Looking Within – Analyzing Demographics Within Rural Populations

Considerations for Public Health Researchers

CDC Office of Rural Health

Purpose

This document aims to give public health researchers, analysts, and program staff clear guidance on when, why, and how to disaggregate (break down) rural data by key demographic groups—such as race, ethnicity, income, age, gender, location, and disability—when conducting public health surveillance, evaluation, or research. Rural populations are frequently treated as a single analytic group in public health datasets and reports. However, this broad classification can conceal differences and nuances within rural communities themselves. Disaggregating rural data helps uncover subgroup-specific patterns in disease burden, health behaviors, social determinants of health, and access to care. These insights are crucial for designing effective public health programs, allocating resources efficiently, and monitoring progress over time.

This tip sheet helps support the CDC's Office of Rural Health priorities and broader federal public health outcome goals. It encourages context-specific approaches that go beyond rural versus urban comparisons and look within rural populations to identify specific risk factors, protective factors, and opportunities for intervention. Identifying and addressing gaps in data visibility strengthens the scientific foundation for effective and community-specific rural health policy and practice.

Why This Matters

Rural populations in the United States are diverse and multidimensional. Treating them as a homogeneous group can miss differences in health outcomes, risk factors, and access to care. Disaggregated data:

1. Reveal **disparities** by race/ethnicity, age, geography, income, sex, and more.
2. Support **results-driven principles** that CDC's Office of Rural Health prioritizes.
3. Improve **targeting and tailoring of interventions** for underserved or high-risk groups.
4. Enable resources to be directed where they are most needed via **precision public health**.

Examples

- James CV et al. (MMWR, 2017) – Racial/Ethnic Health Disparities Among Rural Adults analyzed national survey data (2012–2015) to compare multiple health indicators within rural populations by race/ethnicity (non-Hispanic White, Black, Hispanic, AI/AN). The report documented marked differences across outcomes such as insurance coverage, preventive services, and chronic disease, demonstrating that rural residents are not a homogeneous group.
- HRSA data show stark differences in maternal mortality across rural subgroups, with rural Black women facing 2–3x higher rates than their White counterparts (HRSA MCHB, 2020).

When to Disaggregate

Disaggregating rural data helps identify differences in sub-groups, tailor interventions, and generate new hypotheses. *Consider disaggregating data when*:

1 Subgroup-Specific Outcomes Are Policy-Relevant or Intervention-Driven.
If your program or intervention focuses on specific populations—such as rural veterans, Black maternal health, or older adults, disaggregated data help evaluate impact, justify funding, and guide resource allocation.

Example: CDC's Hear Her campaign on maternal mortality prioritizes rural Black and AI/AN women due to their elevated risk. Disaggregating maternal health indicators by race and geography revealed that rural Black women in noncore counties had a **3x higher rate of maternal death** compared to rural White women, underscoring the need for culturally specific interventions[1].

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2. Disparities Are Known or Suspected.
Use disaggregation to confirm, measure, and better understand disparities previously documented in literature, surveillance systems, or community reports.

Example: Analysis of Behavioral Risk Factor Surveillance System (BRFSS) data showed that rural adults with disabilities have higher rates of smoking[2] and physical inactivity[3] . Without disaggregating by disability status, this elevated risk would be masked in general rural adult statistics.

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[1] Merkt, P. T., Kramer, M. R., Goodman, D. A., Brantley, M. D., Barrera, C. M., Eckhaus, L., & Petersen, E. E. (2021). Urban-rural differences in pregnancy-related deaths, United States, 2011–2016. American journal of obstetrics and gynecology, 225(2), 183-e1. https://doi.org/10.1016/j.ajog.2021.02.028
[2] Vander Weg, M. W., Cunningham, C. L., Howren, M. B., & Cai, X. (2011). Tobacco use and exposure in rural areas: Findings from the Behavioral Risk Factor Surveillance System. Addictive behaviors, 36(3), 231-236. https://doi.org/10.1016/j.addbeh.2010.11.005
[3] Pharr, J. R., & Bungum, T. (2012). Health disparities experienced by people with disabilities in the United States: a Behavioral Risk Factor Surveillance System study. Global journal of health science, 4(6), 99. https://doi.org/10.5539/gjhs.v4n6p99

3. Data Quality Supports Reliable Subgroup Estimates.
Disaggregate when your dataset has sufficient sample size and precision to support meaningful subgroup analysis. Look for oversampled groups (e.g., AI/AN in PRAMS), pooled multi-year estimates, or modeled data (e.g., PLACES or NHIS modeling).

Consideration: Use stratification cautiously with small subgroups—combine years or regions if needed, and always present confidence intervals.

Example: Using CDC PLACES data, researchers mapped the prevalence of diabetes among adults aged 65+ across frontier counties. Disaggregation by age revealed **localized clusters of high prevalence** that were not visible in aggregate county-level data[4].

4.You're in the Hypothesis-Generating or Exploratory Phases of Research.
In the early stages of research, disaggregation can help identify emerging patterns or unusual trends that merit further study.

Considerations: Clearly label findings from exploratory disaggregation as hypothesis-generating rather than confirmatory and avoid over-interpretation. Use these results to inform future data collection, targeted surveillance, or analytic refinement rather than definitive conclusions.

Example: In examining suicide trends in rural youth, researchers noticed **anomalously high suicide rates among rural Hispanic males aged 10–24** in specific Southwest counties[5]. This finding led to a targeted investigation into firearm access and culturally relevant mental health services in that region.

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5. Priority-Focused or Community-Centered Principles Require It.
Even when sample sizes are limited, disaggregation may be necessary to honor community-identified priorities, respond to stakeholder demands, or meet the goals of priority-focused programs.

Consideration: When disaggregating data based on community priorities, document the rationale and acknowledge any statistical limitations. Pair quantitative results with qualitative insights or community context to ensure findings are interpreted respectfully and used appropriately for planning and decision-making.

Example: In a community-led assessment in rural Alaska Native villages, residents requested data disaggregated by **language spoken at home** and **traditional subsistence practices**—variables not traditionally analyzed but essential for culturally grounded public health planning.

[4] Cuadros, D. F., Li, J., Musuka, G., & Awad, S. F. (2021). Spatial epidemiology of diabetes: methods and insights. World journal of diabetes, 12(7), 1042. https://doi.org/10.4239/wjd.v12.i7.1042

[5] Silva, C., & Van Orden, K. A. (2018). Suicide among Hispanics in the United States. Current opinion in psychology, 22, 44-49. https://doi.org/10.1016/j.copsyc.2017.07.013

Standard Demographic Variables to Consider

To uncover meaningful variation within rural populations, it is essential to consider a range of demographic variables. Below are core variables that often reveal public health disparities when stratified, along with examples of their use in practice and how they can inform analyses.

1. Race and Ethnicity.
Race and ethnicity remain powerful predictors of health outcomes due to structural differences, historical disinvestment, and ongoing differences in healthcare access, quality, and structural drivers of health.

Considerations:

- Use Office of Management and Budget (OMB) categories at a minimum. Where possible, further disaggregate within broad groups (e.g., Mexican vs. Puerto Rican vs. Central American origin).
- Collaborate with Tribal Epidemiology Centers for Indigenous-specific analyses.

Examples:

- Henning-Smith et al., Health Affairs (2019) show that rural counties with a majority of Black or AI/AN residents have significantly higher premature mortality—an explicitly disaggregated rural analysis.
- Womack et al., Public Health Reports (2019) found that infant mortality rates were consistently higher in rural areas than urban areas across most racial/ethnic groups, with the most significant rural-urban gaps among non-Hispanic Black infants.

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2. Age.
Rural areas generally have **older populations**, but age-specific trends can vary significantly and have implications for service delivery and prioritization of risk factors.

Considerations:

- Stratify at a minimum into children (0–17 years old), working-age adults (18–64 years old), and older adults (65 years old and above).
- Consider finer categories for youth suicide, maternal health, or aging-related conditions.

Examples:

- Rural youth (ages 10–24) have **disproportionately high suicide rates**, especially in the West and among males[6].
- Older adults (65+) in rural frontier counties experience **higher fall-related mortality and hospitalizations** due to environmental hazards and limited access to post-acute care[7].

[6] Silva, C., & Van Orden, K. A. (2018). Suicide among Hispanics in the United States. Current opinion in psychology, 22, 44-49. https://doi.org/10.1016/j.copsyc.2017.07.013
[7] Zhang, H., Zhao, Y., Wei, F., Han, M., Chen, J., Peng, S., & Du, Y. (2022). Prevalence and Risk Factors for Fall among Rural Elderly: A County-Based Cross-Sectional Survey. International journal of clinical practice, 2022(1), 8042915. https://doi.org/10.1155/2022/8042915

3. Sex.
Sex shapes health risks, health-seeking behaviors, care access, and exposures to violence and discrimination. Differences may be magnified in rural settings due to the scarcity of specialized providers and cultural stigma.

Considerations:

- Differentiate between sex when data is available.

Examples:

- Rural men account for a **disproportionate share of suicide and firearm fatalities,** particularly in the South and Midwest[8].

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4. Income and Poverty Status.
Economic deprivation is a powerful determinant of health and is widespread in rural areas, particularly in persistent poverty counties (i.e., counties with ≥20% poverty over the past 30 years)[9].

Considerations:

- Use federal poverty level (FPL), income-to-poverty ratio, or other income brackets.
- Consider coupling with employment status and occupation for more granularity.

Examples:

- Disaggregated BRFSS data show rural residents living below 100% of FPL are **significantly less likely to be up to date on preventive screenings**[10].
- Frontier counties with high poverty levels have higher **rates of late-stage cancer diagnoses**, often due to underinsurance and provider shortages[11].

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5. Educational Attainment.
Education influences health literacy, employment, and health outcomes, and is often lower in rural areas, particularly among older adults and in the southern United States, including Appalachia.

Considerations:

- Commonly grouped as: less than high school, high school diploma/GED, some college, and bachelor's degree or higher.
- Combine age with other factors to examine generational patterns in health behaviors.

[8] Fontanella, C. A., Hiance-Steelesmith, D. L., Phillips, G. S., Bridge, J. A., Lester, N., Sweeney, H. A., & Campo, J. V. (2015). Widening rural-urban disparities in youth suicides, United States, 1996-2010. JAMA pediatrics, 169(5), 466-473. https://doi.org/10.1001/jamapediatrics.2014.3561
[9] Braveman, P., & Gottlieb, L. (2014). The social determinants of health: it's time to consider the causes of the causes. Public health reports, 129(1_suppl2), 19-31. https://doi.org/10.1177/00333549141291S206

[10] Sepassi, A., Li, M., A. Zell, J., Chan, A., Saunders, I. M., & Mukamel, D. B. (2024). Rural-urban disparities in colorectal cancer screening, diagnosis, treatment, and survivorship care: a systematic review and meta-analysis. The oncologist, 29(4), e431-e446. https://doi.org/10.1093/oncolo/oyad347
[11] De Souza, J. A., Hunt, B., Asirwa, F. C., Adebamowo, C., & Lopes, G. (2016). Global health equity: cancer care outcome disparities in high-, middle-, and low-income countries. Journal of Clinical Oncology, 34(1), 6-13. https://doi.org/10.1200/JCO.2015.62.2860

Examples:

- Rural adults with less than a high school education have **higher smoking rates and lower flu vaccination coverage**, per BRFSS[12].
- In Appalachian counties, **lower educational attainment correlates with higher prevalence of obesity and diabetes**[13].

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6. Disability Status.
Rural adults with disabilities face significant challenges in mobility, transportation, access to care, and social participation which can impact physical and mental health.

Considerations:

- Use functional limitation categories where available (e.g., cognitive, ambulatory).
- Assess interaction with poverty, isolation, and aging.

Examples:

- CDC's Disability & Health Data System shows that rural adults with disabilities are more likely to report **unmet health care needs due to cost and lack of accessible transportation**.
- Rural children with disabilities often face **gaps in early intervention services**, especially in frontier or Tribal regions[14].

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6. Immigrant and Refugee Status.
Rural immigrant communities—such as farmworkers, meatpacking workers, or refugee resettlement populations—may face compounding barriers related to documentation, language, and discrimination.

Considerations:

- It may only be available in qualitative or programmatic data, not in national surveys.
- Consider using the **language spoken at home** or the **country of birth** as proxies.

Examples:

- During the COVID-19 pandemic, rural meatpacking towns with large immigrant populations experienced significant outbreaks, often linked to overcrowded housing and language access barriers.

[12] Takayama, M., Wetmore, C. M., & Mokdad, A. H. (2012). Characteristics associated with the uptake of influenza vaccination among adults in the United States. Preventive medicine, 54(5), 358-362. http://dx.doi.org/10.1016/j.ypmed.2012.03.008
[13] Barker, L., Gerzoff, R., Crespo, R., & Shrewsberry, M. (2011). Age at diagnosis of diabetes in Appalachia. Population Health Metrics, 9(1), 54. https://doi.org/10.1186/1478-7954-9-54
[14] Decker, K. B., Williams, E. R., Cook, G. A., & Fry, M. M. (2021). The early intervention referral process for rural infants and toddlers with delays or disabilities: A family perspective. Maternal and child health journal, 25(5), 715-723. https://doi.org/10.1007/s10995-020-03067-2

Examples:

- The CDC's Agriculture Worker Safety and Health Program has highlighted **occupational exposure risks among rural immigrant men** in agricultural communities, including exposure to pesticides/fertilizers, solvents/fuels, heat stress, and UV radiation.

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8. Geographic Subtypes.
Not all rural areas are the same. Disaggregating by geographic subtypes can reveal structural and regional disparities often obscured by broad metro/nonmetro categories.

Considerations:

- Use classifications like frontier vs. non-frontier, Appalachian vs. Delta vs. non-Appalachian, and persistent poverty status.
- Combine geography with race/ethnicity for place-based insights.

Examples:

- CDC's MMWR on Unintentional Injury showed that **frontier counties** had higher injury death rates, especially among AI/AN populations.
- Appalachian counties face **elevated opioid overdose and cancer mortality**, independent of income or education[15].

How to Do It: Practical Considerations

Disaggregating rural data requires both technical skill and thoughtful interpretation. Below are key considerations to ensure your analysis is statistically sound, meaningful, and outcome-focused:

1. Data Suppression and Small Numbers

- Disaggregated data often results in small cell sizes, which can compromise both privacy and statistical reliability.
- To assess precision, use suppression rules (e.g., n < 10) and apply confidence intervals or relative standard errors to ensure accurate results.
- To improve stability, aggregate multiple years of data (e.g., 3- or 5-year pooled estimates) to reduce the variability of the estimates.
- When direct estimates are unstable, consider using Bayesian smoothing or modeled estimates (e.g., CDC PLACES or IHME).

[15] Rengifo, S., Wu, A., Ioffreda, P., Ilyas, A. M., & ILYAS, A. M. (2023). Differences in opioid-related deaths in the Appalachian region in 2018-2021 by state and rural-urban county classification. Cureus, 15(6). https://doi.org/10.7759/cureus.40480

2. Visualization

- Effective visualizations can uncover patterns that tables alone may obscure.
- To compare subgroups within rural counties, use stratified bar charts or side-by-side maps.
- To show variation across geographies without relying on urban comparisons, apply rural-only heatmaps.
- To show overlapping identities (e.g., race × poverty) for intersectional analysis, consider dot plots or faceted graphs.

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3. Narrative Framing

- To avoid reinforcing stereotypes or pathologizing rural communities, interpret findings with care and clarity.
- Emphasize within-group variation, not just rural-urban gaps.
- Avoid deficit framing—contextualize disparities using social and structural drivers of health and historical disinvestment.
- Highlight community strengths and resilience where appropriate (e.g., kin networks, mutual aid, and informal caregiving).

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4. Intersectionality

- Explore how multiple identities interact to shape health outcomes.
- Examine race, income, and geography together (e.g., “rural Black women in persistent poverty counties”).
- To understand how structural disadvantage accumulates across populations, layer variables where possible.

When you combine statistical rigor with intentional storytelling, your disaggregated rural analyses can yield more actionable insights and contribute to achieving broader scientific and public health goals.

Cautions and Limitations

Disaggregated data within rural populations offer valuable insights. However, you must break down data carefully, transparently, and ethically. Consider this guidance as you plan and interpret subgroup analyses:

1. Avoid Overinterpreting Sparse Data

- Small sample sizes are common when disaggregating rural data, particularly for historically underrepresented subgroups (e.g., AI/AN or immigrant populations).
- When data is too sparse to produce reliable or meaningful estimates, do not force disaggregation.
- Always report confidence intervals, relative standard errors (RSE), and other measures of precision.
- If subgroup estimates are exploratory or unstable, clearly label them as hypothesis-generating or descriptive only.

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2. Acknowledge Ecological Fallacy Risks

- Many rural health data sources, such as CDC WONDER or, are available at the county or ZIP code level, but not at the individual level.
- Be cautious about inferring individual-level associations from aggregate data.
- For interpretation, consider combining geographic data with qualitative insights or community-level knowledge.

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3. Don't Pathologize Subgroups

- If not framed carefully, data disaggregation can unintentionally reinforce narratives of deficiency or dysfunction in certain rural populations.
- Shift the focus from individual "risk behaviors" to structural and systemic factors—such as underinvestment, racism, policy neglect, or service shortage areas.
- Avoid language that blames communities. Instead, highlight context, root causes, and opportunities for support.

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4. Recognize Structural Data Gaps

- Some subgroups may be invisible or misrepresented in standard datasets due to underreporting, misclassification, or the limited number of categories.
- AI/AN populations are often misclassified in vital records.
- Disability type and immigration status are rarely collected in large national surveys.
- When quantitative data is limited, work with community partners and qualitative data to fill contextual gaps.

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5. Ethical Considerations and Community Accountability

- Disaggregated data may reveal sensitive or stigmatizing findings. Ensure that your analysis aligns with community priorities and leverages appropriate review and feedback mechanisms.
- When possible, engage affected communities in the interpretation and dissemination of subgroup findings.
- Respect Tribal data sovereignty, particularly when analyzing AI/AN populations. Follow HHS Office of the Chief Data Officer Policies and Processes for Tribal Data.

Key Takeaways

- **Rural populations are diverse**. Disaggregation by race, age, income, and other demographics can reveal critical within-group differences often hidden in rural-urban comparisons.
- **Use disaggregation when it adds value**. Prioritize it when informing policy, addressing priority populations, or identifying high-need subgroups—especially when data quality supports it.
- **Consider multiple dimensions**. Race, sex, poverty, disability, geography, and intersectionality all influence rural health outcomes and access to care.
- **Balance rigor and relevance**. To ensure data are meaningful, reliable, and appropriately framed, use pooled estimates, confidence intervals, and visualization strategies.
- **Interpret ethically**. Avoid deficit-based narratives and ecological fallacies. Emphasize structural context over individual blame.
- **Acknowledge limitations**. Some subgroups may be undercounted or misclassified. Ensure transparent reporting and community-informed interpretation.
- **Addressing differences requires visibility**. Disaggregation helps make rural differences visible, actionable, and solvable—and supports CDC's broader public health goals.

Conclusion

Disaggregating rural data by demographic subgroups can be a powerful tool for advancing visibility and precision in public health. Yet with this power comes responsibility—to analyze ethically, interpret contextually, and report transparently. When we acknowledge the strengths and limitations of our data, we ensure that our work accurately describes disparities and contributes to community-informed, just, and lasting solutions.

For additional support or to explore collaboration opportunities, please contact the CDC Office of Rural Health at ruralhealth@cdc.gov.