Appendix for "Identifying individual and departmental drivers of fetal deaths among Venezuelan and Colombian mothers in Colombia, 2017-2020"

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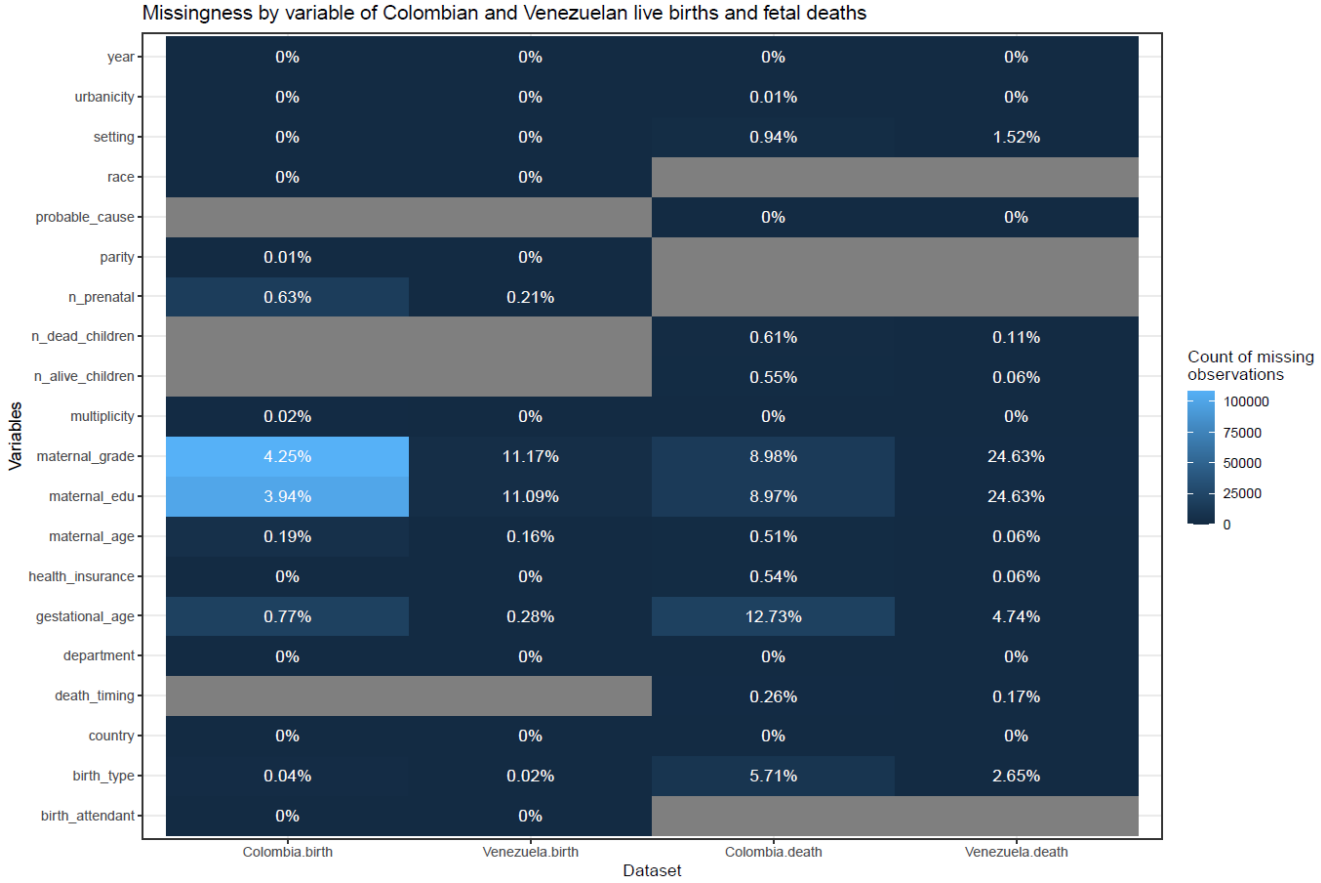
Section 1. More information on the dataset and sample

Section 1.1. Patterns of data missingness

Figure S1. Heatmap of data missingness by country of origin and delivery type



The percentages overlayed on the heatmap depict the percentage of observations of each square that are missing (eg. 24.63% of Venezuelan deaths do not have data on maternal grade). The gray rectangles reflect variables that are not reported in the corresponding dataset. For example, number of prenatal visits is not reported for fetal deaths.

Venezuelan and Colombian women were not eligible for inclusion in our primary analysis if they were missing data on parity, maternal age, or health insurance status. Women of other nationalities were similarly omitted from our sample. The characteristics of the excluded Colombian and Venezuelan women are presented below.

Table S1. Demographic characteristics of excluded Colombian and Venezuelan women with deliveries in Colombia, 2017-2020

		Live births N (%)	Fetal deaths N (%)
N		5020	991
Country of origin	Colombia	4977 (99.14)	989 (99.80)
	Venezuela	43 (0.86)	2 (0.20)
Department	Amazonas	61 (1.22)	0 (0.00)
	Antioquia	9 (0.18)	86 (8.68)
	Arauca	0 (0.00)	10 (1.01)
	Atlantico	0 (0.00)	64 (6.46)

	Bogota	4 (0.08)	201 (20.28)
	Bolivar	1 (0.02)	51 (5.15)
	Boyaca	4 (0.08)	21 (2.12)
	Caldas	3 (0.06)	13 (1.31)
	Caqueta	64 (1.27)	10 (1.01)
	Casanare	2 (0.04)	13 (1.31)
	Cauca	2 (0.04)	30 (3.03)
	Cesar	1078 (21.47)	25 (2.52)
	Choco	2158 (42.99)	5 (0.50)
	Cordoba	18 (0.36)	26 (2.62)
	Cundinamarca	0 (0.00)	32 (3.23)
	Guainia	14 (0.28)	2 (0.20)
	Guaviare	1 (0.02)	0 (0.00)
	Huila	2 (0.04)	34 (3.43)
	La Guajira	729 (14.52)	12 (1.21)
	Magdalena	54 (1.08)	41 (4.14)
	Meta	0 (0.00)	27 (2.72)
	Narino	527 (10.50)	18 (1.82)
	Norte de Santander	81 (1.61)	23 (2.32)
	Putumayo	63 (1.25)	10 (1.01)
	Quindio	2 (0.04)	10 (1.01)
	Risaralda	0 (0.00)	18 (1.82)
	Santander	22 (0.44)	47 (4.74)
	Sucre	8 (0.16)	14 (1.41)
	Tolima	87 (1.73)	37 (3.73)
	Valle del Cauca	10 (0.20)	109 (11.00)
	Vaupes	7 (0.14)	0 (0.00)
	Vichada	9 (0.18)	2 (0.20)
Maternal age	Missing age	4821 (96.04)	788 (79.52)
	10-14 years old	5 (0.10)	3 (0.30)
	15-19 years old	47 (0.94)	54 (5.45)
	20-24 years old	61 (1.22)	59 (5.95)
	25-29 years old	38 (0.76)	52 (5.25)
	30-34 years old	26 (0.52)	21 (2.12)
	35-39 years old	14 (0.28)	8 (0.81)
	40-44 years old	6 (0.12)	6 (0.61)
	45+ years old	2 (0.04)	0 (0.00)
Maternal education	Missing education data	4811 (95.84)	950 (95.86)
	None	114 (2.27)	3 (0.30)
	Some or all primary school	57 (1.14)	12 (1.21)
	Some secondary school or more	38 (0.76)	26 (2.62)
Health insurance	Missing health insurance	121 (2.41)	843 (85.07)
	Contributive	74 (1.47)	78 (7.87)
	Not insured	1278 (25.46)	10 (1.01)
	Other	3 (0.06)	1 (0.10)
	Subsidized	3544 (70.60)	59 (5.95)
Parity Mean (SD)		1.16 (0.67)	2.10 (1.41)

SD: Standard deviation

This table reflects the demographic and geographic distribution of women who were excluded from our analysis solely because they were missing a variable of interest. It does not include women of other countries of origin, who were outside of the present analysis.

Section 1.2. Further details on analytical sample demographics

Table S1. Geographic distribution of fetal deaths and live births

Department	Colombian and Venezuelan women		Colombian women		Venezuelan women		Crude fetal death odds ratio for Venezuelan women (95% CI)*
	Live births N (%)	Fetal deaths N (%)	Live births N (%)	Live births N (%)	Fetal deaths N (%)	Live births N (%)	
Amazonas	4926 (0.19)	75 (0.05)	4926 (0.19)	75 (0.05)	0 (0.00)	0 (0.00)	N/A
Antioquia	295634 (11.49)	18385 (11.83)	295462 (11.60)	18377 (11.96)	172 (0.66)	8 (0.45)	0.75 (0.34-1.42)
Arauca	21341 (0.83)	2766 (1.78)	18234 (0.72)	2374 (1.54)	3107 (11.93)	392 (22.12)	0.97 (0.86-1.08)
San Andres, Providencia y Santa Catalina	3031 (0.12)	643 (0.41)	3031 (0.12)	643 (0.42)	0 (0.00)	0 (0.00)	N/A
Atlantico	172869 (6.72)	4895 (3.15)	172809 (6.79)	4894 (3.18)	60 (0.23)	1 (0.06)	N/A
Bogota	406364 (15.80)	32653 (21.01)	405155 (15.91)	32503 (21.15)	1209 (4.64)	150 (8.47)	1.55 (1.30-1.83)
Bolivar	136441 (5.30)	3642 (2.34)	131251 (5.15)	3554 (2.31)	5190 (19.92)	88 (4.97)	0.63 (0.50-0.77)
Boyaca	55581 (2.16)	1959 (1.26)	55543 (2.18)	1957 (1.27)	38 (0.15)	2 (0.11)	1.49 (0.24-4.88)
Caldas	34091 (1.33)	1082 (0.70)	33965 (1.33)	1079 (0.70)	126 (0.48)	3 (0.17)	0.75 (0.18-1.98)
Caqueta	27418 (1.07)	1456 (0.94)	27418 (1.08)	1456 (0.95)	0 (0.00)	0 (0.00)	N/A
Casanare	24793 (0.96)	428 (0.28)	23437 (0.92)	426 (0.28)	1356 (5.20)	2 (0.11)	0.08 (0.01-0.25)
Cauca	60809 (2.36)	2426 (1.56)	60791 (2.39)	2426 (1.58)	18 (0.07)	0 (0.00)	N/A

Cesar	88306 (3.43)	1231 (0.79)	88296 (3.47)	1231 (0.80)	10 (0.04)	0 (0.00)	N/A
Choco	23464 (0.91)	399 (0.26)	23464 (0.92)	399 (0.26)	0 (0.00)	0 (0.00)	N/A
Cordoba	103567 (4.03)	10450 (6.72)	103556 (4.07)	10450 (6.80)	11 (0.04)	0 (0.00)	N/A
Cundinamarca	84263 (3.28)	5860 (3.77)	84249 (3.31)	5859 (3.81)	14 (0.05)	1 (0.06)	N/A
Guainia	4047 (0.16)	85 (0.05)	3755 (0.15)	75 (0.05)	292 (1.12)	10 (0.56)	1.71 (0.82-3.20)
Guaviare	5181 (0.20)	696 (0.45)	5181 (0.02)	696 (0.45)	0 (0.00)	0 (0.00)	N/A
Huila	74800 (2.91)	8410 (5.41)	74796 (2.94)	8408 (5.47)	4 (0.02)	2 (0.11)	4.45 (0.62-22.79)
La Guajira	86964 (3.38)	1263 (0.81)	82217 (3.23)	1207 (0.79)	4747 (18.22)	56 (3.16)	0.80 (0.61-1.04)
Magdalena	96710 (3.76)	4091 (2.63)	96636 (3.80)	4087 (2.66)	74 (0.28)	4 (0.23)	1.28 (0.39-3.08)
Meta	62021 (2.41)	5613 (3.61)	62005 (2.44)	5613 (3.65)	16 (0.06)	0 (0.00)	N/A
Narino	69619 (2.71)	6932 (4.46)	69586 (2.73)	6915 (4.50)	33 (0.13)	17 (0.96)	5.18 (2.82-9.18)
Norte de Santander	95902 (3.73)	9054 (5.82)	87945 (3.45)	8092 (5.27)	7957 (30.54)	962 (54.29)	1.31 (1.22-1.41)
Putumayo	16496 (0.64)	2616 (1.68)	16451 (0.65)	2615 (1.70)	45 (0.17)	1 (0.06)	N/A
Quindio	23218 (0.90)	966 (0.62)	23211 (0.91)	966 (0.63)	7 (0.03)	0 (0.00)	N/A
Risaralda	43068 (1.67)	2001 (1.29)	43060 (1.69)	1998 (1.30)	8 (0.03)	3 (0.17)	8.08 (1.77-27.96)
Santander	115804 (4.50)	5384 (3.46)	115066 (4.52)	5369 (3.49)	738 (2.83)	15 (0.85)	0.44 (0.25-0.70)
Sucre	64745 (2.52)	3755 (2.42)	64734 (2.4)	3754 (2.44)	11 (0.04)	1 (0.06)	N/A

Tolima	62168 (2.42)	2447 (1.57)	62145 (2.44)	2446 (1.59)	23 (0.09)	1 (0.06)	N/A
Valle del Cauca	200961 (7.81)	13480 (8.67)	200923 (7.89)	13477 (8.77)	38 (0.15)	3 (0.17)	1.18 (0.28-3.25)
Vaupes	2566 (0.10)	54 (0.03)	2566 (0.10)	54 (0.04)	0 (0.00)	0 (0.00)	N/A
Vichada	5247 (0.20)	240 (0.15)	4499 (0.18)	190 (0.12)	748 (2.87)	50 (2.82)	1.58 (1.14-2.16)

OR: Odds ratio; CI: Confidence interval; N/A: Not applicable
* The crude ORs in this column are estimated using Equation 1 and the subset of data from the specific departments. Only departments with more than one Venezuelan fetal death were eligible for estimation.

Section 2. Public opinion xenophobia indicator

Section 2.1. Relevant Likert scale variables regarding xenophobic attitudes

We used the publicly available, de-identified microdata from the 2020 Latinobarometer survey conducted in Colombia to derive a xenophobic attitudes indicator. From the span of over 200 variables, we identified 10 scale variables that touched on the respondents' attitudes towards immigrants:[1]

1. "Is it ____ to receive immigrants from Venezuela?"
    a. *Options:* Very positive; Somewhat positive; Somewhat negative; Very negative
2. "From your point of view, you and that of your family, does the arrival of immigrants benefit or harm you?"
    a. *Options:* Benefit; Neither; Harm
        i. *Notes:* For our purposes, the option of "neither" was coded as not having xenophobic attitudes.
3. "Do you strongly agree, agree, disagree, or strongly disagree with the following statements:
    a. Immigrants are good for the country's economy.
    b. Immigrants come to take our jobs away.
    c. Immigrants increase crime rates.
    d. Immigrants contribute with ideas to our culture and society.
    e. Immigrants are a burden for the state.
    f. Immigrants give more than what they receive.
    g. Our country should help immigrants that suffer political persecution in their countries.
    h. Immigrants should have the same access to health, education, and housing than Colombians."

Section 2.2. Xenophobic sentiment indicator

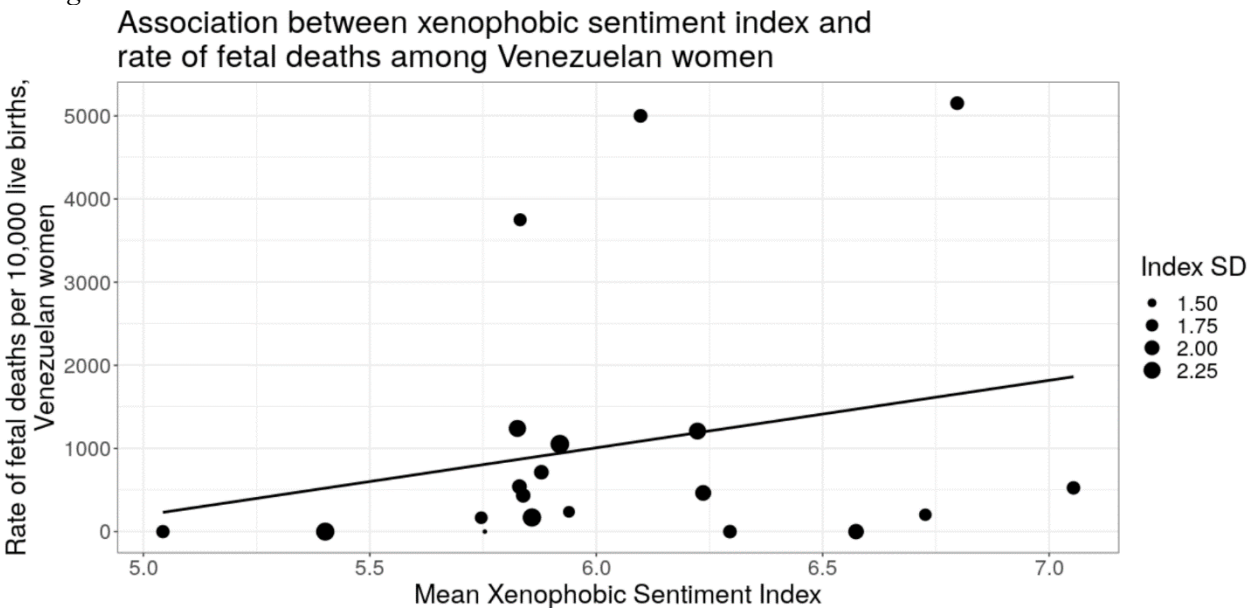
Table S3. Mean xenophobic sentiment index by department

Department	Mean xenophobic sentiment index (SD)
Bogota	5.83 (2.29)
Amazonas	5.40 (2.44)
Antioquia	6.24 (2.12)
Atlantico	5.75 (1.78)
Bolivar	5.86 (2.47)
Boyaca	7.05 (1.85)
Caldas	5.94 (1.70)

Cauca	6.30 (1.86)
Cesar	5.04 (1.84)
Cordoba	5.75 (1.40)
Cundinamarca	5.88 (1.98)
Huila	6.10 (1.88)
Magdalena	5.83 (1.98)
Meta	6.57 (2.08)
Narino	6.80 (1.89)
Norte de Santander	6.22 (2.27)
Risaralda	5.83 (1.80)
Santander	6.73 (1.76)
Tolima	5.84 (1.96)
Valle del Cauca	5.92 (2.49)

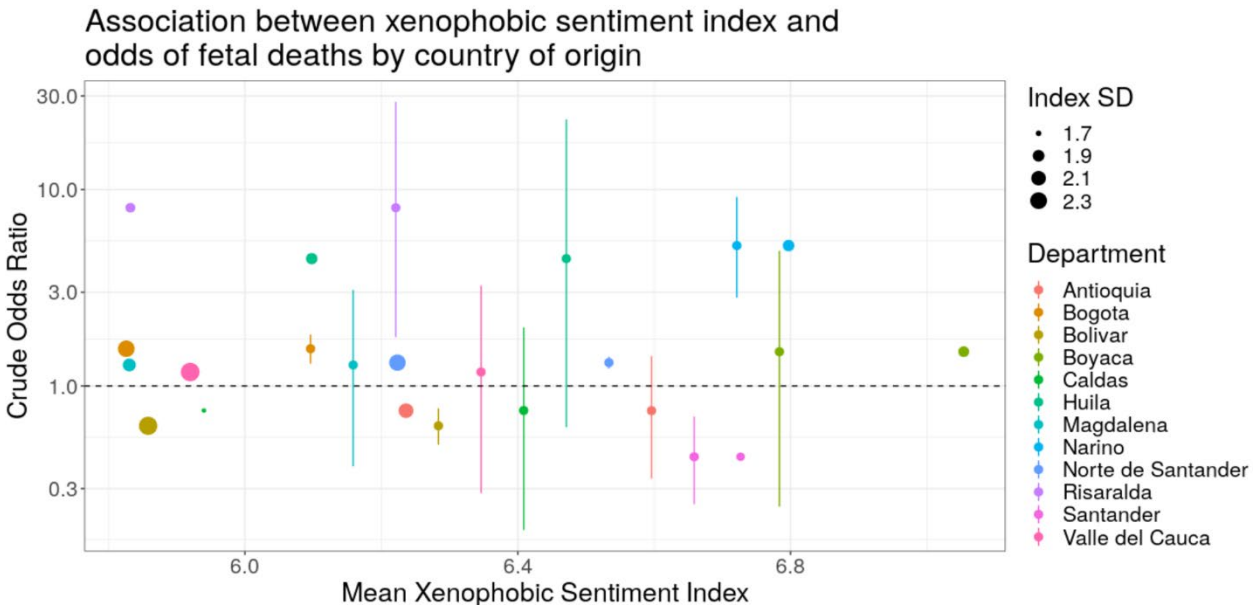
SD: Standard deviation

Figure S2. The relationship between mean xenophobic index and rate of fetal death per 10,000 live births among Venezuelan women



The figure below depicts the crude odds ratio of fetal death for Venezuelan women (relative to Colombian women) stratified by department. The crude odds ratio (reported in Table S1) was estimated for departments with more than one fetal death among Venezuelan women.

Figure S3. The relationship between mean xenophobic index and odds ratios of fetal death for Venezuelan women



Section 3. Other departmental indicators

Table S4. Departmental indicators of interest

Department	Average number of prenatal visits (SD)	Crude rate of cesarean sections per 100 deliveries	Gross domestic product per capita*
Amazonas	3.87 (2.59)	0.22	6.39
Antioquia	6.88 (2.65)	0.30	14.78
Arauca	4.85 (2.51)	0.32	12.88
Archipielago de San Andres, Providencia y Santa Catalina	6.37 (2.68)	0.57	13.64
Atlantico	6.04 (2.58)	0.65	11.77
Bogota	6.54 (2.91)	0.41	22.21
Bolivar	5.98 (2.53)	0.57	13.48
Boyaca	6.70 (2.92)	0.31	16.22
Caldas	7.00 (2.26)	0.27	10.60
Caqueta	5.26 (2.46)	0.37	6.87
Casanare	5.40 (2.93)	0.35	24.33
Cauca	5.78 (2.34)	0.31	8.88
Cesar	5.76 (2.45)	0.55	12.35
Choco	4.35 (2.64)	0.21	5.89
Cordoba	5.83 (2.22)	0.62	7.10
Cundinamarca	5.88 (2.58)	0.31	13.50
Guainia	2.14 (2.32)	0.16	5.38
Guaviare	4.29 (2.43)	0.31	5.22
Huila	6.47 (2.34)	0.36	10.53
La Guajira	4.08 (2.64)	0.41	6.44
Magdalena	5.42 (2.58)	0.59	7.02
Meta	5.42 (2.46)	0.27	21.18
Narino	6.44 (3.05)	0.47	6.37

Norte de Santander	5.38 (2.56)	0.46	8.65
Putumayo	5.57 (2.47)	0.33	6.76
Quindio	7.23 (2.70)	0.28	9.70
Risaralda	6.45 (2.32)	0.28	11.05
Santander	6.33 (2.37)	0.50	25.11
Sucre	5.88 (2.44)	0.67	6.55
Tolima	6.11 (2.29)	0.34	10.60
Valle del Cauca	6.60 (2.45)	0.35	14.50
Vaupes	2.76 (2.97)	0.10	4.20
Vichada	2.27 (2.70)	0.11	5.07

SD: Standard deviation

* Extracted as reported in Peiró-Palomino, J., Prieto-Bustos, W. O. & Tortosa-Ausina, E. Regional income convergence in Colombia: population, space, and long-run dynamics. Ann Reg Sci 70, 559–601 (2023).

Section 4. Individual-level fixed-effects model

Table S5. Pooled and stratified multivariate model results of only individual-level drivers of fetal deaths among Colombian and Venezuelan women

		Individual-level fixed effects model		
Variable		OR (95% CI)*	OR among Venezuelan women (95% CI)**	OR among Colombian women (95% CI)***
Country of origin	Colombian	1.00 (reference)	N/A	N/A
	Venezuelan	0.72 (0.68-0.75)	N/A	N/A
Parity		1.12 (1.12-1.13)	1.08 (1.05-1.12)	1.12 (1.12-1.13)
Maternal age	45+ years old	3.27 (3.05-3.51)	2.06 (0.6-5.42)	3.28 (3.06-3.52)
	40-44 years old	2.4 (2.34-2.47)	2.39 (1.68-3.33)	2.4 (2.34-2.47)
	35-39 years old	1.48 (1.45-1.51)	1.09 (0.86-1.39)	1.48 (1.45-1.51)
	30-34 years old	1.12 (1.1-1.14)	1.2 (1-1.42)	1.12 (1.1-1.14)
	25-29 years old	1.02 (1.01-1.04)	1.15 (1-1.32)	1.02 (1.01-1.04)
	20-24 years old	1.00 (reference)	1.00 (reference)	1.00 (reference)

	15-19 years old	1.01 (0.99-1.02)	1.16 (1.01-1.33)	1.01 (0.99-1.02)
	10-14 years old	1.7 (1.61-1.79)	1.05 (0.55-1.82)	1.71 (1.62-1.8)
Maternal education	Some secondary school or more	1.00 (reference)	1.00 (reference)	1.00 (reference)
	Attended some or all primary school	0.71 (0.70-0.71)	0.87 (0.76-0.98)	0.70 (0.70-0.71)
	Attended less than a year of school	0.48 (0.45-0.51)	0.69 (0.41-1.08)	0.48 (0.45-0.51)
	No education data reported	1.88 (1.85-1.92)	2.51 (2.23-2.83)	1.87 (1.83-1.91)
Health insurance status	No health insurance	1.00 (reference)	1.00 (reference)	1.00 (reference)
	Other health insurance	0.71 (0.69-0.74)	17.57 (0.69-445.39)	0.71 (0.68-0.74)
	Contributive health insurance	0.76 (0.75-0.78)	2.14 (0.99-4.08)	0.76 (0.75-0.78)
	Subsidized health insurance	0.61 (0.59-0.62)	0.96 (0.73-1.23)	0.6 (0.59-0.62)

OR: Odds ratio; CI: Confidence interval; c-section: cesarean section
*The ORs in this column are estimated using Equation 3 including country of origin as a fixed effects variable.
** The ORs in this column are estimated from a subset of data including only Venezuelan women and using Equation 3 without country of origin.
*** The ORs in this column are estimated from a subset of data including only Colombian women and using Equation 3 without country of origin.

Section 5. Sensitivity analyses

Section 5.1. Restricting data to only full-term deliveries

Table S6. Pooled and stratified multivariate model results of drivers of fetal deaths among Colombian and Venezuelan women at 38 weeks of gestation or more

Variable		OR (95% CI)	OR among Venezuelan women (95% CI)**	OR among Colombian women (95% CI)***
Country of origin^	Colombian	1.00 (reference)	N/A	N/A
	Venezuelan	1.35 (1.00-1.77)$^{+}$	N/A	N/A

Country of origin*	Colombian	1.00 (reference)	N/A	N/A
	Venezuelan	0.70 (0.51-0.93)	N/A	N/A
Parity		1.11 (1.09-1.14)	1.14 (0.97-1.34)	1.11 (1.09-1.14)
Health insurance status	No health insurance	1.00 (reference)	1.00 (reference)	1.00 (reference)
	Contributive health insurance	0.39 (0.34-0.44)	0.00 (0.00-14062.17)	0.39 (0.34-0.44)
	Other health insurance	0.34 (0.24-0.47)	N/A	0.34 (0.24-0.46)
	Subsidized health insurance	0.74 (0.67-0.83)	1.63 (0.39-4.54)	0.74 (0.66-0.83)
Maternal age	45+ years old	2.93 (1.90-4.31)	6.28 (0.28-46.5)	2.86 (1.84-4.24)
	40-44 years old	2.36 (1.97-2.81)	2.31 (0.31-10.05)	2.37 (1.98-2.82)
	35-39 years old	1.64 (1.45-1.86)	2.20 (0.74-5.83)	1.64 (1.44-1.86)
	30-34 years old	1.28 (1.14-1.42)	0.77 (0.24-2.07)	1.28 (1.15-1.43)
	25-29 years old	0.98 (0.88-1.08)	0.61 (0.23-1.45)	0.98 (0.89-1.09)
	20-24 years old	1.00 (reference)	1.00 (reference)	1.00 (reference)
	15-19 years old	1.17 (1.06-1.30)	0.75 (0.30-1.71)	1.18 (1.06-1.31)
	10-14 years old	1.21 (0.81-1.74)	2.51 (0.14-13.13)	1.19 (0.79-1.71)
Maternal education	Some secondary school or more	1.00 (reference)	1.00 (reference)	1.00 (reference)
	Attended some or all primary school	1.12 (1.04-1.22)	0.99 (0.45-2.05)	1.13 (1.04-1.22)
	Attended less than a year of school	3.08 (2.57-3.67)	4.81 (1.48-12.95)	3.05 (2.54-3.63)
	No education data reported	3.76 (3.39-4.17)	1.88 (0.84-3.94)	3.82 (3.43-4.24)
Health insurance status	No health insurance	1.00 (reference)	1.00 (reference)	1.00 (reference)
	Other health insurance	0.34 (0.24-0.47)	N/A	0.34 (0.24-0.46)
	Contributive health insurance	0.39 (0.34-0.44)	0.00 (0.00-14062.17)	0.39 (0.34-0.44)
	Subsidized health insurance	0.74 (0.67-0.83)	1.63 (0.39-4.54)	0.74 (0.66-0.83)
Departmental average number of prenatal visits		0.97 (0.93-1.02)	1.50 (0.86-2.40)	0.98 (0.93-1.02)
Departmental proportion of c-section deliveries		0.22 (0.17-0.29)	0.01 (0-0.97)	0.23 (0.17-0.30)

Departmental gross domestic product per capita	0.98 (0.98-0.99)	0.87 (0.77-0.97)	0.98 (0.98-0.99)

OR: Odds ratio; CI: Confidence interval

^The crude OR for country of origin reported in these rows is estimated using Equation 1.

[+] The lower bound rounds to 1.00 at two decimal places but falls below the null (OR = 1.00).

*The OR for country of origin reported in these rows is estimated using Equation 4.

** The ORs in this column are estimated from a subset of data including only Venezuelan women and using a variation on Equation 4.

*** The ORs in this column are estimated from a subset of data including only Colombian women and using a variation on Equation 4.

Section 5.2. Restricting data to only women with no health insurance

Table S7. Pooled and stratified multivariate model results of drivers of fetal deaths among Colombian and Venezuelan women with no health insurance

	Variable	OR (95% CI)	OR among Venezuelan women (95% CI)**	OR among Colombian women (95% CI)***
Country of origin^	Colombian	1.00 (reference)	N/A	N/A
	Venezuelan	0.74 (0.70-0.78)	N/A	N/A
Country of origin*	Colombian	1.00 (reference)	N/A	N/A
	Venezuelan	0.91 (0.86-0.96)	N/A	N/A
Parity		1.05 (1.04-1.07)	1.11 (1.07-1.15)	1.05 (1.04-1.06)
Maternal age	45+ years old	2.87 (2.09-3.87)	1.58 (0.37-4.64)	3.04 (2.19-4.15)
	40-44 years old	2.67 (2.40-2.97)	2.29 (1.58-3.25)	2.72 (2.44-3.04)
	35-39 years old	1.68 (1.57-1.80)	1.09 (0.84-1.39)	1.75 (1.63-1.88)
	30-34 years old	1.36 (1.29-1.43)	1.17 (0.97-1.41)	1.38 (1.30-1.46)
	25-29 years old	1.14 (1.09-1.19)	1.16 (1.01-1.34)	1.14 (1.09-1.19)
	20-24 years old	1.00 (reference)	1.00 (reference)	1.00 (reference)
	15-19 years old	0.97 (0.93-1.02)	1.19 (1.03-1.36)	0.95 (0.91-1.00)

	10-14 years old	1.40 (1.16-1.68)	1.15 (0.60-2.01)	1.45 (1.19-1.75)
Maternal education	Attended some secondary school or more	1.00 (reference)	1.00 (reference)	1.00 (reference)
	Attended some or all primary school	0.87 (0.83-0.90)	0.85 (0.75-0.97)	0.87 (0.83-0.90)
	Attended less than a year of school	0.67 (0.57-0.79)	0.71 (0.41-1.13)	0.67 (0.56-0.80)
	No education data reported	2.39 (2.27-2.52)	2.34 (2.05-2.66)	2.37 (2.24-2.50)
Departmental average number of prenatal visits		1.27 (1.24-1.31)	2.2 (2.03-2.38)	1.26 (1.23-1.30)
Departmental proportion of c-section deliveries		0.25 (0.21-0.28)	0.00 (0.00-0.00)	0.31 (0.27-0.36)
Departmental gross domestic product per capita		1.03 (1.02-1.03)	0.92 (0.91-0.94)	1.04 (1.03-1.04)

OR: Odds ratio; CI: Confidence interval

^The crude OR for country of origin reported in these rows is estimated using Equation 1.

*The OR for country of origin reported in these rows is estimated using Equation 4.

** The ORs in this column are estimated from a subset of data including only Venezuelan women and using a variation on Equation 4.

*** The ORs in this column are estimated from a subset of data including only Colombian women and using a variation on Equation 4.