

Beyond the Pregnancy Checkbox: Recommendations for Improving Maternal Mortality Surveillance in Rural Colorado.

Ann Morris, BS; Sylvie Kimpton, MS; Leon Kelly, MD; Mark Payton, PhD; Affiliated with Rocky Vista University College of Osteopathic Medicine

INTRODUCTION

The pregnancy status checkbox was added to U.S. death certificates in 2003 to improve identification of pregnancy-associated and maternal deaths. Although implementation increased maternal death ascertainment, studies have demonstrated potential misclassification, especially in cases lacking clinical verification^{1,2}. Differences in reporting practices and surveillance infrastructure may disproportionately affect rural communities and ethnic minority populations.

Based on prior national studies, we anticipate that pregnancy checkbox-based surveillance will produce significantly different maternal mortality estimates than additional reporting framework incorporating additional verification questions regarding pregnancy timing, pregnancy outcome, and sources of pregnancy confirmation^{1,2}. We believe there will be greater discrepancies observed in rural counties in Colorado and further expect that surveillance differences may vary across racial and ethnic groups, potentially influencing estimates of maternal mortality disparities. Finally, we hypothesize that incorporating structured verification questions into the pregnancy status section of the death certificate would reduce pregnancy-status misclassification while improving the comparability of maternal mortality surveillance across jurisdictions.

METHODOLOGY

Study Design & Data Sources

- Retrospective observational study of Colorado maternal deaths, **2013–2024**
- Colorado death certificates and vital records
- Publicly available Colorado maternal mortality surveillance data
- Maternal Mortality Review Committee (MMRC) classifications³, where available

Study Population & Variables

- Death certificates indicating pregnancy-associated or pregnancy-related mortality
- Counties classified as **urban or rural** using Colorado’s established rurality classification ⁴
- Primary geographic variables: county and rural/urban status

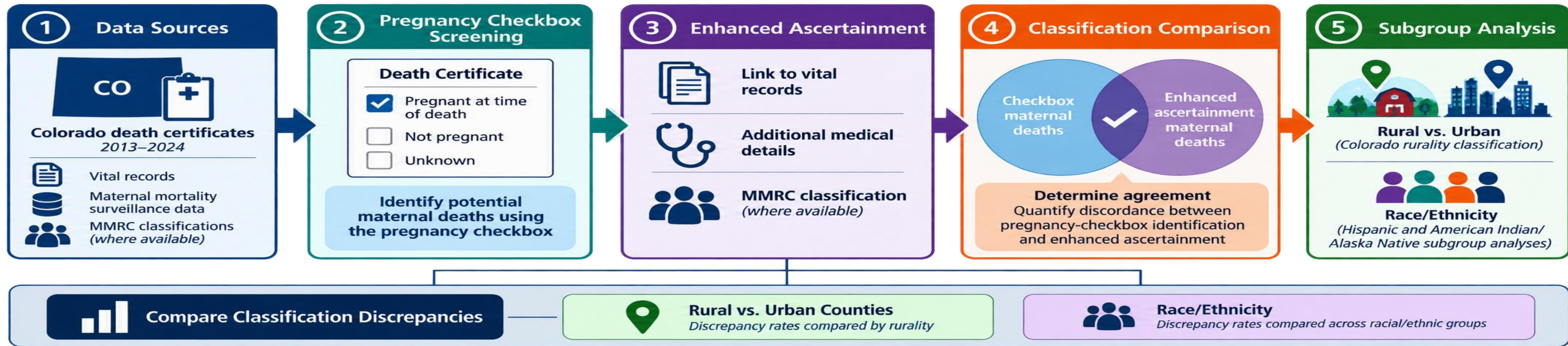
Additional variables: pregnancy-checkbox status, cause of death, pregnancy timing/outcome, and maternal-death classification

Primary Analysis

- Compare maternal deaths identified by the **pregnancy checkbox alone** with deaths identified through **enhanced ascertainment**, incorporating additional medical/vital-record information and MMRC classification when available
- Quantify discordance between pregnancy-checkbox identification and enhanced ascertainment
- Compare classification discrepancies between **urban and rural counties**

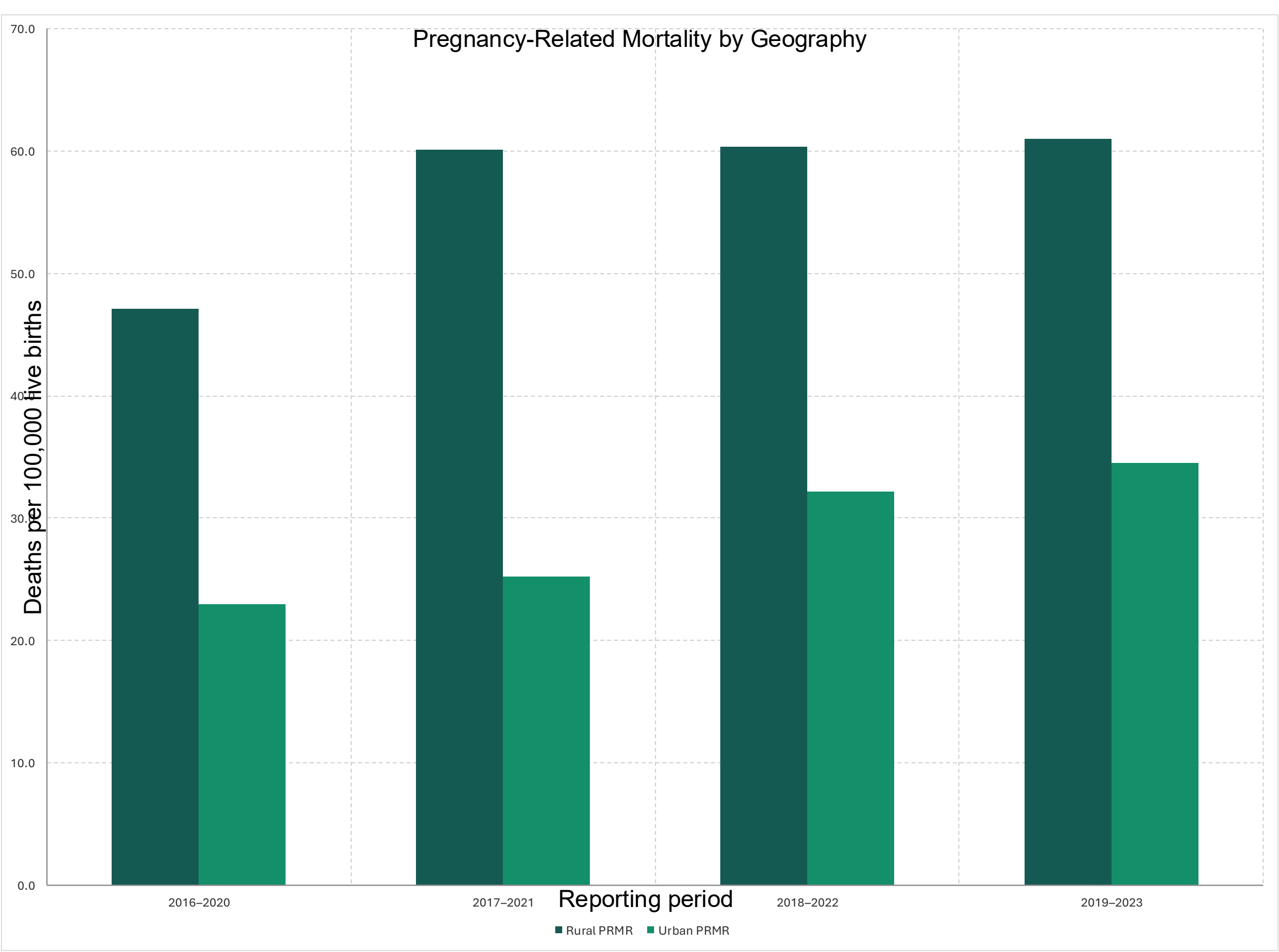
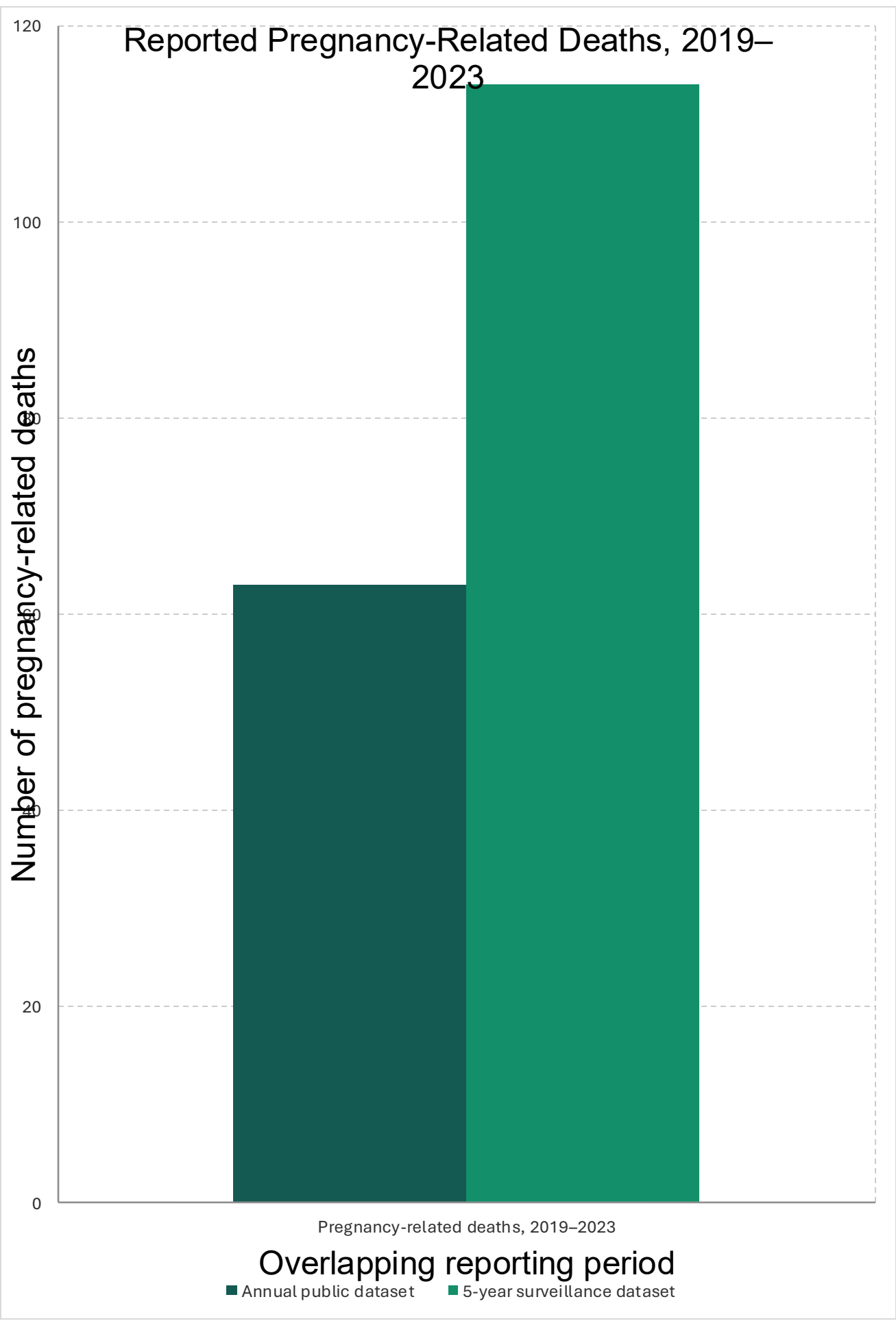
Statistical Analysis

- Construct a maternal-death database containing county, rurality, race/ethnicity, cause of death, pregnancy-checkbox status, and verified maternal-death classification
- Summarize agreement and discrepancies using counts, proportions, and mortality ratios where appropriate
- Test differences in classification between rural and urban populations and across racial/ethnic groups
- Statistical methodology will be finalized in consultation with a biostatistician



Infographic created by ChatGPT®

RESULTS



From 2019–2023, Colorado’s pregnancy-related mortality ratio was 61.0 per 100,000 live births in rural areas versus 34.5 in urban areas, 1.77 higher in rural populations^{3,4,5}. Public datasets also differed substantially, reporting 63 versus 114 pregnancy-related deaths during the same period, warranting further evaluation in ascertainment and reporting inconsistencies.

DISCUSSION

- A substantial discrepancy was observed between publicly available Colorado pregnancy-related mortality datasets, with 63 deaths identified in annual data compared with 114 deaths reported in aggregate surveillance data for 2019–2023. This 44.7% difference highlights the potential influence of case definitions, ascertainment, adjudication, and reporting methodology on maternal mortality estimates.
- Pregnancy-associated deaths substantially exceeded pregnancy-related deaths (229 vs. 114 during 2019–2023), emphasizing that identification of pregnancy status does not independently establish pregnancy-related causality. Accurate pregnancy-status documentation represents an important initial component of subsequent maternal mortality surveillance and case review.
- Geographic disparities were observed, with rural residents experiencing a pregnancy-related mortality ratio approximately 1.77 times that of urban residents during 2019–2023. **Because subgroup estimates are based on relatively small numbers of deaths, even limited case misclassification could meaningfully influence calculated mortality ratios and apparent disparities.**
- These preliminary findings support case-level evaluation of death certificates and supports the need for further investigation to determine whether observed discrepancies reflect differences in reporting methodology, case ascertainment, or pregnancy-status classification and to evaluate whether discordance varies across demographic and geographic populations.

CONCLUSION

Improved pregnancy-status verification procedures could enhance the accuracy of maternal mortality surveillance in Colorado. Findings from this study could inform future revisions to death certificate reporting practices to support more accurate identification of maternal deaths and initiate appropriate interventions, particularly in rural and historically underserved populations.

1. Joseph KS, Lisonkova S, Boutin A, et al. Maternal mortality in the United States: are the high and rising rates due to changes in obstetrical factors, maternal medical conditions, or maternal mortality surveillance? *Am J Obstet Gynecol*. 2024;230(4):440.e1–440.e13. doi:10.1016/j.ajog.2023.12.038.
2. Catalano, A., Davis, N. L., Petersen, E. E., Harrison, C., Kielytkya, L., You, M., Conrey, E. J., Ewing, A. C., Callaghan, W. M., & Goodman, D. A. (2020). Pregnant? Validity of the pregnancy checkbox on death certificates in four states, and characteristics associated with pregnancy checkbox errors. *American Journal of Obstetrics and Gynecology*, 222(3), 269.e1–269.e8. <https://doi.org/10.1016/j.ajog.2019.10.005>
3. Colorado Department of Public Health and Environment. *Maternal Mortality in Colorado, 2016–2020*. Colorado Maternal Mortality Prevention Program and Review Committee, 2023.
4. Colorado Department of Local Affairs. (n.d.). Colorado community classification. <https://cdola.colorado.gov/colorado-community-classification>
5. Colorado Department of Public Health and Environment. (2019–2023). *Colorado Health and Environmental Data*. <https://www.cohealthdata.dphe.state.co.us/>
6. OpenAI. (2026). *Roadmap of Data Collection and Interpretation*. (ChatGPT) [Infographic]. <https://chatgpt.com>