



# Resources for Measuring Rurality in Research on Maternity Care

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## Key Findings

- A critical component of addressing rural maternal health disparities is the measurement and classification of “rurality” in public health and health services research. The way rurality is defined carries important implications for public health outcomes and the applicability of research findings.
- There is no single standard for measuring rurality in maternal health research, and each measure has strengths (e.g., availability in data, practicality) and weaknesses (e.g., discordance with residents’ lived experiences, complexity).
- Researchers should carefully consider which rurality measures best accomplish their aims, conduct sensitivity analyses around measurement decisions, and incorporate self-reported rurality measures when possible.

## Purpose

Definitions of rurality vary across research and policy, and these definitions directly affect health service eligibility, interpretation of research findings, and may impact health outcomes. The primary objective of this brief is to explore the complexities inherent in defining rurality in maternal health research. We report information about various measures and definitions commonly employed to categorize rural populations and discuss the implications of these definitions for research, public health interventions, and policy formulation. In addition, this brief aims to provide insights into how different measures of rurality influence research outcomes, with the goal of informing best practices in maternal health research.

## Background and Policy Context

Research consistently indicates that individuals residing in rural areas of the United States (US) face significantly higher risks of maternal and infant morbidity and mortality compared to those in urban areas.<sup>1-5</sup> Structural barriers, including the loss of health care services and persistent workforce shortages, have limited rural residents’ access to essential maternal and obstetric care.<sup>6-8</sup>

Accurately identifying rural populations in research is essential for advancing policy, research, public health, and clinical efforts to address geographic inequities in maternal and infant health. Such research requires careful attention to how the concept of “rurality” is measured. Rural health experts have described the complexity of assessing rurality, including how individuals and communities are categorized, and its significant implications for research interpretation, program planning, and policy decisions (including funding allocations).<sup>9</sup> As such, decisions made by maternal health researchers about how to measure rurality can have important implications for maternal health care access and health outcomes.

Researchers, as well as federal and state governments, use various definitions of rurality (e.g., Metropolitan Statistical Areas, Rural-Urban Continuum Codes, Urban Influence

Codes, Rural-Urban Commuting Area codes, Frontier and Remote Area codes) to describe populations, conduct analyses, and determine access to and eligibility for programs.<sup>10</sup> There are drawbacks to the use of any of these definitions, including the potential for misclassification. There are reasons to use different definitions – including data availability, sample size/cell size restrictions for data presentation, statistical power to detect differences, consistency with prior research, boundary stability, and practicality in applying findings in real-world contexts (for example, it is very difficult to implement programs based on ZIP codes or census tracts because these area-units do not have public health infrastructure, as exists for area-units like cities, counties, tribes, and states).

Multiple methods have been developed to classify geography. Most definitions and delineations do not actually define rurality but rather focus on urban or metropolitan area designations, and rurality is defined as “everything else” or the “absence” of urbanity. This is a limitation of many measures and reflects an urban-centric perspective. Still, many definitions and measures are commonly used in research on rural maternity care, each with distinct strengths and limitations. The descriptions below do not include all potential measures of rurality, and new measures are developed regularly. However, certain definitions and measures have been frequently used and may be important to consider.

## Commonly Used Measures in Studies of Rural Maternity Care

### Metropolitan/Micropolitan Statistical Areas

[Metropolitan and micropolitan statistical areas](#) are defined by the US Office of Management and Budget (OMB) based on population cores and adjacent communities integrated with the core by a high degree of commuting, known as core-based statistical areas (CBSAs). CBSAs, and their resulting metropolitan and micropolitan statistical areas, are composed of counties and county equivalents. These areas are reassessed regularly, and the standards and methodology for CBSA assessments are updated every ten years following the decennial census and with updated commuting data.<sup>11</sup> Historic data files for CBSA identifications are also available.<sup>12</sup>

### Urban-Rural Classification Scheme for Counties

[The National Center for Health Statistics’ \(NCHS\) Urban-Rural Classification Scheme for Counties](#) is one commonly used county-based measure that divides rural and urban counties into six categories, based on CBSAs with added information regarding the population of the metropolitan area and the size of principal cities within these areas (metropolitan categories include large central metro, large fringe metro, medium metro, and small metro; non-metropolitan categories include micropolitan and noncore). (See below for examples of research studies that have used the NCHS Urban-Rural Classification Scheme for Counties by dichotomizing the six-category scheme.)

### Rural-Urban Continuum Codes

[Rural-Urban Continuum Codes \(RUCC\)](#) are county-based measures produced by the Department of Agriculture’s Economic Research Service division (USDA ERS), which define metropolitan counties by their population sizes and non-metropolitan counties by their population densities and urban adjacency. RUCC designations are also derived from CBSAs and define rural and urban counties into nine categories – three for metropolitan counties, and six for non-metropolitan counties. (See below for examples of research studies using RUCC designations.)

### Urban Influence Codes

[Urban Influence Codes \(UIC\)](#) are also produced by the USDA ERS and are similar to RUCC designations, but are classified based on the population size of cities within each county. UICs subdivide urban counties into two categories and rural counties into ten categories.

### Rural-Urban Commuting Area Codes

[Rural-Urban Commuting Area \(RUCA\)](#) codes classify census tracts by degrees of urbanization, population densities, and the sizes and direction of population commuting flows. RUCA codes are also produced by the USDA ERS and are updated with data from the decennial census and the American Community Survey. RUCA codes delineate Census tracts as metropolitan, micropolitan, small towns, and rural following

a scale from 1-10 (1 being urban and 10 being highly rural). RUCA codes are available as an approximation for ZIP codes based on the overlap with census tract boundaries. (See below for examples of research studies using RUCA designations.)

## Frontier and Remote Area Codes

[Frontier and Remote \(FAR\) Area Codes](#) use ZIP codes to designate areas by their degree of remoteness, as defined by the amount of time it takes on average to travel via car to a nearby urban area. These codes are also updated based on the decennial census and can be useful for research on the most remote rural areas. (See below for examples of research studies using FAR codes.)

## Self-reported rurality

While there are no national standards for self-reported rurality, there is a growing recognition of the importance of gathering data on people's self-reported rurality. In 2017, the American Housing Survey began asking respondents if they considered their neighborhood to be "urban," "suburban," or "rural."<sup>13</sup> Currently, there is validation work underway for the Rural Identity Scale, developed at the University of Kentucky.<sup>14</sup> For now, several types of questions have been used to assess self-identified rurality, asking survey respondents to describe the community where they live as rural, urban, or suburban, or asking clinicians whether they practice in a rural or urban community. (More information and examples of research studies are described below.)

## Commonly Used Measures for Categorizing Rurality in Maternity Care Research

### County-based dichotomous measures

These measures classify areas simply as metropolitan (urban) or non-metropolitan (rural). Metropolitan Statistical Areas (MSAs) are designated by the OMB and are often used to distinguish between urban and rural areas, particularly in large-scale research studies. These county-based dichotomous measures typically define areas as metropolitan or non-metropolitan (metropolitan=urban, non-metropolitan=rural). Several national datasets contain county-based dichotomous measures of rurality, including the Behavioral Risk Factor Sur-

veillance System (BRFSS), the National Health Interview Survey (NHIS; in aggregate for 2019 forward), the National Health and Nutrition Examination Survey (NHANES), the National (Nationwide) Inpatient Sample (NIS; in aggregate), and the Pregnancy Risk Assessment Monitoring System (PRAMS).

Some examples of research studies that have used a county-based dichotomous measure of rurality include:

- [Obstetric Volume and Severe Maternal Morbidity Among Low-Risk and Higher-Risk Patients Giving Birth at Rural and Urban US Hospitals – Kozhimannil et al., 2023](#)
- [Rural/urban differences in rates and predictors of intimate partner violence and abuse screening among pregnant and postpartum United States residents – Kozhimannil et al., 2024](#)
- [The Availability of Midwifery Care in Rural United States Communities – Sheffield et al., 2024](#)

### County-based measures with greater detail on rurality

These measures also classify areas as metropolitan and non-metropolitan, but further subdivide non-metropolitan areas into other categories with greater detail on rurality. One common way that this type of measure is used is by distinguishing non-metropolitan counties as noncore or micropolitan, based on whether the county contains a town with at least 10,000 residents (if so, it is micropolitan; if not, it is noncore). For example, this approach is used in the NCHS Urban-Rural Classification Scheme for Counties to distinguish between types of rural counties; a non-metropolitan area with a town of 10,000-49,999 residents is designated as micropolitan, and a non-metropolitan area without a town of at least 10,000 residents is designated as noncore.<sup>15</sup> Additionally, rural areas may be classified based on adjacency to urban counties, which adds another layer of nuance to the understanding of rurality. This common method distinguishes non-metropolitan counties based on whether they are adjacent to urban counties (if so, they are urban-adjacent; if not, they are non-adjacent). Some measures combine these two approaches, incorporating both population

size and urban adjacency into county-based measures of rurality. For example, RUCC designations combine information on the size of a county's population that lives in an urban center (referred to as the "degree of urbanization") with whether the county is adjacent or not adjacent to a metropolitan area; depending on this combination, rural counties may be classified according to six possible designations of non-metropolitan areas.<sup>16</sup> Examples of maternity care research studies using these types of county-based measures with greater detail on rurality are shown below.

Several national datasets contain detailed county-based measures of rurality such as these, including the Area Health Resource File (AHRF), the Centers for Disease Control and Prevention's Wide-ranging Online Data for Epidemiologic Research (CDC WONDER), the County Health Rankings (CHR), and the Surveillance, Epidemiology, and End Results (SEER) Program Populations. Additionally, there are other data sources that require purchase and/or data use agreements, including the American Hospital Association's (AHA) Annual Survey, which can potentially be linked to birth records or other data sources for analyses of rural maternal health.

Some examples of research studies that have used a county-based measure of rurality, distinguishing between noncore and micropolitan counties, include:

- [Loss of Hospital-Based Obstetric Services in Rural Counties in the United States, 2010-2022 – Kozhimannil et al., 2024](#)
- [Closure of Hospital Obstetric Services Disproportionately Affects Less-Populated Rural Counties – Hung et al., 2017](#)
- [State Variability in Access to Hospital-Based Obstetric Services in Rural US Counties – Hung et al., 2017](#)

Some examples of research studies that have used county-based measures of rurality, distinguishing between non-metropolitan counties that are adjacent and non-adjacent to metropolitan counties, include:

- [Association Between Loss of Hospital-Based Obstetric Services and Birth Outcomes in Rural Counties in the United States – Kozhimannil et al., 2018](#)
- [Rural Residency as a Risk Factor for Severe Maternal Morbidity – Hansen et al., 2022](#)

Some examples of research studies that have used county-based measures of rurality using *both* population size and urban adjacency include:

- [Birth Volume and Geographic Distribution of US Hospitals With Obstetric Services From 2010 to 2018 – Handley et al., 2021](#)
- [Characteristics of US Rural Hospitals by Obstetric Service Availability, 2017 – Kozhimannil et al., 2020](#)
- [American Indians Travel Great Distances for Obstetrical Care: Examining Rural and Racial Disparities – Thorsen et al., 2023](#)

### Measures based on census tracts and/or ZIP codes

These measures, based on area-units that are geographically much smaller than counties, can provide more granular data on differences and diversity within non-metropolitan areas compared to county-based measures. The level of detail these measures can provide is valuable; however, a potential drawback of these measures is that they are often difficult to translate into clinical and policy actions, as census tracts and ZIP codes are not often used as geographic boundaries in decision-making. There are very few publicly available datasets that contain this level of granularity for geographic measurements, though some restricted datasets may include information on census tracts and ZIP codes. One potential advantage of ZIP code-based measures is that in primary data collection, respondents may be able to provide a ZIP code, which can be linked to level of rurality using these measures, and in some cases, respondents may be more comfortable providing ZIP code information than exact address information.



The Federal Office of Rural Health Policy (FORHP) defines rural areas using a combination of metropolitan/non-metropolitan county designations and census tract-level designations to provide more granular detail about rurality in geographically large counties. For example, FORHP defines a census tract as rural if it is located in a large (greater than 400 square miles) county with a small population density (35 or fewer people per square mile) despite being designated as a metropolitan county by RUCA code.<sup>17</sup>

Some examples of research studies that have used measures of rurality based on census tracts and/or ZIP codes include:

- [Associations Between Maternal Residential Rurality and Maternal Health, Access to Care, and Very Low Birthweight Infant Outcomes – Ondusko et. al., 2022](#)
- [Assessing the Relationship Between Census Tract Rurality and Severe Maternal Morbidity in California \(1997-2018\) – Berkowitz et. al., 2024](#)
- [Trends in Patient Perceptions of Care Toward Rural and Urban Hospitals in the United States: 2014-2019 – Li et. al., 2024](#)

### Self-reported rurality

Self-report is an important measure of rurality that has been underutilized in research. County-based measures, in particular, are commonly used in programs and research because they align with administrative units (federal, state, and local programs are often administered at the county level). County-based measures are also widely available and consistently measured in datasets. However, US counties vary tremendously in size and population density,<sup>10,18</sup> which is why county- and census tract-level designations of rurality for a particular area may differ.<sup>19</sup> Many people who logically consider themselves rural residents live in a remote part of a county that also contains an urban center and is thus classified as “metropolitan.” Use of measures that include sub-county level designations (such as census tracts) can help address this, but no externally defined measure can perfectly capture individuals’ own expe-

riences with their rurality. While self-reported rurality has generally not been widely used, and has been used sparsely in maternal health-related research, the following are some examples of research studies in other disciplines that have compared self-reported rurality with other commonly used measures:

Comparing self-reported rurality with the NCHS Urban-Rural Classification Scheme for Counties, RUCC designations, and ZIP code measures:

- [Evaluating What Makes a US Community Urban, Suburban or Rural – Igielnik et al., 2019 \(Pew Research Center\)](#)

Comparing self-reported rurality with RUCC designations:

- [The Rural Identity Scale \(RIS\): Development and Validation – Oser et al., 2022](#)

Comparing self-reported rurality with ZIP code based RUCA designations:

- [Concordance of Rural-Urban Self-identity and ZIP Code-Derived Rural-Urban Commuting Area \(RUCA\) Designation – Onega et al., 2019](#)

Comparing self-reported rurality with census tract-based RUCA designations:

- [Self-Reported vs RUCA Rural-Urban Classification among North Carolina Pharmacists – Castle & Tak, 2021](#)

### Discussion and Implications

Measuring rurality effectively in public health and health services research is necessary, particularly given increased attention at the federal government level to respond to rural health needs. Effective measurements of rurality are also critical for maternal and infant health research in the US, especially given rural-urban disparities in negative maternal and infant health outcomes<sup>1-5</sup> and health care access<sup>6-8</sup> around the time of pregnancy.

Notably, the CDC released its inaugural Rural Public Health Strategic Plan in 2024, which includes a focus

on incorporating measures of rurality into the CDC's data collection, analysis, and reporting procedures.<sup>20</sup> The CDC's new goals around measuring rurality are welcomed, as many national datasets currently do not release granular levels of geographic data without extensive approval processes. Such limitations are usually related to data privacy; geographic identifiers are often suppressed for individuals residing in sparsely populated counties due to re-identification risk. Due to these extensive approval processes for accessing information about smaller geographic units, applying for data access and entering into data use agreements can take many months and require substantial financial resources. These lengthy and often costly pre-approval processes can limit access to data on rurality and reduce the amount of work that can be completed within a project's budget and timeframe. This potentially reduces the chances of successfully competing for grant funding for research on rural populations – especially rural subpopulations – and less research results in a more limited understanding of residents of the most sparsely populated or remote counties.

As such, it is important to rural health researchers that the CDC and other entities continue to prioritize the inclusion of multiple and more specific measures of rurality in publicly available datasets. To enable an assessment of rurality while protecting individual data privacy, researchers can use aggregate measures of rurality (like a dichotomous county-based variable) within larger geographic units (like states). Such creative solutions and data innovations are integral to research on maternity care, where the highest risks often occur at the intersections of rurality and other factors (from individual sociodemographic characteristics to state policies).

There is no gold standard for measuring rurality in maternal health research, presenting both challenges and opportunities. Each measure has its own set of limitations, including the risk of misclassification and varying levels of granularity. While commonly used, county-based measures may fail to capture important geographic and demographic nuances of metropolitan and non-metropolitan areas. Self-reported rurality offers an alternative approach, as it accounts for individuals' lived experiences, which may differ from administrative classifications. Though its application in maternal

health research remains limited, preliminary studies indicate that a significant percentage of individuals who self-identify as rural live in counties classified as metropolitan, underscoring the potential benefits of considering self-reported rurality in research.

Researchers must select the rurality measures that best align with their study objectives, available data, and the policy context. Using an administrative unit like a county may be advantageous for policy-related decision-making, while other measures might offer advantages related to maintaining consistency with previous research or capturing specific aspects of rurality, such as distance from urban centers, population density, commuting patterns, or geographic features. Conducting sensitivity analyses using various measures of rurality can enhance the robustness of findings in research on rural populations. These comprehensive efforts are critical for informing policies that aim to improve maternal and infant health outcomes in rural areas.

## Conclusion

Given the diversity of rural places, no single measure can meet the needs of all research projects or communities. However, it is crucial to continue advancing rural maternal health research by evaluating the consistency of findings across different measures of rurality. Incorporating multiple measures, conducting sensitivity analyses, and including self-reported rurality in data collection and analyses will strengthen the evidence base for developing more effective research, programs, and policies aimed at improving maternal and infant health equity for rural residents.

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## RECOMMENDED RESOURCES

The following resources offer valuable insights into the complexities of defining rurality and can assist researchers and policymakers in selecting appropriate measures for their specific contexts.

### [The How Does the Definition of "Rural" Impact Research? \(ruralhealthresearch.org\)](https://ruralhealthresearch.org)

This comprehensive document from the Rural Health Research Gateway explains the differences between various nationally available measures of rurality.

### [Am I Rural? Tool \(ruralhealthinfo.org\)](https://ruralhealthinfo.org)

Specific addresses can be entered into this tool, operated by the Rural Health Information Hub, to determine whether a location is considered rural based on various definitions of rurality (e.g., definitions used for eligibility criteria for federal programs).

### [Measuring Rurality in Health Services Research: a Scoping Review – Danek et al., 2022](#)

This paper presents a scoping review of studies in leading health services research journals that measure rurality.

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