HHS Public Access

Author manuscript

J Womens Health (Larchmt). Author manuscript; available in PMC 2024 April 09.

Published in final edited form as:

J Womens Health (Larchmt). 2023 December ; 32(12): 1320–1327. doi:10.1089/jwh.2023.0057.

Pregnancy-Related Deaths by Hispanic Origin, United States, 2009–2018

Wilda Parker-Collins, PhD[1], **Fanny Njie, MPH**[1,2], **David A. Goodman, PhD, MS**[1], **Shanna Cox, MSPH**[1], **Jeani Chang, PhD, MPH**[1], **Emily E. Petersen, MD**[1,3], **Jennifer L. Beauregard, PhD, MPH**[1,3]

[1]Division of Reproductive Health, National Center for Chronic Disease Prevention and Public Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia, USA.

[2]Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee, USA.

[3]U.S. Public Health Service, Commissioned Corps, Rockville, Maryland, USA.

Abstract

Objective: To describe pregnancy-related mortality among Hispanic people by place of origin (country or region of Hispanic ancestry), 2009–2018.

Materials and Methods: We conducted a cross-sectional descriptive study of pregnancy-related deaths among Hispanic people, stratified by place of origin (Central or South America, Cuba, Dominican Republic, Mexico, Puerto Rico, Other and Unknown Hispanic), using Pregnancy Mortality Surveillance System data, 2009–2018. We describe distributions of pregnancy-related deaths and pregnancy-related mortality ratios (number of pregnancy-related deaths per 100,000 live births) overall and by place of origin for select demographic and clinical characteristics.

Results: For 2009–2018, the overall pregnancy-related mortality ratio among Hispanic people was 11.5 pregnancy-related deaths per 100,000 live births (95% confidence intervals [CI]: 10.8–12.2). In general, pregnancy-related mortality ratios were higher among older age groups (*i.e.*, 35 years and older) and lower among those with higher educational attainment (*i.e.*, college degree or higher). Approximately two in five pregnancy-related deaths among Hispanic people occurred on the day of delivery through 6 days postpartum. Place of origin-specific pregnancy-related mortality

Address correspondence to: David A. Goodman, PhD, MS, Maternal Mortality Prevention Team, Division of Reproductive Health, National Center for Chronic Disease Prevention, and Public Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Highway NE, MS K-23, Atlanta, GA 30341, USA, igc4@cdc.gov.

Authors' Contributions

W.P.-C: Conceptualization; Writing—Original Draft.
F.N.: Data curation; Formal analysis; Writing—Review and editing.
D.A.G.: Conceptualization; Writing—Review and editing; Supervision.
S.C.: Conceptualization; Writing—Original draft; Writing—Review and editing.
J. C.: Data curation; Writing—Original draft.
E.E.P.: Data curation; Methodology; Writing—Original draft; Writing—Review and editing.
J.L.B.: Methodology; Data Curation; Formal analysis; Validation; Writing—Review and editing.

Author Disclosure Statement

No competing financial interests exist.

Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

ratios ranged from 9.6 (95% CI: 5.8–15.0) among people of Cuban origin to 15.3 (95% CI: 12.4–18.3) among people of Puerto Rican origin. Hemorrhage and infection were the most frequent causes of pregnancy-related deaths overall among Hispanic people. People of Puerto Rican origin had a higher proportion of deaths because of cardiomyopathy.

Conclusions: We identified differences in pregnancy-related mortality by place of origin among Hispanic people that can help inform prevention of pregnancy-related deaths.

Keywords

pregnancy-related death; Hispanic; Hispanic origin; mortality

Introduction

According to data from maternal mortality review committees in 36 U.S. states, from 2017 to 2019, >80% of pregnancy-related deaths were determined to be preventable.[1] Yet the *U.S. pregnancy-related mortality ratio*, defined as the number of pregnancy-related deaths per 100,000 live births, has not declined in 25 years.[2] Hispanic people are the largest racial or ethnic minority population in the United States.[3] Pregnancy-related mortality ratio among Hispanic people in the United States was 11.2 during 2016–2018, compared with 13.7 among non-Hispanic White people, 26.5 among non-Hispanic American Indian or Alaska Native people, and 41.4 among non-Hispanic Black people.[2]

Health status among Hispanic people varies by nativity (country of birth) and place of origin (country or region of Hispanic ancestry).[4,5] For example, a study showed that people of Puerto Rican origin have cardiovascular disease mortality rates higher than people of other Hispanic origin.[4] Foreign-born Hispanic people have 47% less heart disease, 48% less cancer, and 29% less high blood pressure compared with U.S.-born Hispanic people.[5] These chronic health conditions are also known to be associated with pregnancy complications.[6–8] Recent state reports describe varying pregnancy-related mortality ratios among Hispanic people; this variation may be because of different places of origin among the Hispanic populations in these states.[9–13] Heterogeneity in severe maternal morbidity by Hispanic places of origin (Hispanic origin) has been discussed.[14] Variation in pregnancy-related deaths by Hispanic origin has not been recently described in the literature.[15]

The objective of this analysis was to describe the pregnancy-related mortality ratio among Hispanic people by place of origin during 2009–2018 and to describe pregnancy-related deaths among Hispanic people by demographics, pregnancy characteristics, and cause of death.

Materials and Methods

This descriptive analysis uses data on all reported pregnancy-related deaths among Hispanic people during 2009–2018 from the Centers for Disease Control and Prevention (CDC)'s Pregnancy Mortality Surveillance System (PMSS).[2] This time frame was selected to maximize our capacity to report information at a level that is clinically relevant, informative, and detailed, within the context of PMSS reporting restrictions. PMSS is a national

surveillance system for pregnancy-related deaths started by CDC in 1986 because more clinical information was needed to fill data gaps regarding causes of maternal deaths.[2]

Fifty-two reporting areas (50 U.S. states, New York City, and Washington, DC) voluntarily submit the following data to CDC's Division of Reproductive Health: copies of death certificates for people who died during or within 1 year of pregnancy; linked birth certificates or fetal death reports as applicable; and additional data when available. Additional data sources might include medical records, autopsy reports, media reports (identified by LexisNexis®), pregnancy checkbox quality assurance inquiries, and maternal mortality review committee data.

Data are abstracted into the PMSS database and reviewed by medical epidemiologists to determine whether a death was pregnancy related and the cause of death. A pregnancy-related death is defined as the death of a person during or within 1 year of pregnancy, irrespective of the duration and site of pregnancy, caused by a pregnancy complication, a chain of events initiated by pregnancy, or aggravation of an unrelated condition by the physiologic effects of pregnancy.[16] Data used in this report are collected and reported as "women"; however, not all individuals who give birth identify as women. To align with efforts to use inclusive language,[17] throughout this report we use the term "people."

Cause of death coding includes the following 10 mutually exclusive categories: hemorrhage; infection; amniotic fluid embolism; thrombotic pulmonary or other embolism (*i.e.*, air, septic, or fat); hypertensive disorders of pregnancy (*i.e.*, preeclampsia or eclampsia); anesthesia complications; cerebrovascular accidents; cardiomyopathy; other cardiovascular conditions (*e.g.*, congenital heart disease, ischemic heart disease, cardiac valvular disease, hypertensive heart disease, and congestive heart failure); and other noncardiovascular medical conditions (*e.g.*, endocrine, hematologic, immunologic, and renal).[6] This analysis excludes injury deaths because pregnancy relatedness cannot generally be determined for these deaths through PMSS processes.

We ascertained Hispanic origin *via* the death record and, if missing from the death certificate, *via* the linked live birth or fetal death record, or both, when available. We restricted analyses to pregnancy-related deaths among Hispanic people, regardless of race or combination of races and birthplace (born within and outside the U.S. states and Washington, DC). In addition, we excluded 32 (0.5%) pregnancy-related deaths among people with unknown Hispanic origin (*i.e.*, not recorded on any vital records) from our analyses. For most analyses we categorized Hispanic origin into six groups: Central or South America, Cuba, Dominican Republic, Mexico, Puerto Rico, and Other and Unknown Hispanic. To align with standard Hispanic origin categorizations available in our birth data source, the National Vital Statistics System (NVSS), we focused our analysis on these six groups.

Pregnancy-related deaths among people of Puerto Rican origin are limited to those occurring within the U.S. states and Washington, DC. If Hispanic origin was not specified in any of the vital records available for a decedent, and only "Hispanic," "Spanish," or "Latino" ancestry was selected, then we categorized place of origin as Other and Unknown Hispanic.

We included results among people of Other and Unknown Hispanic place of origin in tables but did not present or interpret this information in the Results or Discussion sections because it represents a grouping of people with heterogeneous Hispanic origins.

We obtained counts of live births for 2009–2018 from NVSS and stratified them by year, place of Hispanic origin, maternal age, and maternal educational attainment. Available NVSS categories for place of Hispanic origin for all years were Central or South America, Cuba, Mexico, Puerto Rico, and Other and Unknown Hispanic.[18] NVSS began reporting counts of births to people of Dominican origin in 2018; previously, these births were included in the Other and Unknown Hispanic category.[18] We estimated the total count of births to people of Dominican origin for 2009–2017 based on the observed percentage of Other and Unknown Hispanic origin births that were of Dominican origin for 2018–2020. NVSS did not report maternal education data in publicly available U.S. natality files starting in 2007 (for births reported on the 1989 revision of the standard U.S. birth certificate); for births with unreported data, we imputed maternal educational attainment using hot deck methodology[19] to assign each missing value with an observed response from a birth of the same Hispanic origin and age group.

Characteristics of interest were maternal age, nativity, maternal educational attainment, timing of death, and underlying cause of death. We ascertained maternal age from the death record and categorized it as <25, 25–34, and 35 years or older. We identified nativity from the death record and categorized it as born in the United States (50 U.S. states and Washington, DC), born outside the United States (including U.S. territories), and not stated/unknown, in accordance with National Center for Health Statistics reporting standards.[18] We ascertained maternal educational attainment from the death record and categorized it as less than high school, completed high school, some college, college graduate or higher, and unknown (*i.e.*, missing information). Maternal education is included because educational attainment is a fundamental social determinant of health, with the potential to influence the risk of pregnancy-related mortality.[20]

We determined timing of death in relation to pregnancy using information from the death records, and birth or fetal death records when available, as previously described.[6] Categories for timing of death in relation to pregnancy were during pregnancy, day of delivery, 1–6 days after the end of pregnancy, 7–42 days after the end of pregnancy, and 43–365 days after the end of pregnancy.[6] We described the distribution of maternal characteristics both overall and stratified by Hispanic origin. We excluded unknown nativity, education, and timing of death from proportion calculations; however, we provide frequencies in tables. Second, we calculated overall pregnancy-related mortality ratios, and pregnancy-related mortality ratios stratified by place of Hispanic origin and by both place of Hispanic origin and select maternal characteristics (maternal age, maternal educational attainment).

When calculating pregnancy-related mortality ratios stratified only by place of Hispanic origin, we used a four-category grouping: (1) Central or South America, (2) Mexico, (3) Puerto Rico, and (4) Other and Unknown Hispanic (includes Cuba and Dominican Republic) for place of Hispanic origin for the main analyses. However, we additionally present results among people of Dominican and Cuban origin. We did not calculate pregnancy-related

mortality ratios among people of Dominican and Cuban origin stratified by other maternal characteristics because of small numbers of deaths.

Pregnancy-related mortality ratios stratified by other maternal characteristics were not calculated for the four-category grouping because of lack of aligned denominator data from NVSS. Following convention, and using National Center for Health Statistics methods for Poisson confidence intervals (CIs) for death rates, we calculated 95% CIs for pregnancy-related mortality ratios.[21] The number of pregnancy-related deaths represent complete "population" counts for the United States. As such, pregnancy-related mortality ratios are not subject to sampling error. We provide the CIs to acknowledge uncertainty introduced by inherent variation of vital event registration processes, and not as a test of statistical significance. Finally, we described proportionate mortality by calculating the distribution of cause of death categories overall and stratified by place of Hispanic origin.

For these analyses, we categorized place of Hispanic origin using the six-category grouping for place of Hispanic origin. We used SAS version 9.4 for calculating descriptive statistics. This study did not involve human subjects as defined in 45CFR 46.102(e) and thus, did not require review by an institutional review board.

Results

During 2009–2018, there were 6,749 pregnancy-related deaths in the United States identified by PMSS. Of these deaths, 1,060 were among Hispanic people. The distribution of pregnancy-related deaths among Hispanic people by place of origin was Mexico (*n*=695, 65.6%), Central or South America (*n*=161, 15.2%), Puerto Rico (*n*=106, 10.0%), Dominican Republic (*n*=39, 3.7%), Cuba (*n*=19, 1.8%), and Other and Unknown Hispanic origin (*n*=40, 3.8%; Table 1).

The distribution of pregnancy-related deaths by Hispanic origin varied by nativity, maternal education, age, and timing of death in relation to pregnancy (Table 1). People aged 25–34 years made up 44.3%–46.2% of pregnancy-related deaths across all groups of Hispanic origin, except for people of Cuban origin. The proportion of deaths occurring among people born outside the United States ranged from 30.2% among people of Puerto Rican origin to 86.8% among people of Central or South American origin. A majority of deaths among people of Mexican and Puerto Rican origin (53.2% and 69.8%, respectively) were U.S. born, whereas most people of Cuban and Dominican origins (63.2% and 76.9%, respectively) were of foreign born. Overall, approximately two in five (38.7%) pregnancy-related deaths among Hispanic people occurred among people who completed less than a high school education. Of note, in PMSS data 22.6% of deaths among Hispanic people had unknown educational attainment.

In addition, of all deaths among people of Mexican origin, for a large number, education was unknown (*n*=213, 30.7%). Among deaths with known education attainment, the proportion of Hispanic decedents who had completed a college degree or higher ranged from 6.0% among people of Mexican origin to 21.1% among people of Dominican origin and people of Cuban origin.

Timing of death was known for 85.1% of the 2009–2018 pregnancy-related deaths among Hispanic people. Overall, the highest proportion of deaths occurred during pregnancy (26.6%), followed by 7–42 days after the end of pregnancy (22.5%), 1–6 days after the end of pregnancy (22.4%), and day of delivery (19.7%); proportions were lowest for 43–365 days after the end of pregnancy (8.8%). Deaths during pregnancy represented the largest proportion of deaths among people of Mexican origin (28.6%). Among people of Cuban origin, 1–6 days after the end of pregnancy represented the largest proportion (37.5%), and among people of Dominican (32.4%) and Central or South American origin, 7–42 days after the end of pregnancy represented the largest proportion (24.8%) of pregnancy-related deaths.

During 2009–2018, pregnancy-related mortality ratio among Hispanic people was 11.5 pregnancy-related deaths per100,000 live births(95% CI: 10.8–12.2;Table 2).By place of origin, pregnancy-related mortality ratio ranged from 9.6 (95% CI: 5.8–15.0) among people of Cuban origin to 15.3 (95% CI: 12.4–18.3) among people of Puerto Rican origin.

Pregnancy-related mortality ratio was higher among older age groups than younger age groups for Hispanic people overall—ranging from 6.9 (95% CI: 6.0–7.8) for people <25 years old to 26.2 (95% CI: 23.4–28.9) among people 35 years and older—and across all Hispanic origins. Point estimates for the pregnancy-related mortality ratio among people of Puerto Rican origin in all three age groupings were higher than pregnancy-related mortality ratio among those of other Hispanic origins in the same age groupings. Overall pregnancy-related mortality ratios ranged from 7.6 among both Hispanic people with some college education (95% CI: 6.5–8.8) and who completed college (95% CI: 6.0–9.5) to 10.2 (95% CI: 9.1–11.4) among Hispanic people with less than a high school education.

Among Hispanic people who did not complete high school, people of Mexican origin had a pregnancy-related mortality ratio of 10.2 (95% CI: 8.8–11.5), whereas the pregnancy-related mortality ratios among Central or South American and Puerto Rican origins who did not complete high school were 11.9 (95% CI: 9.2–15.1) and 17.9 (95% CI: 11.7–26.2), respectively. People of Puerto Rican origin had higher pregnancy-related mortality ratio point estimates across all known education levels compared with other Hispanic origins of equivalent education.

The two most frequent causes of pregnancy-related death were infection and hemorrhage among Hispanic people overall and among people of Mexican, Central or South American, and Cuban origin (Table 3). Among people of Dominican origin, hemorrhage and cerebrovascular accidents were the most frequent causes of death, each representing 18.0% of all such deaths among people of Dominican origin. The two most frequent causes of death for people of Puerto Rican origin were infection and cardiomyopathy (first and second, respectively). Cardiomyopathy was the cause of death for 14.2% of pregnancy-related deaths among people of Puerto Rican origin, which was over twice the proportion among people of Mexican and Dominican origins (5.9% and 5.1%, respectively). Hypertensive disorders of pregnancy were the cause of death for 15.8% of deaths among people of Cuban origin and 15.4% among people of Dominican origin; these proportions were over twice that observed among people of other Hispanic origins.

Discussion

This study identified differences in pregnancy-related mortality by place of Hispanic origin. Hispanic people in the United States differ in terms of nativity, country of origin, and socioeconomic background.[22] A majority (65.6%) of pregnancy-related deaths in our study were among people of Mexican origin. People of Mexican origin also make up the largest number of births among Hispanic people, accounting for 60.2% of total live births in our analysis. In our study, people of Puerto Rican origin had the highest overall pregnancy-related mortality ratio. A previous study found that adults of Puerto Rican origin report multiple chronic illnesses more frequently than other Hispanic populations.[23] Our observed differences in pregnancy-related mortality ratio by disaggregated Hispanic ethnicity may help provide information for more focused prevention opportunities of pregnancy-related deaths based on the origin composition of local populations.

In a prior study of pregnancy-related deaths by Hopkins et al. among Hispanic people, 1987–1992, the three most frequent causes of death were pregnancy-induced hypertension (hypertensive disorders of pregnancy), hemorrhage, and infection.[15] Our study found that infection, hemorrhage, and other cardiovascular conditions were the three leading causes of pregnancy-related death. In contrast with Hopkins et al., which only analyzed data in aggregate, we stratified our analyses by place of Hispanic origin to examine more granular patterns in causes of death.[15] Our analysis identified cardiomyopathy as the second most frequent cause of pregnancy-related deaths among people of Puerto Rican origin; a proportion of pregnancy-related deaths higher than among other Hispanic origins. Similarly, our analysis identified that hypertensive disorders of pregnancy among people of Cuban and Dominican origins occurred at a proportion higher than among people of other Hispanic origins.

Our findings are important considerations in selecting, designing, and evaluating prevention interventions. Strategies and interventions to prevent pregnancy-related deaths owing to cardiomyopathy and hypertensive disorders of pregnancy may include increasing recognition of warning signs by health care professionals, and postpartum people and their support networks to ensure timely diagnosis and appropriate treatment.[24,25] Interventions may also include expanding availability and access to community-based care coordination and wrap-around services that can help with scheduling of specialist care appointments, filling prescriptions, and clarifying questions about care plans.[6,26–28]

Timing of death is another important consideration for implementing interventions. Another publication, using PMSS data from 2011 to 2015, found that among pregnancy-related deaths where timing of death was known, 31.3% occurred during pregnancy, 16.9% on the day of delivery, 18.6% at 1–6 days postpartum, 21.4% at 7–42 days postpartum, and 11.7% at 43–365 days postpartum.[6] These findings were consistent with our study among Hispanic people where the highest proportion of deaths occurred during pregnancy followed by 7–42 days postpartum and 1–6 days postpartum. Overall, two in five pregnancy-related deaths among Hispanic people were on the day of delivery through 6 days postpartum, highlighting a role for hospital-based interventions for prevention. To prevent pregnancy-related mortality among Hispanic people, there may be specific value for developing and implementing

clinical interventions that address leading causes of death during and following delivery, including obstetric initiatives that focus on hemorrhage and sepsis.[29–31]

A higher proportion of people of Central or South American, Dominican, and Cuban origins were born outside the United States; a potentially important intervention for these populations may include language services. This has been identified by Maternal Mortality Review Committees as a recommendation theme among preventable pregnancy-related deaths[32] and an important strategy in provision of equitable care.[6]

Limitations

The findings in this report are subject to certain limitations. First, small population sizes prevented disaggregation by people of Cuban and Dominican origin in some analyses, and results with small numbers should be interpreted with caution. Second, Hispanic origin reported in the death or birth record data, or both, may be inadequately reported.[8] In our study, for 40 deaths decedent's place of origin was not specified; however, we identified Hispanic ancestry by the use and selection of "Hispanic," "Spanish," or "Latino" terms in available vital records. Third, our approach to estimating births to people of Dominican origin may have resulted in either under- or overestimation of a Dominican-specific pregnancy-related mortality ratio. Fourth, aggregating 10 years of data over time may have masked more recent patterns in pregnancy-related mortality.

Fifth, because PMSS does not include data from Puerto Rico, this analysis only included deaths of people of Puerto Rican origin occurring in U.S. states and Washington, DC, and we were unable to describe pregnancy-related deaths of people of Puerto Rican origin occurring in U.S. territories. Sixth, some aggregation of Central or South American countries may obscure differences in outcome by country of origin. Finally, variables that have been associated with outcomes among people of Hispanic origin were not available in PMSS data and may provide further context such as immigration status, health insurance status, site of care (urban vs. rural), and primary language spoken at home.[33–35]

Conclusion

By understanding population-specific variations by Hispanic origin there is increased information for preventing pregnancy-related deaths. These findings may be helpful for more focused opportunities for prevention of pregnancy-related deaths and eliminating maternal health disparities than those opportunities developed by looking at deaths among Hispanic people overall.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgment

The authors thank Kristi Seed, Carla Syverson, and William M. Callaghan, for their contribution in data abstraction, knowledge, and advice related to the Pregnancy Mortality Surveillance System data during the analysis.

References

1. Trost S, Beauregard J, Chandra G, et al. Pregnancy-Related Deaths: Data from Maternal Mortality Review Committees in 36 U.S. States, 2017–2019. Atlanta, GA; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services, 2022. Available from: https://reviewtoaction.org/sites/default/files/2022-10/Pregnancy-Related-Deaths-Data-MMRCs-2017-2019-H.pdf [Last accessed: April 25, 2023].
2. Centers for Disease Control and Prevention. Pregnancy Mortality Surveillance System. Available from: https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm [Last accessed: February 18, 2022].
3. United States Census Bureau. U.S. population more racially and ethnically diverse than measured in 2010. Available from: https://www.census.gov/library/stories/2021/08/2020-united-states-population-more-racially-ethnically-diverse-than-2010.html [Last accessed: February 27, 2022].
4. Rodriguez F, Hastings KG, Boothroyd DB, et al. Disaggregation of cause-specific cardiovascular disease mortality among Hispanic subgroups. JAMA Cardiol 2017; 2(3):240–247; doi: 10.1001/jamacardio.2016.4653 [PubMed: 28114655]
5. Dominguez K, Penman-Aguilar A, Chang MH, et al. Vital signs: Leading causes of death, prevalence of diseases and risk factors, and use of health services among Hispanics in the United States: 2009–2013. MMWR Morb Mortal Wkly Rep 2015;64(17):469–478 [PubMed: 25950254]
6. Petersen EE, Davis NL, Goodman D, et al. Vital signs: Pregnancy-related deaths, United States, 2011–2015, and strategies for prevention, 13 states, 2013–2017. MMWR Morb Mortal Wkly Rep 2019;68(18):423–429; doi: 10.15585/mmwr.mm6818e1 [PubMed: 31071074]
7. Elfassy T, Al Hazzouri AZ, Cai J, et al. Incidence of hypertension among US Hispanics/Latinos: The Hispanic Community Health Study/Study of Latinos, 2008 to 2017. J Am Heart Assoc 2020;9(12):e015031; doi: 10.1161/JAHA.119.015031 [PubMed: 32476602]
8. Petersen EE, Davis NL, Goodman D, et al. Racial/ethnic disparities in pregnancy-related deaths—United States, 2007–2016. MMWR Morb Mortal Wkly Rep 2019;68(35): 762–765; doi: 10.15585/mmwr.mm6835a3 [PubMed: 31487273]
9. Colorado Department of Public Health and Environment. Colorado Maternal Mortality Prevention Program Legislative Report 2014–2016. 2020. Available from: https://nursing.cuanschutz.edu/docs/librariesprovider2/newsroom-documents/maternal-mortality-in-colorado-2014-2016.pdf?sfvrsn=209887b9_2#:~:text=In%202014%E2%80%932016%2C%20there%20were,deaths%20were%20related%20to%20pregnancy [Last accessed: August 6, 2021].
10. Hernandez L, Thompson A. Florida's Pregnancy-Associated Mortality Review 2018 Update. Division of Community Health Promotion, Florida Department of Health, 2020. Available from: http://www.floridahealth.gov/statistics-and-data/PAMR/_documents/pamr-2018-update.pdf [Last accessed: August 6, 2021].
11. Missouri Pregnancy Associated Mortality Review 2018 Annual Report. Missouri Department of Health and Senior Services, 2021. Available from: https://health.mo.gov/data/pamr/pdf/annual-report.pdf [Last accessed: August 6, 2021].
12. Andino V, Bates A, Buck T, et al. Washington State Maternal Mortality Review Panel: Maternal Deaths 2014–2016. Washington State Department of Health, 2019. Available from: https://www.doh.wa.gov/Portals/1/Documents/Pubs/141-010-MMRPMaternalDeathReport2014-2016.pdf [Last accessed: August 6, 2021].
13. Illinois Maternal Morbidity and Mortality Report. Illinois Department of Public Health, 2018. Available from: https://dph.illinois.gov/content/dam/soi/en/web/idph/files/publications/publicationsowhmaternalmorbiditymortalityreport112018.pdf [Last Accessed: August 6, 2021].
14. Howell EA, Egorova NN, Janevic T, et al. Severe maternal morbidity among Hispanic women in New York City: Investigation of health disparities. Obstet Gynecol 2017; 129(2):285–294; doi: 10.1097/AOG.0000000000001864 [PubMed: 28079772]
15. Hopkins FW, MacKay AP, Koonin LM, et al. Pregnancy-related mortality in Hispanic women in the United States. Obstet Gynecol 1999;94(5 Pt 1):747–752; doi: 10.1016/s0029-7844(99)00393-2 [PubMed: 10546722]

16. Creanga AA, Berg CJ, Syverson C, et al. Pregnancy-related mortality in the United States, 2006–2010. Obstet Gynecol 2015;125(1):5–12; doi: 10.1097/AOG.0000000000000564 [PubMed: 25560097]
17. The American College of Obstetricians and Gynecologists. Inclusive Language j ACOG. Available from: https://www.acog.org/clinical-information/policy-and-position-statements/statements-of-policy/2022/inclusive-language [Last accessed: July 20, 2022].
18. United States Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, et al. Natality – Birth Records (Expanded) Documentation. Available from: https://wonder.cdc.gov/wonder/help/natality-expanded.html#Nativity [Last accessed: February 19, 2022].
19. SAS Institute Inc., SAS Help Center: Hot-Deck Imputation. Available from: https://documentation.sas.com/doc/en/pgmsascdc/9.4_3.4/statug/statug_surveyimpute_details27.htm [Last accessed: February 27, 2022].
20. Kramer MR, Strahan AE, Preslar J, et al. Changing the conversation: Applying a health equity framework to maternal mortality reviews. Am J Obstet Gynecol 2019; 221(6):609.e1–609.e9; doi: 10.1016/j.ajog.2019.08.057
21. Matthews TJ, MacDorman MF. Infant mortality statistics from the 2008 period linked birth/infant death data set. Natl Vital Stat Rep 2012;60(5):26.
22. Fenelon A, Chinn JJ, Anderson RN. A comprehensive analysis of the mortality experience of Hispanic subgroups in the United States: Variation by age, country of origin, and nativity. SSM Popul Health 2017;3:245–254; doi: 10.1016/j.ssmph.2017.01.011 [PubMed: 29349222]
23. Lucas JW, Freeman G, Adams PF. Health of Hispanic Adults: United States, 2010–2014. NCHS data brief, no 251. 2016.
24. American College of Obstetricians and Gynecologists' Presidential Task Force on Pregnancy and Heart Disease and Committee on Practice Bulletins—Obstetrics. ACOG Practice Bulletin No. 212: Pregnancy and heart disease. Obstet Gynecol 2019;133(5):e320–e356; doi: 10.1097/AOG.0000000000003243 [PubMed: 31022123]
25. Mhyre JM, D'Oria R, Hameed AB, et al. The maternal early warning criteria: A proposal from the national partnership for maternal safety. Obstet Gynecol 2014;124(4):782–786; doi: 10.1097/AOG.0000000000000480 [PubMed: 25198266]
26. Guide to Community Preventive Services. TFFRS—Heart Disease and Stroke Prevention: Interventions Engaging Community Health Workers. Available from: https://www.thecommunityguide.org/findings/heart-disease-stroke-prevention-interventions-engaging-community-health-workers [Last accessed: March 2, 2022].
27. Davis MB, Arendt K, Bello NA, et al. . Team-based care of women with cardiovascular disease from pre-conception through pregnancy and postpartum: JACC focus seminar 1/5. J Am Coll Cardiol 2021;77(14):1763–1777; doi: 10.1016/j.jacc.2021.02.033 [PubMed: 33832604]
28. Geiger I, Reber KC, Darius H, et al. Improving care coordination for patients with cardiac disease: Study protocol of the randomised controlled new healthcare programme (Cardiolotse). Contemp Clin Trials 2021;103:106297; doi: 10.1016/j.cct.2021.106297 [PubMed: 33515786]
29. Shields A, de Assis V, Halscott T. Top 10 pearls for the recognition, evaluation, and management of maternal sepsis. Obstet Gynecol 2021;138(2):289–304; doi: 10.1097/AOG.0000000000004471 [PubMed: 34237760]
30. The American College of Obstetricians and Gynecologists. Safe Motherhood Initiative j ACOG. Available from: https://www.acog.org/community/districts-and-sections/district-ii/programs-and-resources/safe-motherhood-initiative [Last accessed: February 27, 2022].
31. Bingham D, Lyndon A, Lagrew D, et al. A state-wide obstetric hemorrhage quality improvement initiative. MCN Am J Matern Child Nurs 2011;36(5):297–304; doi: 10.1097/NMC.0b013e318227c75f [PubMed: 21857200]
32. Howell EA, Brown H, Brumley J, et al. Reduction of peripartum racial and ethnic disparities: A conceptual framework and maternal safety consensus bundle. Obstet Gynecol 2018;131(5):770–782; doi: 10.1097/AOG.0000000000002475 [PubMed: 29683895]

33. Avila RM, Bramlett MD. Language and immigrant status effects on disparities in Hispanic children's health status and access to health care. Matern Child Health J 2013; 17(3):415–423; doi: 10.1007/s10995-012-0988-9 [PubMed: 22466718]

34. Diaz CJ, Niño M Familism and the Hispanic health advantage: The role of immigrant status. J Health Soc Behav 2019;60(3):274–290; doi: 10.1177/0022146519869027 [PubMed: 31526018]

35. Velasco-Mondragon E, Jimenez A, Palladino-Davis AG, et al. Hispanic health in the USA: A scoping review of the literature. Public Health Rev 2016;37(1); doi: 10.1186/s40985-016-0043-2

Table 1.

Characteristics of Pregnancy-Related Deaths Among Hispanic People by Places of Hispanic Origin in the United States, Pregnancy Mortality Surveillance System 2009–2018

Characteristic	*Central or South America* n = *161 (15.2)*[b]	*Cuba* n = *19 (1.8)*[b]	*Dominican Republic* n = *39 (3.7)*[b]	*Mexico* n = *695 (65.6)*[b]	*Puerto Rico* n = *106 (10.0)*[b]	*Other and unknown Hispanic*[a] n = *40 (3.8)*[b]	*Total Hispanic* N = *1,060 (100.0)*
Maternal age (years)							
<25	24 (14.9)	3 (16)	4 (10)	160 (23.0)	29 (27.4)	11 (28)	231 (21.8)
25–34	72 (44.7)	6 (32)	18 (46)	316 (45.5)	47 (44.3)	21 (53)	480 (45.3)
35+	65 (40.4)	10 (53)	17 (44)	219 (31.5)	30 (28.3)	8 (20)	349 (32.9)
Nativity[c]							
Born in the United States[d]	21 (13.2)	7 (37)	9 (23)	369 (53.2)	74 (69.8)	36 (97)	516 (49.0)
Born outside the United States[e]	138 (86.8)	12 (63)	30 (77)	325 (46.8)	32 (30.2)	1 (3)	538 (51.0)
Not stated/unknown	2	0	0	1	0	3	6
Maternal education[c]							
Less than HS	65 (43.3)	4 (21)	6 (16)	210 (43.6)	26 (25.2)	7 (24)	318 (38.7)
Completed HS/GED	36 (24.0)	5 (26)	15 (40)	153 (31.7)	38 (36.9)	12 (41)	259 (31.6)
Some college	24 (16.0)	6 (32)	9 (24)	90 (18.7)	27 (26.2)	9 (31)	165 (20.1)
College graduate/higher	25 (16.7)	4 (21)	8 (21)	29 (6.0)	12 (11.7)	1 (4)	79 (9.6)
Unknown	11	0	1	213	3	11	239
Timing of death[c]							
During pregnancy	29 (21.2)	1 (6)	6 (16)	167 (28.6)	26 (26.8)	11 (34)	240 (26.6)
Day of delivery	32 (23.4)	5 (31)	11 (30)	107 (18.4)	19 (19.6)	4 (13)	178 (19.7)
1–6 days after end of pregnancy	30 (21.9)	6 (38)	6 (16)	142 (24.4)	14 (14.4)	4 (13)	202 (22.4)
7–42 days after end of pregnancy	34 (24.8)	4 (25)	12 (32)	118 (20.2)	24 (24.7)	11 (34)	203 (22.5)
43–365 days after end of pregnancy	12 (8.8)	0 (0)	2 (5)	49 (8.4)	14 (14.4)	2 (6)	79 (8.8)
Unknown	24	3	2	112	9	8	158

Data are presented as *n* (%) or *n*.

[a]Other and Unknown Hispanic includes Hispanic people with no origin specified.

[b] Percentages for the individual component categories might not add to 100% because of rounding.

[c] Percentages for the individual component might not add to 100% because of the Unknown category.

[d] Includes 50 U.S. states and Washington, DC.

[e] Includes U.S. territories.

GED, general education development test; HS, high school.

Table 2.

Pregnancy-Related Mortality Ratios Among Hispanic People by Places of Hispanic Origin and Select Sociodemographics in the United States, Pregnancy Mortality Surveillance System 2009–2018

	Central or South America	Mexico	Puerto Rico	Other and Unknown Hispanic, Cuba, Dominican Republic[a]	
Characteristic	**PRMR (95% CI)**	**PRMR (95% CI)**	**PRMR (95% CI)**	**PRMR (95% CI)**	**Total Hispanic PRMR (95% CI)**
Total	11.5 (9.7–13.2)	12.5 (11.6–13.5)	15.3 (12.4–18.3)	6.3 (5.1–7.6)	11.5 (10.8–12.2)
Maternal age (years)					
<25	6.6 (4.2–9.8)	7.7 (6.7–9.1)	10.1 (6.8–14.5)	3.0 (1.8–4.7)	6.9 (6.0–7.8)
25–34	9.5 (7.4–11.9)	11.7 (10.5–13.1)	14.6 (10.7–19.4)	5.9 (4.3–7.9)	10.6 (9.6–11.5)
35+	23.2 (17.9–29.6)	28.5 (24.7–32.3)	37.1 (25.0–52.9)	17.2 (12.0–23.9)	26.2 (23.4–28.9)
Maternal education					
Less than HS	11.9 (9.2–15.1)	10.2 (8.8–11.5)	17.9 (11.7–26.2)	4.9 (2.9–7.9)	10.2 (9.1–11.4)
Completed HS/GED	11.1 (7.8–15.3)	8.7 (7.3–10.1)	17.6 (12.4–24.1)	6.4 (4.4–9.0)	9.3 (8.1–10.4)
Some college	8.8 (5.6–13.1)	7.5 (6.1–9.3)	12.1 (7.9–17.5)	5.1 (3.3–7.6)	7.6 (6.5–8.8)
College graduate/higher	10.6 (6.9–15.7)	6.2 (4.2–8.9)	11.9 (6.1–20.7)	5.5 (3.0–9.5)	7.6 (6.0–9.5)

The percentages of pregnancy-related deaths with unknown maternal education by place of origin: Central or South America—6.8%, Mexico—30.7%, Puerto Rico—2.8%, Other and Unknown—12.2%, Total Hispanic—22.6%.

Counts of pregnancy-related deaths and births used to calculate PRMRs are provided in Supplementary Tables S1 and S2, respectively.

[a]Other and Unknown includes Cuba (PRMR = 9.6; 95% CI: 5.8–15.0), Dominican Republic (PRMR = 12.3; 95% CI: 8.7–16.7), Hispanic people with no origin specified.

CI, confidence interval; PRMR, pregnancy-related mortality ratios.

Table 3.

Causes of Pregnancy-Related Death Among Hispanic People by Places of Hispanic Origin, United States, Pregnancy Mortality Surveillance System 2009–2018

Cause of death	*Central or South America*, n = *161 (15.2)*[b]	*Cuba*, n = *19 (1.8)*[b]	*Dominican Republic*, n = *39 (3.7)*[b]	*Mexico*, n = *695 (65.6)*[b]	*Puerto Rico*, n = *106 (10.0)*[b]	*Other and Unknown Hispanic*[a], n = *40 (3.7)*[b]	*Total Hispanic* N = *1060 (100.0)*
Infection	21 (13.0)	4 (21)	3 (8)	128 (18.4)	18 (17.0)	10 (25)	184 (17.4)
Hemorrhage	32 (19.9)	7 (37)	7 (18)	109 (15.7)	13 (12.3)	6 (15)	174 (16.4)
Other cardiovascular conditions	19 (11.8)	1 (5)	3 (8)	85 (12.2)	10 (9.4)	2 (5)	120 (11.3)
Other noncardiovascular medical conditions[c]	17 (10.6)	0 (0)	3 (8)	70 (10.1)	12 (11.3)	6 (15)	108 (10.2)
Cerebrovascular accident	15 (9.3)	2 (11)	7 (18)	63 (9.1)	7 (6.6)	0 (0)	94 (8.9)
Hypertensive disorders of pregnancy	13 (8.1)	3 (16)	6 (15)	62 (8.9)	7 (6.6)	2 (5)	93 (8.8)
Thrombotic embolism	14 (8.7)	1 (5)	3 (8)	55 (7.9)	8 (7.6)	2 (5)	83 (7.8)
Cardiomyopathy	14 (8.7)	0 (0)	2 (5)	41 (5.9)	15 (14.2)	6 (15)	78 (7.4)
Unknown	8 (5.0)	1 (5)	2 (5)	41 (5.9)	10 (9.4)	2 (5)	64 (6.0)
Amniotic fluid embolism	7 (4.4)	0 (0)	3 (8)	38 (5.5)	6 (5.7)	4 (10)	58 (5.5)
Anesthesia complications	1 (0.6)	0 (0)	0 (0)	3 (0.4)	0 (0.0)	0 (0)	4 (0.4)

Data are represented as *n* (%).

[a] Other and Unknown Hispanic includes Hispanic people with no origin specified.

[b] Percentages for the individual component categories might not add to 100% because of rounding.

[c] Other noncardiovascular conditions cause of death include select cancers, gestational trophoblastic neoplasia, collagen vascular, autoimmune disease, endocrine disorders, hematologic, immune deficiency problems, neurologic/neurovascular conditions, pulmonary conditions, and renal disease.