (c) Unemployment: proportion of people aged 15 years and older who were not employed the previous week, available to work, searched for work or made specific efforts to secure employment or to establish a business in the previous four weeks;[18] and (d) Subemployment: proportion of people with employment who

received income below the minimum wage and/or worked less than the legal day and have the desire and availability to work additional hours.[18]

Statistical analysis

To estimate women's awareness regarding warning signs during pregnancy, delivery and the post-partum period, responses for each of the eight signs were summed. Correlates of obstetric warning sign awareness were evaluated using hierarchical logistic models with the zone as a clustering variable. Individual-level factors included ethnicity and age, while the four socio-economic indicators listed previously were considered as potential area-level factors of awareness. Statistical analysis was conducted using Stata v14.

Results

A total of 3435 women completed the survey (97.4% participation), and the mean age was 24.6 years (standard deviation: 6.5 years). In terms of ethnicity, 83.2% of the sample identified themselves as mestizas (mixed ethnicity), 5.6% as indigenous, 5.7% as black, Afro-Ecuadorian, Afro-descendent or mulata, while the remaining percent (2.1%) of participants identified as 'other'. Table 1 summarises the responses to each of the eight warning signs. The signs that were most readily recognised as issues that required immediate medical attention were rupture of the amniotic sac (89.3%) and presence of bleeding or a malodorous secretion (87.1%). In contrast, only 71.6% of participants admitted they would seek immediate medical attention in the case of a very strong headache. On average, 7.6% of participants answered that they would try alternative or traditional remedies at the occurrence of a warning sign instead of going to a healthcare centre (Table 1). Additionally, 5.9% would first try an alternative treatment and only seek medical attention after this option failed. For instance, 10.6% of surveyed women said that if the baby had an abnormal position before birth, they would first try to do womb massage to reposition the baby. An additional 6.9% would attempt vaginal birth, regardless of the position of the baby and 5.9% would go to a healthcare centre only after the other two options failed. In total, 86.9% of participants were 'aware' of four of the eight obstetric warning signs. Only 40.8% of participants responded that they would seek immediate medical attention for all eight warning signs.

In order to understand patterns of warning sign awareness across Ecuadorian administrative zones, we examined whether area-level socio-economic indicators are correlated with levels of awareness in each zone. Table 2 summarises specific participation per administrative zone, along with the socio-economic indicators considered for the analysis. The highest poverty index (38.0%) and illiteracy level (8.1%) were found in zone 3 where many indigenous communities reside.

We investigated whether awareness of obstetric warning signs was associated with individual characteristics or area-level socio-economic indicators (Table 3). Older participants were more likely to be aware of warning signs, but this was not statistically significant. However, self-defined ethnicity was statistically significantly associated with awareness of warning signs. Specifically, when compared to mestizos, indigenous participants were 59% less likely to be aware of obstetric warning signs after adjusting for age and area-level socio-economic indicators (odds ratio [OR] = 0.41, 95% confidence interval [CI] = 0.28–0.59).

In terms of area-level predictors, poverty and subemployment were associated with women's awareness of obstetric warning signs. Fig. 1 shows the relationship between percent poverty per zone and the percent of women aware of warning signs. Zones with higher levels of poverty had lower levels of awareness of obstetric warning signs among women. Indeed, for every 1% increase in area poverty, participants had a 5% decreased likelihood of being aware of obstetric warning signs (OR = 0.95, 95% CI = 0.93–0.96), considering clustering and other factors (Fig. 1, Table 4). Similarly, higher levels of subemployment per zone were associated with lower levels of warning sign awareness after adjusting for other factors.

Zones 5, 6, 8 and 9 (where the major cities of Ecuador are) had the highest percentage of participants aware of warning signs, while zones 3 and 7 had the lowest levels of awareness

Table 1 – Participants' responses to eight obstetric warning signs.

	Warning sign	Responses				
		Immediate medical attention, n (%)	Pharmacological treatment, n (%)	Traditional remedies,[a] n (%)	Medical attention if alternatives fail, n (%)	Wait and see, n (%)
1	Strong headache	2378 (71.6)	451 (13.6)	251 (7.6)	239 (7.2)	–
2	Strong abdominal ache	2555 (75.9)	–	312 (9.2)	239 (7.1)	261 (7.8)
3	Bleeding/malodorous secretion	2934 (87.1)	–	141 (4.2)	172 (5.1)	120 (3.6)
4	Rupture of the amniotic sac	3004 (89.3)	–	129 (3.8)	147 (4.4)	85 (2.5)
5	High fever	2641 (78.4)	286 (8.5)	218 (6.5)	222 (6.6)	–
6	Abnormal presentation of the baby	2572 (76.6)	–	357 (10.6)	199 (5.9)	231 (6.9)
7	Decrease in the baby's movement	2777 (82.4)	–	246 (7.3)	168 (5.0)	179 (5.3)
8	Delayed labour	2470 (73.5)	–	377 (11.2)	195 (5.8)	317 (9.4)

[a] Traditional remedies for each warning sign: (1) Strong headache: medicinal tea for pain relief, (2) Strong abdominal ache: medicinal tea for pain relief, (3) Bleeding/malodorous secretion: sit in a tub of warm water, (4) Rupture of the amniotic sac: bed rest, (5) High fever: medicinal tea for fever reduction, (6) Abnormal presentation of the baby: womb massage to reposition the baby, (7) Decrease in the baby's movement: womb massage and/or sugary drink, (8) Delayed labour: walk and/or do traditional exercises to start labour.

Table 2 – Number of participants and socio-economic indicators for each administrative zone in Ecuador[a].

Administrative zone	Participants (n)	%	Poverty[b], %	Illiteracy[c], %	Unemployment[d], %	Subemployment[e], %
National	3435	100	22.9	5.6	5.2	19.9
Zone 1	284	8.3	36.0	5.8	6.6	17.8
Zone 2	127	3.7	33.9	7.0	4.2	17.9
Zone 3	243	7.1	38.0	8.1	3.0	20.5
Zone 4	197	5.7	20.9	7.3	3.2	21.3
Zone 5	704	20.5	21.5	5.6	3.9	21.1
Zone 6	453	13.2	30.0	6.2	3.3	17.0
Zone 7	293	8.5	27.6	4.0	4.7	21.2
Zone 8	464	13.5	17.7	4.2	6.4	23.3
Zone 9	670	19.5	13.6	3.7	7.6	13.3

[a] Zones: (1) Esmeraldas, Imbabura, Carchi, Sucumbíos; (2) Pichincha (excluding Quito), Napo, Orellana; (3) Cotopaxi, Tungurahua, Chimborazo, Pastaza; (4) Manabí, Santo Domingo de los Tsáchilas; (5) Santa Elena, Guayas (excluding Guayaquil City, Samborondón and Durán), Bolívar, Los Ríos, Galápagos; (6) Cañar, Azuay, Morona Santiago; (7) El Oro, Loja, Zamora Chinchipe; (8) Guayaquil, Samborondón and Durán; (9) Quito Metropolitan District.
[b] Poverty: proportion of people whose monthly income per capita is below the poverty line ($83.79 in December 2015).
[c] Illiteracy: proportion of people older than 15 years who cannot read, write or understand a simple text.
[d] Unemployment: proportion of people aged 15 years and older who were not employed the previous week, are available to work, searched for work or made specific efforts to secure employment or to establish a business in the previous four weeks.
[e] Subemployment: proportion of people with employment who received income below the minimum wage and/or worked less than the legal day and have the desire and availability to work additional hours.
Source: National Institute of Statistics and Census

(Table 3). Using zone 9 (the capital Quito) as the reference category, we compared the level of awareness between zones. There were no significant differences in awareness between zones 5, 6, 8 and 9 in the crude and adjusted models. On the other hand, participants in zone 3 were 78% less likely to recognise four or more warning signs than participants in Quito after adjusting for age and ethnicity (OR = 0.22, 95% CI = 0.15–0.33).

In addition to enquiring about awareness of warning signs, the survey asked participants to identify the sources of information regarding these signs (Table 5). The most common source of information was personal communication with a health professional including primary doctor, obstetrician-gynaecologist or traditional midwife. Meanwhile, mass media tools by themselves appeared to be less effective in communicating information regarding obstetric warning signs. Compared to those who reported getting the campaign message through mass media only, women who obtained obstetric information from a health professional were 1.90 times more likely to be aware of obstetric warning signs (95% CI = 1.34–2.71), adjusted by age and ethnicity.

Discussion

After the conclusion of the 'Ecuador Free of Maternal Deaths' campaign, 87% of women were aware of at least half of the eight obstetric warning signs and would seek

Table 3 – Awareness of obstetric warning signs by individual- and area-level sociodemographic characteristics.

Factors	Not aware	Aware	Crude logistic regression[a]		Adjusted logistic regression[a,b]	
			OR (95% CI)	P-value	OR (95% CI)	P-value
Individual-level factors						
Age in years (mean ± SD)	24.2 ± 6.5	24.7 ± 6.5	1.01 (1.00–1.03)	0.10	1.01 (1.00–1.03)	0.09
Ethnicity (n, %)						
Mestizo (mixed)	326 (11.4)	2521 (88.6)	Ref	Ref	Ref	Ref
Indigenous	65 (34.2)	125 (65.8)	**0.35 (0.25–0.50)**	**0.00**	**0.41 (0.28–0.59)**	**0.00**
Black/Afro-Ecuadorian	38 (19.4)	158 (80.6)	**0.67 (0.45–1.00)**	**0.05**	0.70 (0.46–1.04)	0.08
Montubio	7 (5.4)	122 (94.6)	1.94 (0.88–4.26)	0.10	1.78 (0.81–3.91)	0.15
Other	13 (17.8)	60 (82.2)	0.62 (0.33–1.16)	0.13	0.73 (0.38–1.44)	0.37
Area-level factors (mean ± SD)						
% Poverty	27.0 ± 8.4	23.4 ± 7.8	**0.95 (0.91–0.99)**	**0.01**	**0.94 (0.90–0.98)**	**0.00**
% Illiteracy	5.6 ± 1.6	5.3 ± 1.3	0.87 (0.66–1.14)	0.32	1.04 (0.77–1.41)	0.80
% Unemployment	4.9 ± 1.6	5.1 ± 1.7	1.06 (0.82–1.38)	0.66	0.88 (0.68–1.14)	0.34
% Subemployment	19.5 ± 2.8	18.8 ± 3.4	0.93 (0.81–1.07)	0.30	**0.91 (0.82–1.00)**	**0.05**

SD, standard deviation; OR, odds ratio; CI, confidence interval.
Bolded values indicate statistical signifcance.
[a] Using zone as a clustering variable.
[b] Adjusted by both individual-level and area-level factors using hierarchical models.

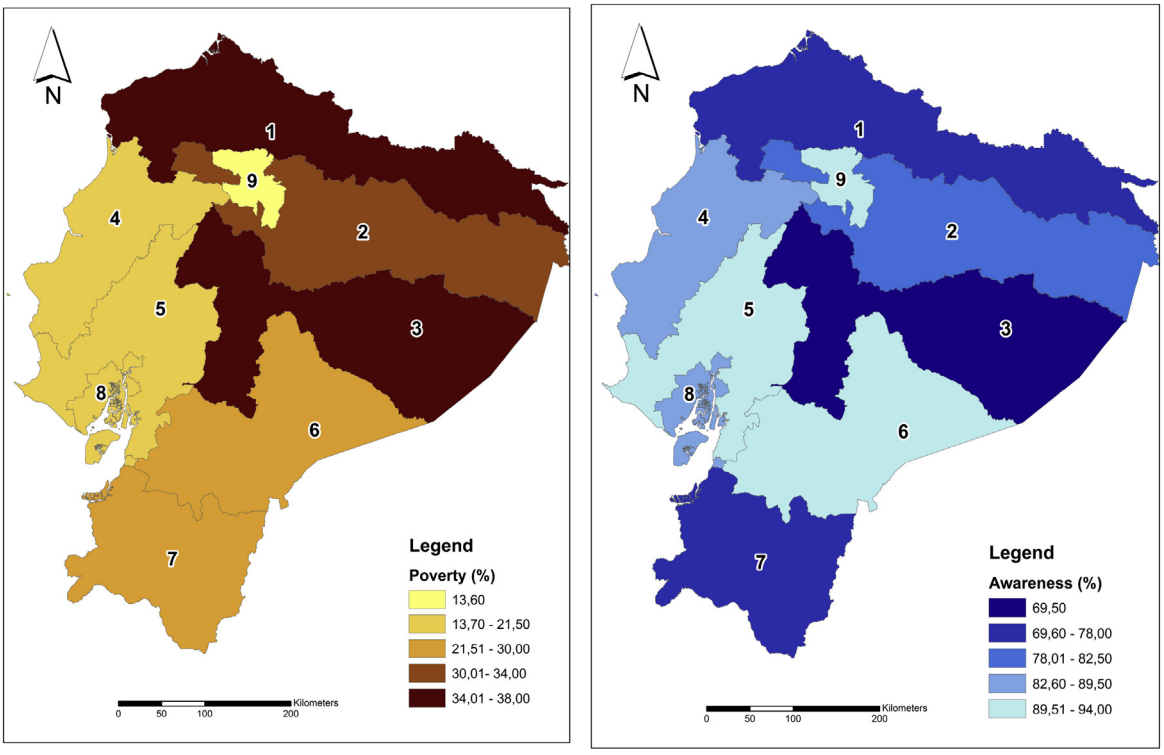

Fig. 1 – Maps of percent poverty and percent of women aware* of obstetric warning signs per administrative zone. *A participant was considered to be aware if she recognised four or more warning signs. Zones: (1) Esmeraldas, Imbabura, Carchi, Sucumbíos; (2) Pichincha (excluding Quito), Napo, Orellana; (3) Cotopaxi, Tungurahua, Chimborazo, Pastaza; (4) Manabí, Santo Domingo de los Tsachilas; (5) Santa Elena, Guayas (excluding Guayaquil City, Samborondon and Duran), Bolívar, Los Ríos, Galapagos; (6) Cañar, Azuay, Morona Santiago; (7) El Oro, Loja, Zamora Chinchipe; (8) Guayaquil, Samborondon and Duran; (9) Quito Metropolitan District.

immediate medical attention if they occurred. However, warning sign awareness was unequally distributed throughout the population and varied according to socio-economic indicators and ethnicity. Specifically, indigenous women were less likely to recognise and seek medical attention for these signs in comparison to mestizos. Zones with higher rates of poverty were associated with lower rates of obstetric warning sign awareness. Our study also

Table 4 – Awareness of obstetric warning signs by the administrative zone.

Zone[a]	Aware	Crude logistic regression[b]		Adjusted logistic regression[b,c]	
	n (%)	OR (95% CI)	P-value	OR (95% CI)	P-value
1	222 (78.2)	**0.30 (0.20–0.44)**	**0.00**	**0.34 (0.22–0.51)**	**0.00**
2	105 (82.7)	**0.39 (0.23–0.68)**	**0.00**	**0.48 (0.28–0.84)**	**0.01**
3	169 (69.6)	**0.19 (0.13–0.28)**	**0.00**	**0.22 (0.15–0.33)**	**0.00**
4	172 (87.3)	**0.57 (0.34–0.94)**	**0.03**	0.64 (0.37–1.10)	0.11
5	640 (90.9)	0.82 (0.56–1.21)	0.32	0.79 (0.53–1.17)	0.23
6	427 (94.3)	1.35 (0.83–2.20)	0.23	1.41 (0.85–2.33)	0.18
7	217 (74.1)	**0.24 (0.16–0.35)**	**0.00**	**0.25 (0.17–0.37)**	**0.00**
8	415 (89.4)	0.70 (0.46–1.05)	0.09	0.72 (0.47–1.09)	0.12
9	619 (92.4)	Ref	Ref	Ref	Ref

OR, odds ratio; CI, confidence interval.
Bolded values indicate statistical signifcance.
[a] Zones: (1) Esmeraldas, Imbabura, Carchi, Sucumbíos; (2) Pichincha (excluding Quito), Napo, Orellana; (3) Cotopaxi, Tungurahua, Chimborazo, Pastaza; (4) Manabí, Santo Domingo de los Tsachilas; (5) Santa Elena, Guayas (excluding Guayaquil City, Samborondon and Duran), Bolívar, Los Ríos, Galapagos; (6) Cañar, Azuay, Morona Santiago; (7) El Oro, Loja, Zamora Chinchipe; (8) Guayaquil, Samborondon and Duran; (9) Quito Metropolitan District.
[b] Stratified by the administrative zone; no area-level predictors were considered.
[c] Adjusted by individual-level factors only (sex and ethnicity).

Table 5 – Awareness of obstetric warning signs by source of information.

Source of information	Total	Aware	Crude logistic regression[c]		Adjusted logistic regression[c,d]	
	n (%)	n (% of total)	OR (95% CI)	P-value	OR (95% CI)	P-value
Mass media only[a]	346 (10.07)	287 (82.95)	Ref	Ref	Ref	Ref
Health professional only[b]	1247 (36.30)	1125 (90.22)	**1.79 (1.27–2.55)**	**0.001**	**1.90 (1.34–2.71)**	**<0.001**
Family only	140 (4.08)	103 (73.57)	**0.58 (0.36–0.95)**	**0.030**	0.72 (0.43–1.21)	0.214
>1 source	1430 (41.63)	1274 (86.93)	**1.67 (1.19–2.33)**	**<0.001**	**1.73 (1.23–2.43)**	**0.002**
No source	272 (7.92)	197 (72.43)	**0.52 (0.35–0.79)**	**0.002**	0.58 (0.39–0.88)	0.010

CI, confidence interval; OR, odds ratio.
Bolded values indicate statistical signifcance.
[a] Radio, TV, the Internet, Ministry of Health campaign posters.
[b] Obstetrician-gynaecologist, midwife, traditional midwife, during preparation of the birth plan.
[c] Using zone as a clustering variable.
[d] Adjusted by both individual- and area-level factors using hierarchical models.

found that mass media tools, such as radio, television or the Internet, appear to be less popular among pregnant women as sources of obstetric information than personal communication.

Lack of recognition and understanding of obstetric warning signs leads to a delay in seeking out health services. Although most pregnant women in our study recognised the warning signs, approximately 8–15% would try a traditional remedy before or instead of seeking immediate medical attention. Traditional, ancestral and indigenous health knowledge and practice have an important role in health and medicine,[21,22] but failure to obtain timely medical attention for obstetric warning signs has been reported to contribute to maternal death by 30–70%.[23,24] That said, while knowledge of obstetric warning signs is the first step in improving maternal health, knowledge alone is insufficient. Women must then seek medical care that must be available, accessible, accommodating, affordable and acceptable to them.[9]

Our study revealed that indigenous women were less aware of obstetric warning signs than mestizas. In an attempt to be culturally sensitive, the Ecuadorian government changed legislation in 2008 requiring that the Ministry of Health incorporate traditional health practices into the public health system.[22] The new healthcare model, 'Modelo de Atención Integral de Salud Familiar Comunitario e Integral' (MAIS), establishes that all Ecuadorians have the right to receive high-quality, culturally appropriate services.[22,25] Under the MAIS model, these teams should provide indigenous communities with culturally and linguistically appropriate health services. However, it is unclear how, or if, this model is actually implemented. A qualitative study in two rural parishes of Ecuador found inconsistent levels of integration of indigenous practices such as inclusion of traditional birth attendants during pregnancy and childbirth.[22] Another study of the indigenous practice of vertical birth (squatting as opposed to lying down) found contentious attitudes from medical professionals including anger and resentment towards patients.[21] These results suggest that although formally included in Ecuadorian health policy, traditional health knowledge has not been effectively integrated into practice. If well implemented, this policy could more effectively communicate messages about warning sign awareness by doing so in a culturally relevant manner.

Consistent with our results, recognition of obstetric warning signs varies according to rural vs urban residence,[6,14,24] the educational level of participants[24,26] and the employment status[14,26] internationally. A cross-sectional study of prenatal care services in Jordan found that years of education, for either husband or wife, were positively correlated with knowledge of pregnancy complications.[24] Poverty, education and ethnicity have been shown to correlate with MMR in Ecuador. In a 2014 cross-sectional study, MMR per province was positively associated with the percent of indigenous population and inversely associated with gross domestic product and percent of households with electricity.[27] These findings together indicate that low-income and minority status impacts both, awareness of obstetric warning signs and maternal mortality outcomes.

A qualitative study conducted in six indigenous communities in the Cotopaxi province (part of administrative zone 3) explored the various social determinants of women's health[28] and complements our larger scale analysis. Indigenous women living in these underresourced communities had several barriers to access timely medical attention. One of the major barriers was the double burden of domestic and agricultural roles that women held to support their families on a meagre income. In addition to decreased time to access healthcare, working an average of 14.6 h/day on agricultural production and domestic chores takes a physical toll on women's health. Most women interviewed reported that they maintained this intense work load until delivery and resumed their habitual activities within a few weeks of childbirth. Our observations underscore this intersectionality of poverty and ethnicity through which indigenous women living in underresourced areas carry a double burden for accessing culturally appropriate and timely medical care.

Results from our study are encouraging. Most women were aware of four of the eight obstetric warning signs. Awareness of warning signs could be a critical modifiable component of the pathway between sociodemographic factors and maternal mortality. The influence of area-level socio-economic deprivation and accessibility to healthcare services should be incorporated into policy analysis. Campaigns to inform women about obstetric warning signs

must be part of a more integrated evaluation of the healthcare system. Messages of future campaigns will be more effectively communicated through healthcare providers instead of mass media. Worldwide, community-based interventions that involve local trained personnel are most successful in promoting trust and bringing the population closer to the healthcare system.[29]

One of the major strengths of this study is the nationally representative sample for each of the nine administrative zones in Ecuador. This balanced sampling approach allows our conclusions to be extended to the general population and can inform healthcare policy decisions at the national level. In addition, healthcare workers from within the community performed the data collection, increasing the likelihood that participants would answer questions, regardless of their literacy level.

This study also has some weaknesses. The study was cross-sectional after a national campaign but with no baseline information. However, our objective was not to evaluate the effectiveness of this campaign but to better understand current patterns of warning sign awareness. This, in turn, could serve as a baseline and influence the design of future campaigns. Additionally, although we used the methods of Bogale et al.,[14] there is variability in classifying women as knowledgeable/aware of obstetric warning signs which may prevent direct comparison across similar studies.

Conclusions

To our knowledge, this is the first Ecuadorian study evaluating awareness of obstetric warning signs with demographic and socio-economic indicators. Poverty, subemployment and indigenous ethnicity were found to be risk factors for the lack of awareness. Campaigns regarding obstetric warning signs need to be part of a more integrated evaluation of the healthcare system. The influence of area-level socio-economic deprivation and spatial accessibility to healthcare services should be incorporated into policy analysis. Identifying the factors that influence a women's awareness of the obstetric warning signs can inform educational efforts and patient-centred strategies to reduce discrepancies in maternal mortality within the Ecuadorian population.

Author statements

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Ethical approval

The study was reviewed and approved by the International Review Board of Universidad San Francisco de Quito and the Ecuadorian Health Ministry. For the current analysis, fully de-identified databases were utilised, so we did not require informed consent forms from participants.

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Competing interests

The authors declare that they have no competing interests.

Author contributions

G.B. made substantial contributions to the conception or design of the work and performed the statistical analysis of this cross-sectional study. She also analysed and interpreted the results and participated in writing, editing and revising the manuscript after reviewers' suggestions. M.G. made substantial contributions to the conception or design of the work and its analysis. She performed a critical revision of important intellectual content. She was involved in all aspects of the manuscript, ensuring that questions and all areas related to the accuracy and integrity of any part of the work were appropriately investigated and resolved. B.M. participated in the research and analysis of the results as well as writing and editing the manuscript. P.C.-B. created the maps, contributed with the discussion and conclusion of the manuscript and edited the manuscript. E.B. participated in the research and analysis of the results as well as writing and editing the manuscript. S.S. helped in writing the original study proposal and IRB documents. E.Q. led the original data collection and edited the manuscript. M.H.H.T. and A.P.J.A. participated in original data collection and edited the manuscript. E.W. contributed to structuring research focus, article and substantial revisions to the manuscript after we received reviewers' comments. All authors read and approved the final manuscript.

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