# APPENDIX A. DATA ABSTRACTION FORM

| Name of Study | | | | | | Check if Background paper ☐ |
|---|---|---|---|---|---|---|
| Journal | | First Author | | Year | | Inclusion Eligibility? Y N If "No", what #? |

| Study Design | Cohort | Cross-sectional | Case-control | RCT | Non-RCT | Review/Meta-analysis |
|---|---|---|---|---|---|---|
| | | | | | | |

| | Unit | # sites/ national? | Sample size | Inclusion/Exclusion Criteria | Vet? | Rural/ urban? | Rural definition used |
|---|---|---|---|---|---|---|---|
| Sample | | | | | Y N | Y N | |

| | Registry | Survey (note response rate) | Health care Records | Primary vs. secondary | National database (define) | Date(s) of dataset |
|---|---|---|---|---|---|---|
| Data Source | | | | 1° 2° | | |

| | Stat method | Adjusted Covariates/Independent Variables | | |
|---|---|---|---|---|
| Analyses | | | Appropriate Stats? | Y N N/A |
| | | | Adjusted for sampling bias? | Y N N/A |
| | | | Adjusted for non-response bias? | Y N N/A |
| | | | Adjusted for clustering? | Y N N/A |

| | Findings: Include outcome measures and, if appropriate, magnitude of effect. |
|---|---|
| Outcome Measure | |

| Question | 1 | 2 | 3 | 4 | 4a |
|---|---|---|---|---|---|
| | | | | | |

# APPENDIX B. PEER REVIEW COMMENTS AND AUTHOR RESPONSES

| REVIEWER COMMENT | RESPONSE |
|---|---|
| **1. Are the objectives, scope, and methods for this review clearly described?** | |
| Yes. This is a good review. | Thank you. |
| Yes, although I think it will be important to highlight that this review is comparing the care of rural vs. urban patients in general, and that *data for rural vs. urban veterans are even more sparse and therefore one cannot infer that rural veterans face the same disparities in care as rural non-veterans.* | We agree, and have clarified this in the text. |
| Yes | |
| Yes. The objectives, scope, and methods make sense and are useful for researchers, providers, and policymakers. More work of this kind is needed. It is not clear why only ambulatory care articles were included in the study selection when some of the topics were relevant beyond only ambulatory care. The repeated mention of inconsistencies and other problems related to definitions of rurality and the way "rural vs. urban" is viewed conceptually were very important. More detailed suggestions about what needs to be done to address this (e.g., how will consensus be reached) would be helpful. More explicit information is needed about the study selection, data abstractions, data synthesis, and rating of the body of evidence. It would be hard to replicate this review with the information given. | We focused on ambulatory care. Including hospital care would have made the review unwieldy and too diffusely focused. That being said, some traditionally non-ambulatory care topics were included because they were indirect indicators of ambulatory care access and/or quality (e.g., hospitalizations for ambulatory care sensitive conditions). We have further clarified our methodology in the text. |
| a. Yes, though the methods could be expanded. It is difficult to assess the quality or thoroughness of the search for relevant articles, as the description of the process is minimal. Data abstractions were done by "researchers trained in critical analysis of the literature," but there is no description of the training or of the qualifications of the abstractors. There is a bit more description of the evaluative ratings of the studies that were reviewed, but no mention of who did these ratings or of any inter-rater reliability.<br>b. Another concern is that the tables in which you present your ratings of the quality of the studies do not seem to be reflected in the text. For example, in a table, you give two studies low confidence ratings. But in the text, there is no indication that there may be problems with those studies. As one reads the text, the only way he would know that you have doubts about the quality of these studies would be to continually refer to the table at the end of the section. Few readers will do this. Within each section of text, you might want to segregate the good studies form the bad ones so the reader will know which ones to rely most on. | These are both excellent points and we have made relevant revisions in the text. |
| Yes | |
| Yes | |
| Yes | |
| **2. Is there any indication of bias in our synthesis of the evidence?** | |
| No | |

| REVIEWER COMMENT | RESPONSE |
|---|---|
| No. This is a balanced and objective review that highlights the lack of good information and the inability to draw any firm conclusions. | Thank you. |
| No | |
| While there is no strong indication of bias, sources of bias could be better protected against through specific efforts. The methods used for review would be strengthened by blinding reviewers to both author and journal. Inter-rater reliability could be tested by more than one reviewer reviewing the same articles. It is unclear what preparation the reviewers had and how the reviewers were instructed and trained for this purpose. The term "trained reviewer" is used several times without much explanation about what that means. There is variation in that term. | We have elaborated on the methodology in the text to address the issues raised. The first and second authors rated all papers after jointly rating 20 to achieve consensus in our ratings.<br>Since there is no evidence based rating system for non-randomized trials, we had to develop our own. In the text, we acknowledged that the ratings were qualitative in nature and that their primary value was to explicate to the readers the bases of our evaluations. |
| No – as you note, the evidence is pretty inconclusive. | |
| No | |
| No. There really is a lack of good published evidence. One problem, however, is that the synthesis does not include operational products within agencies (i.e., white papers, special studies). In the VA, for example, OQP have conducted internal analysis of clinical quality and patient satisfaction metrics and generally found no differences between patients residing in rural and urban areas. | The task was to develop a synthesis of the existing published peer-reviewed evidence base. We did, however, examine studies conducted by OQP and AHRQ, and have commented on the findings of those reports in our discussion. |
| No | |
| **3. Are there any published or unpublished studies that we may have overlooked?** | |
| Not that I am aware of. | |
| I realize the scope of his review was on published, peer-reviewed literature but reports issued by government agencies that have undergone internal review should perhaps be considered particularly for "high level" views of disparities. The AHRQ National Health Disparities Report, as well as the VHA-published Hospital Report Cards for 2008-2010 are worth consulting. The VHA report cards include breakdown of our performance measurement system (including process and satisfaction results) by rural vs. urban residence. | As noted above, we have now examined studies conducted by OQP and AHRQ, and have commented on the findings of those reports in our discussion. |
| It would also be helpful to expand the scope beyond the three data sources used and include more hand searching (some was done). Inclusion of relevant dissertation research would be helpful. Assuring that negative findings are included (since there is publication bias) would strengthen the findings. | While we agree that information from well controlled studies that did not make it to publication because of negative findings would be informative, the systematic nature of the evidence based synthesis report precludes the use of non-peer reviewed literature. |
| None that I can think of. | |
| The library of articles on telehealth, including telephone management. | When we began the literature review for this report, a separate report was being developed to cover the telehealth literature. |

| REVIEWER COMMENT | RESPONSE |
|---|---|
| See comment above about operational products within agencies. Some of these results are available in the public domain such as Data.gov and on VA Websites. | See comments above. |
| This is a very complete review. | Thank you. |
| **4. Are there any clinical performance measures, programs, quality improvement measures, patient care services, or conferences that will be directly affected by this report? If so, please provide detail.** | Thank you – we will share the responses to this question with the people responsible for dissemination of the report. |
| No | |
| OQP plans to use this evidence review to inform our own measurement systems and reports, and will be particularly careful in our use of risk adjustment procedures that may "adjust away" the impact of rurality. We are also working closely with the Office of Rural Health to create more robust indicators of rural health disparities and believe the partnership will be strengthened by this report. | |
| Results should influence a) findings presented at annual HSR&D national meetings and b) programs funded by the Office of Rural Health | |
| This report should be disseminated widely and used as the basis for creating an agenda for systematically closing gaps in both knowledge and practice. VA's various centers (e.g., VERCs and QUERI groups) can use this report to help focus their efforts and assure that their work is applicable to veterans in rural and highly rural areas. | |
| Not that I am aware of. | |
| This paper has the potential to significantly impact and direct future directions in rural health research and rural health clinical implementation and quality improvement efforts. | |
| **5. Please provide any recommendations on how this report can be revised to more directly address or assist implementation needs.** | |
| a. I recommend leaving out studies that you do not believe contribute. It becomes hard to pick up on the important, relevant findings when everything is presented. Several of the studies were of different provider types not urban/rural differences in health care in my opinion. I also think that more clearly weighting and emphasizing the studies that you believe really are valid and generalizable would improve this paper.<br>b. I think you should add a quality rating column to your evidence tables. It is hard to go back and forth. I would like to see good summary tables in the text when possible. | We have clarified study quality within the text and have added the final Confidence Score rating to our evidence tables to assist readers. |
| You may be able to give more specific recommendations to policy makers, such as which definition of rurality to use, as well as specific advice on how to adjust for patient mix so as not to submerge important rural/urban disparities. | It is our belief that the convention to be used in studies for the categorization of population density cannot be determined by this review and likely will vary depending on the type of study being conducted. Similarly, case mix adjustment depends on the focus of the study (e.g., whether or not to adjust for travel distance) will vary depending on the focus of the study. |

| REVIEWER COMMENT | RESPONSE |
|---|---|
| It would be helpful if there were tables (similar to the ones presenting the strength of evidence) with a + or a – or a NS, indicating which studies found significant rural-urban differences in the main constructs examined. This would allow the reader to get a quick visual on how many and what proportion of studies found differences in diabetes outcomes, for example. | We have added '+' and '-' indicators to our tables to assist readers. |
| Section a beginning on page 49 seems out of place in a summary section. Perhaps it would fit better directly after page 45. | When we began this report, a separate systematic review was to be conducted on telehealth interventions. For this reason, we chose to NOT evaluate telehealth studies and to focus instead on other types of interventions. However, since that review was not conducted, we agree with reviewers that examining only non-telehealth interventions makes little sense and so we have excluded that section from the final report. |
| This is a very dense report with lots of information. I liked the way the authors categorized their review by both their main questions and by disease categories within those. Some specific comments/suggestions:<br>a. Spell out their search terms – saying standard search terms isn't enough<br>b. Specify that you used the VA definition in the intro when you say 40% of veterans are rural<br>c. Even though it's already very long, the review really does lack the whole piece on telehealth that the VA in particular uses to compensate for in-person ambulatory access deficits. At least need to explain why you left that out.<br>d. Since this is a VA report, it might be helpful to segregate VA and non-VA studies within each category, or at least put asterisks on VA studies to denote them. Even saying they looked at "veterans" doesn't say for sure they were looking at VA services, or even VA users.<br>e. In terms of interventions, I didn't see a section on that to be able to give feedback on. I assume this would be the place to include telehealth. This may call for a separate literature review to include all telehealth terms and not rely on "rural" "urban" terms to get at the articles they want.<br>f. The point about paucity of prospective (or even longitudinal but non-interventional) studies is really important. I think this is where HSR&D should make the point (to ORH) that improving care and access to rural veterans is not just about observing and recording what's out there, but about planning interventions and prospectively evaluating their effect on rural veteran's health and access. | We have clarified our methods and the reasons why a review of telehealth interventions were not included. The section on interventions was removed for the reasons noted above.<br>There were an insufficient number of studies conducted within VA to separate them. However, we specifically note VA studies when they were reviewed. |
| Inclusion of non-published results per above comments. Because of the complexity of the issues, report should strongly recommend thoughtful "risk adjusted" analysis | Implications for risk adjustment have since been emphasized in the report. |
| **Additional Comments:** | |
| The finding that continuity of care was reported for rural residents although there was no evidence that they were more likely to have a usual source of care seems incongruous | The distinction has now been clarified in the text. |
| "Among the findings were higher rates of invasive cancer related to lower rates of screening" – Please specify – did the findings really link these two? | Yes, for cervical and breast cancers as we note. |

| REVIEWER COMMENT | RESPONSE |
|---|---|
| "Potential interactions of rurality and race (and/or income) should be considered." – You might comment that this area of research (at least evaluating outcomes) is extremely prone to confounding eg. people may move to urban settings when ill/needing more health care or, people who chose rural locations might make other health care choices than those choosing an urban setting | This was noted in the discussion. |
| "It remains to be determined, however, whether the observed lower health quality of life among rural veterans is due to differences in disease prevalence, disparities in health care or both." Or, different people choose different locals to live in. it is more complex than this in my opinion | We agree, and further clarified this in the text. |
| Regarding the literature search strategy figure, do you think there would be any value in adding more arrows to the bottom box telling what category the papers fell into? | We feel this might increase confusion. |
| The Institute of Medicine definition of disparity does not include variation due to differences in access (IOM, 2003). -Not sure I agree with this statement. I thought the IOM focused on all differences in utilization that were not due to differences in need and preference. I would just drop this sentence and the next | The specific reference was clarified in the text. |
| It might be nice to rate the relevance of the evidence to veterans. Perhaps each summary could start with the VA study or state that no VA study exists. | We specifically indicated which studies focused on veterans. Since many veterans use non-VA care and many of those who use VA split their care between VA and community providers, all studies are potentially relevant to veterans. |
| Mental Health section: Two studies were missed from the Journal of Rural Health that I think are important. One is a VA study.<br><br>Cully JA, Jameson JP, Phillips LL, Kunik ME, Fortney JC. Use of Psychotherapy by Rural and Urban Veterans. Journal of Rural Health, 26(3): 225-233, 2010.<br><br>Fortney JC, Harman JS, Xu S, Dong F. The Association between Rural Residence and the Use, Type, and Quality of Depression Care, Journal of Rural Health,26(3): 205-213, 2010. | These studies were published after our March 2010 pull date. However, given their relevance we note their findings in the discussion. |
| This study found higher suicidality in rural versus urban: Rost, K., M. Zhang, et al. (1998). "Rural-urban differences in depression treatment and suicidality." Medical Care 36(7): 1098-1107. | This study, which was already included in the review, was added to the section covering suicidality. |
| Here are two papers showing that rurality is related to hospitalization rates for depression and schizophrenia:<br><br>Fortney J, Rushton G, Wood S, Zhang I, Xu S, Dong F, Rost K. Community-Level Risk Factors for Depression Hospitalizations. Administration and Policy in Mental Health and Mental Health Services Research, 34(4): 343-352, 2007<br><br>Fortney J, Xu S, Dong F. Community-Level Correlates of Hospitalizations for Persons with Schizophrenia , Psychiatric Services, 60(6): 772-778, 2009. | We included these per your recommendation; however, the methods used were only suggestive regarding reasons for differential hospitalization rates in rural vs. urban areas. |
| "Moreover, while rural residents were found to receive fewer MH services than urban residents in several studies, the clinical impact of this difference was unclear." - See this article: Fortney J. Rost K. and Zhang M. The Impact of Geographic Accessibility on the Intensity and Quality of Depression Treatment. Medical Care 37(9):884-893, 1999. | We have now included this article in our review. |

| REVIEWER COMMENT | RESPONSE |
|---|---|
| Regarding CBOCs and VAMCs This study is actually the better study, as it is quasi-experimental:<br><br>Fortney J, Maciejewski M, Warren J, and Burgess J. Does Improving Geographic Access to VA Primary Care Services Impact Patients' Patterns of Utilization and Costs? Inquiry, 42(1):29-42, 2005 | The relationship between CBOC placement and rurality is not uniform, which is why we did not include this interesting article in our review. |
| Travel Distance - There are actually lots and lots of travel distance articles which you didn't find because you were searching for rural vs urban studies. You might need to either drop this or expand your search. | We agree that our search terms did not allow us to comment sufficiently on this topic. |
| "There is some weak evidence that urban residents have a lower threshold for seeking mental health care than do rural residents" - I don't really believe this. Severity at intake is not different between rural and urban patients. | We are aware of no studies that actually asses provider availability and patient treatment attitudes and needs in urban and rural residents and then associate those differences with use of mental health services. |
| "As has been shown by others (Weeks, Wallace, 2008; Berke, 2009; Stern, 2010) the definition of rural that is used in a study has a significant impact on the findings and, consequently, the policy implications." - I would also reiterate that rural is a proxy for many different things (travel time, stigma, lack of insurance, etc.), and that the rural vs urban literature does not determine what underlying factors are driving the findings. | We have clarified this in the report. |
| "Because many factors are correlated with rurality, adjusting for all available covariates may lead to false conclusions regarding the association of rurality and study outcomes, and provide insufficient information for the development of healthcare policy. For most research questions, a more contextual analytic approach should be used." – Good observation! Might want to include this point in the executive summary. | Thank you for this recommendation. We have now done so. |
| Where possible use data / numbers (and indicate statistical significance, if appropriate) instead of phrases like, little difference, or increased rates etc. or give the page number where the specific data is found later in the document | We have tried to improve the clarity of findings in the report. |
| "However, all but one study found a greater frequency of unstaged cancer at the time of diagnosis in rural areas compared to urban areas." - I think it would be good to mention the outcomes (present or absence of data) on how this finding affects mortality | No information about the implications of unstaged disease for outcomes were made in the papers reviewed. The odds of unstaged disease was not a primary focus of the studies, but was an incidental finding. |
| "Moreover, health care systems operate locally and identifying areas where problems are greatest would help policy makers target areas that have the most need." - Rurality may very well be different in various parts of the country i.e. rural Alaska is different than rural Mississippi etc. | We think these differences have received very little attention. |

# APPENDIX C. EVIDENCE TABLES

## Appendix C, Table 1. Preventive Care/Ambulatory Care Sensitive Conditions

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Casey, 2001[18]<br>Cross-sectional | N = 130,452 respondents<br>Exclusion: respondents whose BRFSS records could not be linked to ARF data using county Federal Information Processing Standard (FIPS) codes<br>Nationwide | National data from the 1997 Behavioral Risk Factor Surveillance System (BRFSS) and the 1999 Area Resource File | Urban = Metropolitan Statistical Area (MSA)<br>Rural adjacent: non-metropolitan county physically adjacent to metropolitan<br>Rural nonadjacent county | Age, gender, education, Income, race/ethnicity, insurance coverage, primary care physicians/1000 population, census region | High | Influenza vaccination in the past year for women ≥ 65 years old (-)<br>Pneumonia vaccination for women ≥ 65 years old (-) |
| Epstein, 2009[27]<br>Cross-sectional | N = 1,508<br>Inclusion: stratified random sample of 200 women who gave birth to a live child 60-100 days before selection date<br>Oregon | 2003 Oregon Pregnancy Risk Assessment Monitoring System<br>Oregon Birth Certificate database<br>Response: 65.8% | Rural-Urban Commuting Area Codes: urban, large rural, or small/isolated rural | Age, marital status, education, Hispanic ethnicity, intended or unintended pregnancy, household income, questionnaire language | Low/ Moderate | Late initiation of prenatal care (-)<br>Barriers to prenatal care initiation (-) |
| Laditka, 2009[28]<br>Cross-sectional | Inclusion: counties with ≥ 1,000 for analyses of children and adults <65 yrs; counties with ≥ 500 for analyses of adults 65+<br>Colorado, Florida, Kentucky, Michigan, New York, North Carolina, South Carolina, and Washington | Hospital discharge data for 2002 from State Inpatient Databases (SIDS); Area Resource File (2002); U.S. Census Bureau; U.S. Census Bureau's Small Area Health Insurance Estimates | 2003 Urban Influence Codes (U.S. Department of Agriculture) with 7 levels from large metro to most rural | Hospital bed supply, hospitals with EDs, health maintenance organization penetration, presence of community health center or rural health center, race, education, population density, unemployment, state fixed effects | Moderate | Hospitalizations for ambulatory care sensitive conditions – ages 18 to 64 (+); R>U<br>Hospitalization for ambulatory care sensitive conditions – ages 65 and older (+); R>U |
| Saag, 1998[29]<br>Cross-sectional | N = 787<br>Inclusion: home-dwelling elderly (age > 65 years), ≥ 1 of the indicator conditions, resident of state's 12 most rural and 10 most urban counties<br>Iowa | Population based phone survey evaluating six common chronic indicator conditions (arthritis, hypertension, cardiac disease, diabetes mellitus, peptic ulcer disease, and chronic obstructive pulmonary disease)<br>Response: 57% | U.S. Department of Agriculture continuum codes.<br>Urban: metro areas with > 250,000 residents<br>Rural: <2,500 residents in a single incorporated place and not adjacent to metro areas | Age, gender, education beyond high school, living on a farm, alcohol use, smoking in the past, medical advice needed in the past year, supplemental private insurance, medication coverage, Medicaid, VA clinic in the past year, Distance from physician, congregate meals, Use of Meals on Wheels, Homemaker service | Low | Continuity of care (seeing same physician) (+); R>U<br>Appointments with specialists (+); R>U<br>Perceived need for medical advice (+); R<U |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Schreiber, 1997[30]<br>Cross-sectional | N = 1,461 Zip Codes with population >300<br>New York | New York State Department of Public Health; U.S. Census Bureau 1990 | Six point urban-rural scale based on population, size of largest city/town, % of workforce that commutes outside the county; grouped to New York City area, upstate New York urban-suburban, and more remote rural | % of population in poverty, population density (population per square mile, % blacks, number of primary care physicians per 1,000 population), location of ZIP code (within 8 miles of hospital, within a health professional shortage area [HPSA]) | Low | Ambulatory Care Sensitive Conditions (ACSC) admissions:<br>a) increased as population density decreased within each of the 3 defined regions (+)<br>b) increased as percentage of black residents increased (+) except in the most rural group (-)<br>c) increased as number of primary care physicians per 1000 increased (+) |
| Zhang, 2000[19]<br>Cross-sectional | N = 4,051<br>Inclusion: men and women aged 65 or older<br>Nationwide | 1994 National Health Interview Survey (NHIS)<br>Overall response: 79.5% | U.S. Office of Management and Budget's (MSAs and non-MSAs) | Census region, education, household income, insurance status, overall health status | Moderate | Flu shots received in previous year (-) |

*See Methods section for explanation

**U=Urban; R=Rural; HR=Highly rural; F=Frontier; S=Suburban; (+)=difference statistically significant; (-)=difference not statistically significant

## Appendix C, Table 2. Cancer Screening

| Author, Year Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/ Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Brown K., 2009[20]<br>Cross-sectional | N = 1,922 women (620 rural)<br>Inclusion: Non-Hispanic whites and non-Hispanic black, age ≥40, reporting screening mammography or no mammography<br>Tennessee | Behavioral Risk Factor Surveillance System (BRFSS) 2001 and 2003 | Rural-Urban Continuum Codes (RUCCs) – collapsed to 2 levels: rural or urban | Age, race/ethnicity, marital status, education, employment, health status, smoker, health insurance, personal health care provider | Moderate | Screening mammography utilization (-) |
| Casey, 2001[18]<br>Cross-sectional | N = 130,452 respondents<br>Exclusion: respondents whose BRFSS records could not be linked to ARF data using county Federal Information Processing Standard (FIPS) codes; California data on mammograms and (Pap) tests (state had modified wording of those questions) | National data from the 1997 Behavioral Risk Factor Surveillance System (BRFSS) and the 1999 Area Resource File | Urban = Metropolitan Statistical Area (MSA)<br>Rural adjacent = nonmetropolitan county physically adjacent to metropolitan<br>Rural nonadjacent county | Age, gender, education, income, race/ethnicity, insurance coverage, primary care physicians/1000 population, census region | High | Colon cancer screening for women and men age ≥50 (+); U>all R<br>Cervical cancer screening for women age > 18 (+); U>all R<br>Mammogram for women age ≥50 (+); U>non-adjacent R |
| Coughlin, 2008[23]<br>Cross-sectional | N = 97,820 (Pap smears), 91,492 (mammography)<br>Inclusion: reported county of residence<br>Pap smears-women with known Pap test status, ≥18 yrs, no history of hysterectomy Mammography-women with known mammography screening status, ≥40 yrs<br>Nationwide excluding Alaska, including District of Columbia | Behavioral Risk Factor Surveillance System (BRFSS) 2002<br>Area Resource Files (ARF) 2004<br>Census 2002 | US Department of Agriculture (USDA) RUCC collapsed to 3 levels: rural, suburban, metropolitan | Individual-level covariates (e.g., age, race, marital status, education, income, employment, health insurance, health status) and contextual covariates (e.g., residence, number of health centers per population, number of physicians per population) | High | Pap test in counties with <300 primary care providers per 100,000 women (+); U>R, U>S<br>Pap test in counties with 300-500 physicians per 100,000 women (+); U>S<br>Mammogram (+); U>R, S>R |
| Coughlin, 2004[22]<br>Cross-sectional | N = 23,565 men and 37,847 women, age ≥ 50 yrs<br>Nationwide | Behavioral Risk Factor Surveillance System (BRFSS) 1998-1999 | USDA RUCC collapsed to 3 levels: rural, suburban, metropolitan | Race/ethnicity, age, gender, education, health insurance, visit to physician in past year, health profile, shortage area | High | Fecal occult blood test in past year (+); U>R, S>R<br>Sigmoidoscopy or colonoscopy in past 5 years (+); U>R |
| Coughlin, 2002[21]<br>Cross-sectional | N = 108,326 women, age ≥ 40 yrs (mammography and clinical breast examination) N=131,813 women, age ≥ 18 yrs, with no history of hysterectomy (Pap testing)<br>Nationwide | Behavioral Risk Factor Surveillance System (BRFSS) 1998-1999 | USDA Beale Codes collapsed to 3 levels: metropolitan, suburban, rural | Age, gender, race, education, number of people in household, health status, visit to physician in past year, marital status | High | Mammogram in past 2 years (+); U>R, U>S, S>R<br>Pap test in past 3 years (+); U>R |

| Author, Year Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/ Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Kinney, 2006[24]<br>Case-control | N = 558 cases and 952 controls (matched on race, age, and gender)<br>Inclusion (cases): ages 50-80 yrs, pathologically confirmed invasive adenocarcinoma of colon<br>North Carolina | Interviews (face-to-face) 1996-2000<br>Response: 72% (cases), 62% (controls) | U.S. Census Bureau 1990 standards<br>Urban: Metropolitan Statistical Area (1 city with ≥50,000 or total metro area of ≥100,000)<br>Rural: non-metropolitan | Age, race, gender, education, poverty index, recent colorectal cancer screening | Moderate | Colon cancer screening (NR); U>R#<br>#Unadjusted analysis |
| Schootman, 1999[25]<br>Cross-sectional | N = 7,200 women<br>Inclusion: Primary breast or cervical carcinoma diagnosed 1991-95, non-institutionalized, ≥18 yrs old<br>Iowa | Behavioral Risk Factor Surveillance System (BRFSS) 1996-97<br>Surveillance, Epidemiology, and End Results (SEER) 1991-95<br>Response: 39% | Based on number of residents per square mile; 5 levels <20, 20-29, 30-39, 40-99, or 100 or more res/mi$^2$; urban=more than 100 res/mi$^2$ | Breast cancer screening model: income, having health insurance<br>Cervical cancer screening model: education, age, income, having health insurance | Moderate | Breast cancer screening (+); U>R<br>Cervical cancer screening (+); U>R |
| Stearns, 2000[26]<br>Cross-sectional | N = 12,637<br>Inclusion: Medicare enrollee for whole year, living in household for whole year<br>Nationwide | Medicare Current Beneficiary Survey (MCBS) 1993 | 1993 Urban Influence Codes (UIC); 9 categories collapsed to 5 for this study | Age, gender, race, Medicaid status, income, education, living arrangement, health status, functional status, provider supply | Moderate | Mammogram in last year (-) (except rural county with city of >10,000 < urban)<br>Pap test in last year (-) |
| Zhang, 2000[19]<br>Cross-sectional | N = 8,970 (Pap smears), 2,729 (mammography), 4,051 (flu shots)<br>Inclusion: completed all three sections of NHIS<br>Three services:<br>Pap smears in past 3 years for women 18-65 yrs, mammogram in past 2 years for women-50-69 yrs, flu shot in past year for people ≥65 yrs<br>Nationwide | U.S. National Health Interview Survey (NHIS) 1994<br>Response: 80% | Metropolitan Statistical Areas (MSA); urban county is within MSA; rural is all other non-metropolitan counties | Education, household income, health insurance status, Census region | Moderate | Pap smear (-)<br>Mammogram (-) |

*See Methods section for explanation
**U=Urban; R=Rural; HR=Highly rural; F=Frontier; S=Suburban; (+)=difference statistically significant; (-)=difference not statistically significant; (NR)=significance not reported

## Appendix C, Table 3. Cancer Care

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Chirumbole, 2009[36]<br>Cross-sectional | N = 10,414 cases (pancreatic), 56,767 (colorectal)<br>Inclusion: colorectal or pancreatic cancer<br>Pennsylvania | Pennsylvania Department of Health, Bureau of Health Statistics Research 2000-05<br>US Census Bureau 2000<br>American Medical Association Physician-Related Data Resources | US Census Bureau; grouped 67 counties into 22 Workforce Investment Areas (WIA); rurality variable was % of a WIA population that was rural | Age, gender, insurance status, education, poverty status, race, number of physicians per 100,000, ratio of oncology physicians to primary care physicians | Low | Later stage at diagnosis:<br>Pancreatic (+); U>R<br>Colorectal (-) |
| Elliott, 2004[35]<br>Data collected as part of group-randomized trial of intervention directed at rural providers | N = 2,568 (1,463 or 57% rural)<br>Inclusion: pathologically confirmed incident cancers of breast, colon, rectum, lung, or prostate; age ≥18 yrs, resided and had primary care physician in one of 18 rural study communities, spoke English, accrued within 6 weeks of diagnosis<br>Lake Superior region (Minnesota, Wisconsin, Michigan) | Health Care Records 1992-97 | U.S. Census Bureau | Age, oncology consultation | Low/ Moderate | *Proportion of cases staged at diagnosis:*<br>(+); U>R for breast, non-small cell lung, and prostate cancer<br>(-); colorectal and small cell lung cancer<br>*Stage at diagnosis:*<br>(+); R>U for breast, colorectal, and non-small cell lung cancer<br>(-); small cell lung or prostate cancer<br>*Initial management score:*<br>(+); R<U for all cancers<br>*Clinical trial participation:*<br>(+); R<U for colorectal and prostate cancer<br>*Surveillance testing score:*<br>(+); R<U lower breast and colorectal cancer<br>(-); for lung and prostate cancer |
| Higginbotham, 2001[37]<br>Cross-sectional | N = 9,685 cancer cases<br>Inclusion: incident cancer cases (primary cancer site)<br>Mississippi | Mississippi State Department of Health Central Cancer Registry and Division of Vital Statistics 1996 | Census data: county with more than 50% rural designated as rural | Age | Moderate | Cancer incidence (-)<br>Cancer mortality (-)<br>Cancer staged at diagnosis :<br>(+); U>R, all sites<br>(+); U>R; women<br>(+); U>R; African Americans (except lung cancer)<br>Advanced stage at diagnosis<br>(+); R>U all sites and lung cancer |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Kinney, 2006[24]<br>Case-control | N = 558 cases and 952 controls (matched on race, age, and gender)<br>Inclusion (cases): ages 50-80 yrs, pathologically confirmed invasive adenocarcinoma of colon<br>North Carolina | Interviews (face-to-face) 1996-2000<br>Response: 72% (cases), 62% (controls) | U.S. Census Bureau, 1990<br>Urban: Metropolitan Statistical Area (1 city with ≥50,000 or total metro area of ≥100,000)<br>Rural: non-metropolitan | Age, race, gender, education, poverty index, sampling probabilities | Moderate | Colon cancer stage at diagnosis (-) |
| Loberiza, 2009[34]<br>Retrospective cohort | N = 2,330<br>Inclusion: lymphoma complete prognostic clinical data, residential ZIP code<br>Patients with lymphoma reported to the Nebraska Lymphoma Study Group (Nebraska and surrounding states) | University of Nebraska Medical Center Oncology Database 1982-2006 | Rural-Urban Commuting Area code; collapsed to 2 categories<br>Providers classified as university- or community-based | Median household income, distance traveled, year of treatment | Low/<br>Moderate | Risk of death (-); risk greater for rural community treated patients than urban or rural university treated patients; in high-risk subgroup risk higher for all groups relative to urban university treated<br>Advanced treatment (-); use was higher in University-treated compared to community treated regardless of residence<br>Death from primary lymphoma (+); R>U |
| McLafferty, 2009[39] | N = 150,794 cases<br>Inclusion: breast, colorectal, lung, or prostate cancer; staged cases<br>Illinois | Illinois State Cancer Registry 1998-2002<br>Surveillance, Epidemiology, and End Results (SEER) staging data | Rural-Urban Commuting Areas: modified to create Chicago city, Chicago suburb, other metropolitan, large town, and rural | Multiple models<br>1) unadjusted<br>2) age, race<br>3) socioeconomic and access variables based on zip code | Moderate | Risk of late stage diagnosis:<br>*Model 1* (+); city > all other regions for all 4 cancers (except lung cancer in suburb)<br>*Model 2* (+); city > all other regions for colorectal, breast (except city similar to most rural), and lung (except city similar to suburb) cancers; city > suburb (only) for prostate cancer<br>*Model 3* (+); city >other metro and large town for breast, city > large town for colorectal, and city >all regions except suburb for lung cancers |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| McLaughlin, 2009[41]<br>Nested case-control | N = 453 patients<br>Inclusion: continuous Medicaid enrollment, newly started on aromatase inhibitor or tamoxifen, hormone receptor-positive tumors, stage I-III breast cancer, started adjuvant hormonal monotherapy during study, female, ≥55 yrs, white or African American<br>North Carolina | Linked North Carolina Central Cancer Registry-Medicaid Claims data 2000-04 | US Census Bureau and US Department of Health and Human Services- urban or rural | Tumor size, type of surgery, race, type of provider and practice setting, admitted to hospital, admitted to nursing facility, receiving home health care, age | Low/<br>Moderate | Treatment with aromatase inhibitors (+); U>R |
| Paquette, 2007[38]<br>Cross-sectional | N = 129,811 (colorectal), 161,479 (lung)<br>Inclusion: all adults (≥20 yrs) in SEER database with primary colorectal or lung cancer<br>Nationwide | Surveillance, Epidemiology, and End Results (SEER) database (National Cancer Institute), 2000-03 | Rural-Urban Continuum Codes (RUCCs) – 9 levels collapsed to: rural (levels 7 and 9) or urban (levels 1 to 3) | Age, race, language isolation, gender, marital status, income | Moderate | Unstaged cancer rates:<br>Colorectal (+); R>U<br>Lung (+); R>U#<br>Stage IV at presentation:<br>Colorectal (+); U>R<br>Lung (+); U>R<br>#Unadjusted analysis |
| Sankaranarayanan, 2009[40] | N = 6,561 cases<br>Inclusion: incident colorectal cancer, age ≥19 yrs, no missing data in registry<br>Nebraska | Nebraska Cancer Registry 1998-2003<br>Surveillance, Epidemiology, and End Results (SEER) staging data | Office of Management and Budget (OMB) 2003 definitions: urban metropolitan, micropolitan non-metropolitan, rural nonmetropolitan | Age, gender, race/ethnicity, marital status, education, income, insurance, anatomic site | Moderate/<br>High | Early stage at diagnosis (+); Micropolitan>R (metropolitan no different from rural) |
| Schootman, 1999[25]<br>Cross-sectional | N = 7,200 women<br>Inclusion: primary breast or cervical carcinoma diagnosed 1991-95, non-institutionalized, ≥18 yrs old<br>Iowa | Behavioral Risk Factor Surveillance System (BRFSS) 1996-97<br>Surveillance, Epidemiology, and End Results (SEER) 1991-95<br>Response: 39% | Based on number of residents per square mile; 5 levels <20, 20-29, 30-39, 40-99, or 100 or more res/mi$^2$; urban=more than 100 res/mi$^2$ | Age | Moderate | In situ breast cancer rate (NR); R<U<br>Invasive cervical carcinoma (NR); R>U<br>Breast or cervical cancer mortality (-) |
| Schootman, 2001[42]<br>Cross-sectional | N = 6,988 (502 [7%] rural)<br>Inclusion: women, all ages, diagnosed with primary microscopically confirmed DCIS 1991-1996, treated with breast conserving surgery<br>9 metropolitan areas and 5 states across U.S. | Surveillance, Epidemiology, and End Results (SEER) program<br>Area Resource File (ARF) | Metropolitan Statistical Area | SEER registry, year of diagnosis | Moderate | Receipt of radiation therapy:<br>Age <65 yrs (+); R<U<br>Age 65+ (-) |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Shugarman 2008[33] | N = 26,073 (84.2% urban, 6.3% large rural, 4.9% small rural, 4.6% isolated rural)<br>Inclusion: continuously enrolled Medicare beneficiaries, age 65+, first diagnosed cancer was lung cancer 1995-99<br>Exclusion: enrolled in managed care, end-stage renal disease, eligible for Medicare due to disability<br>14 registries nationwide | SEER data linked to Medicare claims<br>Area Resource File | Rural-urban commuting area (RUCA codes) – 30 codes collapsed to 4 categories: urban, large rural city, small rural town, isolated small rural town | Gender, race/ethnicity, age at diagnosis, median ZIP code income, comorbidities, number of subspecialists, number of hospitals, residing in health professional shortage area, residing in census tract with >15% non-fluent English speakers | Moderate | Mortality (-)<br>Unstaged at diagnosis (-)<br>Stage at diagnosis (-)<br>Number of subspecialists (+); R<U<br>Receipt of radiation therapy (trend); R<U |

*See Methods section for explanation
**U=Urban; R=Rural; HR=Highly rural; F=Frontier; S=Suburban; (+)=difference statistically significant; (-)=difference not statistically significant; (NR)=significance not reported

## Appendix C, Table 4. Diabetes/End Stage Renal Disease (ESRD)

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Andrus, 2004[47]<br>Non-RCT | N = 187<br>Inclusion: type II diabetes, two or more visits to their clinic in the past 12 months (Rural = 78, Urban = 109)<br>Alabama | Medical records of patients seen in clinics between January and August 2001<br>Data collection took place Aug-Sept 2001 in Rural clinic; and Feb-March 2002 in urban clinic | Not defined other than rural family practice clinic was a "physician-owned private family practice clinic with one physician provider" and urban internal medicine clinic included five physicians specializing in internal medicine and one physician specializing in endocrinology | None | Very Low | Preventive care consistent with American Diabetes Association guidelines (NR); R<U#<br>Blood pressure, lipid, and HbA1c goals met (NR); R<U#<br>#Unadjusted analysis |
| Koopman, 2006[48]<br>Cross-sectional | N = 947<br>Inclusion: US civilian, ≥20 years, non-institutionalized, participated in NHANES III: household adult, examination, and laboratory data files<br>Exclusion: did not participate in all three parts of the survey<br>Nationwide | Third National Health and Nutrition Examination Survey (NHANES III) 1988-1994 | Urban: MSA<br>Rural: Non-MSA | Gender, age, BMI, perceived health status, income, insurance status, education, usual place of care, # times seeing physician in past year, duration of diabetes | Moderate | Undiagnosed diabetes (-)<br>Uncontrolled BP (+); RHispanics>UHispanics<br>Glycemic control (-)<br>Cholesterol control (-) |
| Krishna, 2010[45]<br>Cross-sectional | BRFSS (N = 441,351)<br>MEPS (N = 48,428)<br>Inclusion: age 18 and older<br>Nationwide | Behavioral Risk Factor Surveillance System (BRFSS) 2001-2002; Medical Expenditure Panel Survey (MEPS) 2001-2002. | Urban: MSA<br>Rural: Non-MSA | Age, BMI, insurance coverage, gender, race/ethnicity, education, region of country, income, personal physician | Moderate/<br>High | Prevalence of diabetes (+); R>U<br>Compliance with diabetes care guidelines for eye exam, foot exam, diabetes education (+); R<U based on BRFSS (-); based on MEPS (eye and foot exam only)<br>Compliance with guidelines for HbA1c test (-) |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Morden, 2010[49]<br>Cross-sectional | N=11,688<br>Inclusion: Veterans with diabetes<br>Nationwide | 2005 national Veterans Health Administration cardiometabolic quality of care random sample chart review<br>SMITREC: VA Serious Mental Illness Treatment and Evaluation Center | RUCA categories<br>RUCA 1: urban<br>RUCA 2: large rural city/town<br>RUCA 3: small/isolated rural town | Mental disorder diagnosis, RUCA (1-3), age, gender, race (black/non-black), marital status, substance abuse diagnosis, Charlson comorbidity index score, # VA outpatient visits, # visits to a VA community-based outpatient clinic, VA cost share category | Moderate/<br>High | LDL, foot exams, eye exams, renal testing, HbA1c, blood pressure (-) |
| O'Hare, 2006[44]<br>Cross-sectional | N = 552,279 (and 4,363 dialysis facilities)<br>Inclusion: initiated dialysis between 1/1/95 and 12/31/02 and survived >90 days without transplant<br>Nationwide | U.S. Renal Data System<br>2000 U.S. Census<br>CMS Dialysis Facilities Compare database | Rural-Urban Commuting Area Codes (RUCA):<br>Urban area<br>Large Rural Area<br>Small Rural Area<br>Remote, Small Rural Area | Age, gender, comorbid conditions at start of dialysis, dialysis modality at 90 days; ZIP code per capita income and % >25 yrs with high school diploma<br>Stratified for race/ethnicity | High | Survival (+); all R white non-Hispanic > U white non-Hispanic; remote small R white Hispanic < U white Hispanic; small R and remote small R black > U black<br>Time to kidney transplant (+); all R white non-Hispanic > U white non-Hispanic; large R and small R black < U black; remote small R Native American > U Native American |
| Rosenblatt, 2001[50]<br>Cross-sectional | N = 30,589<br>Inclusion: all fee-for-service Medicare (continuous coverage) patients, 65+ years, alive at the end of the 1994, 2+ physician encounters for diabetes care in 1994, all medical care in Washington<br>Washington state | Medicare Part B claims data 1994 | RUCA subset:<br>Urban<br>Adjacent Large Rural<br>Remote Large Rural<br>Adjacent Small<br>Remote Small | Sociodemographic factors, comorbidities, provider specialty | Moderate | Glycated hemoglobin test (+); Adjacent large R<all other locations<br>(+); Large remote > all others |
| Ward, 2009[48]<br>Cross-sectional | N = 18,377 (from 1,681 ZIP codes with analysis by ZIP)<br>Inclusion: age ≥ 20 years, treated incident end-stage renal disease (ESRD) attributed to diabetes or autosomal dominant polycystic kidney disease (ADPCKD) 1/1/01 to 6/30/04, California resident<br>California | U.S. Renal Data System*, 2000 U.S. Census, California Office of Statewide Health Planning and Development*, U.S. Dept of Health and Human Services Health Resources*<br>*1/1/01 to 6/30/04 | U.S.D.A Rural-Urban Commuting Area Codes; 10 levels collapsed to rural (codes 9, 10) or urban (codes 1-8) | Socioeconomic status (income, proportion with income <200% of poverty level, house value, rent, education, % college graduates), insurance status, hospitalization for hypoglycemic events, rural location | Low | Annual incidence of ESRD attributed to diabetes (-)<br>Annual incidence of ESRD attributed to autosomal dominant polycystic kidney disease (-) |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Weingarten, 2006[51]<br><br>Cohort | Inclusion: fee-for-service Medicare beneficiaries with diabetes, ages 18-75, enrolled for prior 12 months with ≥23 months of continuous Part B coverage, ≥ 1 inpatient or emergency visit or 2 outpatient visits ≥7 days apart<br><br>Exclusion: gestational diabetes, died during measurement period<br><br>Nationwide | CMS National Diabetes Database (Part of Medicare Health Care Quality Improvement Program) 1999-2001<br><br>Participants identified from Part A and Part B claims data | County codes from the Federal Information Processing Standards; based on urban-rural continuum codes – 9 codes collapsed to 3: Urban, Semi-rural (adjacent to metropolitan area), Rural (not adjacent) | Race (white/non-white), ethnicity (Hispanic/non-Hispanic), states (Census divisions) | Low | Indicator rate*<br>A. in 10 top performing states (many in northern and eastern regions of US): 1 of 10 SR<U, 3 of 10 SR>U; 2 of 10 R<U, 2 of 10 R>U<br>B. in 10 lowest performing states (many in south): 9 of 10 SR<U, 1 of 10 SR>U; 7 of 10 R<U, 1 of 10 R>U<br><br>*Indicator rate = Annual HbA1c measurement; Biennial lipid profile; Biennial eye exam |

*See Methods section for explanation
**U=Urban; R=Rural; SR=Semi-rural; (+)=difference statistically significant; (-)=difference not statistically significant; (NR)=significance not reported

## Appendix C, Table 5. Cardiovascular Disease

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Colleran, 2007[55]<br>Cross-sectional | N = 200<br>Inclusion: 50 + years old, seen more than once at the study sites (1 urban academic medical center, 1 rural community clinic) in the previous year<br>New Mexico | Medical record review; randomly selected charts to include 50 patients with cardiovascular disease (CVD) (25 Hispanic, 25 non-Hispanic white) and 50 without CVD from each site | Not defined other than "urban academic medical center", "rural community clinic" | Age, gender, hypertension, diabetes, dyslipidemia, smoking status | Low | Standard medications for treatment of CVD (+); U>R#<br>Cholesterol lowering medications (+); U>R#<br>Attainment of blood pressure goal (+); U>R#<br>Attainment of LDL goal (-)#<br>#Unadjusted analysis |
| Dellasega, 1999[56]<br>Case Reports | N = 32<br>Inclusion: Patients from tertiary care center serving 31 counties, 65+ years old, primary diagnosis a medical or surgical cardiac condition, cognitively intact, being discharged to home<br>Pennsylvania | Patient medical records; phone survey post-discharge to 20 weeks<br>Survey Response: 32/50 completed all five surveys (60%) | Pennsylvania Dept of Aging Rural Services Task Force seven designations:<br>Philadelphia, Allegheny, urban, suburban, semi-urban, semi-rural, and rural (based on population density and proximity to major metropolitan area) | Age, gender, marital status, education, number of hospitalizations, severity of illness | Very Low | Number of medications at discharge and during follow-up (+); U>R with more fluctuations in medications in urban patients<br>Number of cardiac medications at discharge and during follow-up (+); U>R<br>General Health SF-36 scale (NR); R improved over time, U decreased over time |
| Hicks, 2010[53]<br>Cross-sectional | N = 778 surveys<br>Inclusion: Provider completed survey after patient encounter, non-pregnant adult with type 2 diabetes<br>26 practices in Colorado (13 urban; 13 rural) | Provider questionnaire, June 2003-May 2004<br>Response: not stated | Rural: community of fewer than 25,000 residents at least 32 km (20 mi) from a major metropolitan center | Age, gender, race, ethnicity, BP (near goal or uncontrolled), practice level, communication problems, income level, number of prescription medications | Moderate | Provider taking action if BP was poorly controlled (-)<br>Number of medications (+); R>U |
| King, 2006[54]<br>Cross-sectional | N = 300<br>Inclusion: outpatient, diagnosed hypertension (100 from an urban, a suburban, and a rural clinic)<br>South Carolina | Medical record review; consecutive sample | Not defined other than "urban university family practice center", "suburban residency practice", "rural private practice" clinics | Age, race, gender, number of medications, number of visits in past 12 months, comorbidities | Very Low | Blood pressure control (+); R>U |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Morden, 2010[49]<br><br>Cross-sectional | N = 23,780<br><br>Inclusion: Veterans with hypertension (approximately 1/3 with mental disorder [MD])<br><br>Nationwide | 2005 national Veterans Health Administration cardiometabolic quality of care random sample chart review<br>SMITREC: VA Serious Mental Illness Treatment and Evaluation Center | RUCA categories<br>RUCA 1: urban<br>RUCA 2: large rural city/town<br>RUCA 3: small/isolated rural town | Mental disorder diagnosis, RUCA (1-3), age, gender, race (black/non-black), marital status, substance abuse diagnosis, Charlson comorbidity index score, # VA outpatient visits, # visits to a VA community-based outpatient clinic, VA cost share category | Moderate/<br><br>High | Blood pressure control (-) |

*See Methods section for explanation
**U=Urban; R=Rural; (+)=difference statistically significant; (-)=difference not statistically significant; (NR)=significance not reported

## Appendix C, Table 6. HIV/AIDS

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Cohn, 2001[58]<br>Cohort | N = 3,173 (367 rural)<br>Inclusion: HIV-infected adults who received care from January through June, 1996<br>Contiguous United States | HIV Cost and Services Utilization Study (HCSUS) 1996; rural component | Urban: MSA or New England county metropolitan areas<br>Rural: non-MSA<br>Office of Budget and Management, 1992 | Age, gender, race, ethnicity, risk group behavior, education, insurance, household income, region of care, CD4 count, HIV provider type | Moderate/<br>High | Appointments with providers caring for more HIV-infected patients (+); urban care > rural care#<br>Use of pneumocystis carinii pneumonia medication (+); urban care > rural care#<br>Use of highly-active antiretroviral therapy (HAART) (+); urban care > rural care |
| Napravnik, 2006[59]<br>Cross-sectional | N = 1,404<br>Inclusion: 18+ years, attended ≥ 1 clinic appointment at a Univ. of North Carolina HIV clinic between 1/1/2000 and 12/31/2002<br>Southeastern United States (predominantly North Carolina) | Patient medical records from the University of North Carolina HIV outpatient clinic | Rural: MSA with < 50,000 inhabitants | Age, gender, race/ethnicity, insurance status, distance to clinic, clinical AIDS diagnosis, CD4 cell count, time since entry into HIV care | Moderate | Average number of clinic visits per year (-)# |
| Schur, 2002[60]<br>Cohort | N = 275 rural patients<br>Inclusions: HIV infected adults, receiving care from sampled providers (≥ 1 visit in early 1996)<br>Exclusions: patients seen by military, prison, or emergency department providers<br>Contiguous United States | HIV Cost and Services Utilization Study (HCSUS) 1996<br>American Medical Association MasterFile of physicians | Urban: MSA<br>Rural: non-MSA<br>Office of Budget and Management, 1992 | Age, gender, race/ethnicity, risk group, clinical stage, annual income, insurance status, CD4 count | Moderate | 73.6% of rural residents received HIV care in urban setting#<br>Older patients more likely to receive care in rural area (+)# |
| Whyte, 1992[57]<br>Cohort | N = 308 AIDs cases<br>Inclusion: female residents of Georgia aged 13 and older at time of diagnosis whose cases were reported by 12/31/90<br>Georgia | Centers for Disease Control and Prevention (1983-1990)<br>Office of Vital Statistics (Georgia), March 1991 | Metro Atl: residents of 8 counties of metropolitan Atlanta<br>Other Areas: residents of remaining counties | Race, mean age, mode of infection | Very Low | Median survival time (+); Metro>Other#<br>Probability of surviving 90 days (+); Metro>Other# |

*See Methods section for explanation
**U=Urban; R=Rural; (+)=difference statistically significant; (-)=difference not statistically significant; (NR)=significance not reported
#Unadjusted results

## Appendix C, Table 7. Neurologic Conditions

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Buchanan, 2006b[62]<br>Cohort | N = 1,518<br>Inclusion: Member of the National Multiple Sclerosis (MS) Society<br>Exclusion: none<br>Nationwide | Phone interview, Oct 2004 – Jan 2005<br>Response: 31% | Urban: Metropolitan Statistical Area (MSA)<br>Adjacent Rural Area: <50 miles from MSA<br>More Remote Rural Area: >50 miles from MSA | None | Very Low | Saw neurologist in past year (+); U>MRR#<br>Wanted to see neurologist but did not (+); MRR>U, AR>U#<br>Majority of MS care from primary care physician (+); MRR>U# |
| Buchanan, 2006a[61]<br>Cohort | N = 1,518<br>Inclusion: Member of the National Multiple Sclerosis Society<br>Exclusion: none<br>Nationwide | Phone interview, Oct 2004 – Jan 2005<br>Response: 31% | Urban: Metropolitan Statistical Area (MSA)<br>Adjacent Rural Area: <50 miles from MSA<br>More Remote Rural Area: >50 miles from MSA | None | Low/ Very Low | Taking disease-modifying medications (+); U>MRR#<br>Discontinued disease-modifying medications because of other medical side effects(+); AR>U#<br>Discontinued disease-modifying medications because of out-of-pocket expense (+); AR>U# |
| Buchanan, 2006c[63]<br>Cohort | N = 1,518<br>Inclusion: Member of the National Multiple Sclerosis Society<br>Exclusion: none<br>Nationwide | Phone interview, Oct 2004 – Jan 2005<br>Response: 31% | Urban: Metropolitan Statistical Area (MSA)<br>Adjacent Rural Area: <50 miles from MSA<br>More Remote Rural Area: >50 miles from MSA | None | Very Low | Need for mental health care in past 12 months (+); AR<U, MRR<U#<br>No insurance coverage for mental health care (+); AR>U, MRR>U#<br>No providers in area or too far to visit (+); AR>U# |
| Wilson, 2009[66]<br>Cross-sectional | N = 1,427 counties or county sets (contiguous, single state sets of counties merged to achieve population >50,000)<br>Inclusion: all US counties or county sets except Alaska, Hawaii, and 12 cities with changes in county definitions between 1980 and 2000<br>Nationwide | Numbers of rehabilitation therapists (physical [PT] or occupational [OT] therapists, speech-language pathologists [SLP]) from 1980 and 1990 ARF and 2000 EEO<br>Health Professional Shortage Area Data | US Office of Management and Budget (OMB) – metropolitan (metro): central county with ≥1 urbanized area and outlying counties economically tied to core county | None | Moderate/ High | PTs, OTs, or SLPs per 100,000 residents (NR); U>R#<br>PTs, OTs, or SLPs per 100,000 residents (NR); Non-shortage area > partial or total shortage area# |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Johnstone, 2002[65]<br>Cross-sectional | Data on numbers of providers of services to people with traumatic brain injury<br>Missouri | U.S. Census Bureau, 2000; Office of Social and Economic Data Analysis, 2000; Rural Policy Research Institute, 2000; Missouri State Board of Registration for the Healing Arts, 1999; American Board of Professional Psychology; Missouri Brain Injury Association, 2000 | Office of Management and Budget (OMB) designations of Metropolitan and Non-metropolitan<br>(MSA or non-MSA) | None | Moderate/<br>High | Physicians (NR); U>R#<br>Physiatrists (NR); U>R#<br>Nurses (NR); U=R#<br>Rehabilitation Therapists (NR) U>R#<br>Mental Health (NR); U>R# |
| Schootman and Fuortes, 1999[64]<br>Cross-sectional | N = 292 patients age 18+ years with TBI sustained July-Dec 1996<br>Iowa | Survey sent to persons identified through the Iowa Central Registry for Brain and Spinal Cord Injuries, January, 1998<br>Response: 57.4% (292 is subset – those 18 years and older) | Population density (residents/square mile) – 5 levels<br><20, 20-29, 30-39, 40-99, 100+ | Injury severity, age, gender, type of respondent (injured person vs. proxy), inability to see a doctor because of cost | Low | Functional dependence (+); most urban > non-urban<br>Perceived need for services (-) |

*See Methods section for explanation
**U=Urban; R=Rural; MRR=More Remote Rural; AR=Adjacent Rural; (+)=difference statistically significant; (-)=difference not statistically significant; (NR)=significance not reported
#Unadjusted analysis

## Appendix C, Table 8. Mental Health

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| ***Severe Mental Health*** | | | | | | |
| Farrell, 1996[72]<br>Cross-sectional | N = 4,930<br>Inclusion: adults discharged from 8 public psychiatric hospitals to 1 of 40 community mental health centers (CMHC, 23 rural, 17 urban) in 1992<br>Virginia | Questionnaire (completed by CMHC staff), 1992<br>Inpatient Database<br>Questionnaire completion rate: 97% (94% linked to database) | State mental health authority definition - rural is <120 people/ sq mi | None | Moderate | Continuity of care (+); R>U as indicated by a. CMHC had record of discharge, b. CMHC contacted patient during hospitalization, c. patient and CMHC had contact after discharge, d. CMHC provided face-to-face services, and e. composite score[#]<br>[#]Unadjusted analysis |
| Fischer, 2008[73]<br>Cohort | N = 258 (121 or 47% rural; included veterans)<br>Inclusion: ages 18-67, schizophrenia, mental health service utilization records available for at least 18 months<br>Arkansas | Interviews with patients (consumers) and family, friends, or providers who knew patient well (informants) 1992-99 | Office of Management and Budget –<br>Urban: Metropolitan Statistical Area (MSA)<br>Rural: non-MSA | Insight into illness, cognitive functioning, age, gender, ethnicity | Moderate | Irregular vs. regular outpatient mental health service use (+); R>U<br>Comorbid substance abuse effect on mental health service use (+); less effect on patients with family support at least weekly |
| Mohamed, 2009[75]<br>Cohort | N = 5,221 veterans (4,373 urban)<br>Inclusion: participant in mental health intensive case management (MHICM) program<br>Nationwide | Clinical process assessments by MHICM staff after veteran's 1st 6 months in MHICM program, FY2000-FY2005<br>VA Outpatient Encounter File | Rural-Urban Commuting Codes – 4-groups: urban (U), large rural city (LR), small rural town (SR), or isolated rural (R) community | None | Moderate | Patient contact (+); R<U[#]<br>Receipt of services (+); all R<U Psychotherapy, substance abuse treatment, crisis intervention, medication management, screening or care for medical problems, rehabilitation, vocational support, housing support [#]<br>[#]Unadjusted analysis |
| Rost & Owen, 1998[76]<br>Cohort NOTE: telephone interviews with randomly selected adults in 11,078 households; 998 screened positive for depression | N = 54 (46 with 12 month follow-up)<br>Inclusion: ≥18 yrs; screened positive for depression (telephone); not bereaved, manic, or acutely suicidal; lifetime mania identified in face-to-face interviews<br>Arkansas | Telephone and face-to-face interviews 1992-93<br>Response: 85% of eligible after face-to-face interview with complete data (interview at 1 yr) | Urban: Metropolitan Statistical Area (MSA)<br>Rural: non-MSA | Age, gender, education, health insurance, marital status, minority status, income, recent manic symptoms, severity of depression, previous psychiatric hospitalizations, recent drug/alcohol problems, psychiatric co-morbidity, physical condition | Low | During 12 month follow-up:<br>a. any non-acute mental health service (-)<br>b. seen in general medical setting only (+); R>U<br>c. any acute services for physical or mental health (+); R>U<br>d. suicide attempt (-)<br>e. manic episode (+); R>U<br>f. depressive symptoms (-) |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| ***Hospitalization*** | | | | | | |
| Fortney 2007[70]<br>Cross-sectional | N = 811 counties<br>Inclusion: 551, 529 depression related hospitalizations, age 20+<br>14 states nationwide | Statewide Inpatient Database (SID), 2000<br>Census Bureau<br>Dept. of Agriculture<br>Health Resources and Services Administration | Urban Influence Codes (UIC) – 12 categories | Ethnicity, poverty level, education, income, employment, housing stress, county economy source, number of providers, number of hospital beds, penetration rate of HMOs, shortage area, geographic location | Low/<br>Moderate | Hospitalization rate (+); most U>all other UIC categories (5 comparisons were significant) |
| Fortney 2009[71]<br>Cross-sectional | N = 811 counties<br>Inclusion: 1443,107 schizophrenia related hospitalizations, age 20+<br>14 states nationwide | Statewide Inpatient Database (SID), 2000<br>Census Bureau<br>Dept. of Agriculture<br>Health Resources and Services Administration | Urban Influence Codes – 12 categories<br>U.S. Office of Management and Budget – MSA/non-MSA | Ethnicity, poverty level, education, income, employment, housing stress, county economy source, providers, hospital beds, penetration rate of HMOs, shortage area, geographic location | Low/<br>Moderate | Hospitalization rate (+);most U>all other UIC categories (8 comparisons were significant) |
| ***Depression*** | | | | | | |
| Fortney, 1999[74]<br>Cohort | N = 106 of original 470 with depression visit in 6 months after baseline interview, complete data set, and provider in Arkansas (see Rost 1999)<br>Arkansas | See Rost 1999<br>Records from providers, insurers, and pharmacies identified<br>Geocoded addresses for travel time | Used travel time | Age, gender, ethnicity, employment status, education, severity of depression, physical and psychiatric comorbidities, insurance coverage, treatment sector | Low/<br>Moderate | Number of visits (+); increased travel time associated with fewer visits<br>Guideline concordant treatment (+); increased travel time associated with reduced odds of guideline concordant treatment |
| Rost, 2007[78]<br>Cross-sectional (combining data from 2 studies) | N = 1,455 (304 rural)<br>Inclusion: primary care patients with depression (excluded schizophrenia and bipolar disorder)<br>11 states | 2 studies in Quality Improvement for Depression database (through 1999):<br>1) Partners in Care (PIC), 46 practices (3 rural), 5 states (35% agreed to participate; follow-up 89% at 2 yr)<br>2) Quality Enhancement by Strategic Teaming (QuEST), 12 practices (4 rural), 10 states (73% agreed to participate, follow-up 70% at 2 yr) | Practices designated as urban (MSA) or rural (non-MSA) | Age, gender, minority status, education, marital status, employment, depression, psychiatric or physical comorbidity, antidepressant use, social support, stressful life events | Low | Baseline characteristics:<br>a. use of outpatient care (specialty, medical) - past 6 mos (-)#<br>b. antidepressant use -past 6 mos (-)#<br>c. any hospitalization - past 6 mos (-)#<br>Hospitalization for physical problems in 6 months after baseline (+); R>U whether or not they received specialty care during those 6 months<br>Hospitalization for emotional problems (+); R>U at 18 months<br>#Unadjusted analysis |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Rost, 1999[77]<br>Cross-sectional<br>NOTE: telephone interviews with randomly selected adults in 11,078 households; 998 screened positive for depression | N = 434 (286 rural) of original 470 with 12 month data<br>Inclusion: ≥18 yrs; screened positive for depression (both telephone and face-to-face interviews); not bereaved, manic, or acutely suicidal<br>Arkansas | Telephone and face-to-face interviews 1992-93<br>Response: 74% of eligible after screening agreed to face-to-face interview; 92% with complete data | Census data 1990, rural defined as non-metropolitan | Age, gender, education, health insurance, marital status, minority status, employment status, income, living alone, health insurance, severity of depression, physical and psychiatric comorbidity | Moderate | Any outpatient treatment for depression (-)<br>Type of outpatient treatment for depression (-)<br>Quality of outpatient depression treatment (-)<br>Outpatient specialty care visits for depression (+); R<U<br>Outpatient general medicine visits for depression (-)<br>Change in depression severity (-)<br>Hospitalization for physical problems (+); R>U<br>Hospitalization for mental health problems (-) |
| Rost & Zhang, 1998[69]<br>Cross-sectional | See Rost 1999 | See Rost, 1999 | Census data 1990, rural defined as non-metropolitan | See Rost, 1999 | Moderate | Outpatient services for physical problems (-)<br>Outpatient services for mental health other than depression (-)<br>Hospitalizations for physical or mental health problems 1-6 months after baseline (+); R>U<br>Hospitalizations in months 7-12 (-)<br>Suicide attempts (+); R>U |
| ***Post Traumatic Stress Disorder (PTSD)*** | | | | | | |
| Elhai, 2004[79]<br>Cross-sectional | N = 100 veterans (52 rural)<br>Inclusion: male, diagnosed with PTSD at outpatient clinic<br>Southeastern United States | Medical chart review (date not reported) | U.S. Census data 1990 | Service use adjusted for distance and driving time | Very Low | Service use (PTSD clinic, primary care, and specialty care visits) within 1 year after initial PTSD evaluation (-)<br>Dissociative Experiences Scale score (+); R>U<br>MMPI-2 clinical scales (-) |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| ***Substance Abuse*** | | | | | | |
| Booth, 2000[80]<br>Cohort | N = 733<br>Inclusion: current adult drinkers (18+) who met DSM-IV criteria for alcohol abuse or dependence in the past year or were at risk for meeting DSM-IV diagnostic criteria in the following year<br>Six southern states (AL, AR, GA, LA, MS, TN) | Telephone interview<br>Response: 76% (baseline); 90% and 82% of baseline completed interview at 6 and 12 months, respectively | Census Bureau definitions of MSA; rural is non-MSA | Gender, ethnicity, age, income, health insurance, average time to provider, days to see MD for advice about drinking, acceptability of treatment, social support, alcohol abuse (past 6 months), alcohol dependence (past 6 months), lifetime drug use, Axis I DIS diagnosis (past 6 months), antisocial personality disorder, social consequences of drinking, negative life events, chronic medical problems, prior treatment for alcohol problems | Moderate/ High | Twelve month alcoholism treatment use (-) |
| Fortney et al., 1995[84]<br>Cohort | N = 4,621<br>Inclusion: adult (18+) male veterans completing inpatient alcoholism treatment at VA Alcohol Dependency Treatment Program (ADTP)<br>33 VA inpatient ADTPs | VA Patient Treatment File, 1987 | Small community (outside an MSA); metropolitan area (MSAs with < 3 million inhabitants);<br>large metropolitan area (MSAs with > 3 million inhabitants) | Distance to VA medical center, age, marital status, illness severity, race | Moderate | Attendance at outpatient appointment for alcoholism treatment 30 days after discharge from inpatient ADTP (+); small community > metropolitan, large metropolitan < metropolitan |
| Grant, 1996[81]<br>Cross-sectional | N = 42,862<br>Inclusion: non-institutionalized adults (18+)<br>Nationwide | National Longitudinal Alcohol Epidemiological Survey, 1992<br>Response: 97.4% (person); 91.9% (household) | Not provided | Gender, age, ethnicity, education, marital status, family history of alcoholism, past alcohol disorder and treatment, health insurance, employment, income, children < 14 at home, spouse/ partner with alcoholism, onset and severity of alcoholism, daily alcohol intake, major depression, comorbid drug use disorder; illicit drug use in past year | Moderate | Odds of entering treatment in the past year for drinking-related problems (-) |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Metsch & McCoy, 1999[82]<br>Cross-sectional | N = 2,222<br>Inclusion: age 18+, self-reported drug use ≤30 days prior to recruitment; no active drug treatment 30 days prior to intake<br>Two sites in Florida: Miami (urban) and Immokalee (rural) | In-person interview<br>Response: not reported | Not defined<br>Immokalee characterized as an unincorporated area known for agriculture and cattle industries | None | Low/<br>Moderate | Ever in drug-user treatment (+); U>R#<br>Length of prior treatment (+); U>R#<br>Treatment in past 24 months (+); U>R#<br>Attempted but unable to get treatment in past 12 months (+); U>R#<br>Of those using treatment, use of outpatient treatment (-)#<br>#Unadjusted analysis |
| Robertson & Donnermeyer, 1997[83]<br>Correlational | N = 3,629 (497 who used an illegal substance in the past year)<br>Inclusion: age 21+, non-institutionalized, living in residential type of interest<br>Nationwide | National Household Survey on Drug Abuse, 1991<br>Response: not reported | Rural defined as places with <2,500 inhabitants outside of or not next to urban areas (1980 Census)<br>3 residential types: metropolitan-rural (rural area within MSAs); non-metropolitan-rural; non-metropolitan-urban | NONE???? For this outcome | Low | 5.6% of nonmetropolitan-rural drug users sought treatment compared with 6.6% of the remaining respondents |
| ***Suicide*** | | | | | | |
| Fiske, 2005[68]<br>Cross-sectional | N = 41 county clusters (counties of <100,000 grouped with neighboring counties)<br>California (all counties) | California Departments of<br>a. Health Service, Center for Health Statistics, 1993-2001 (odd years)<br>b. Finance (population data)<br>c. Consumer Affairs (providers) | U.S. Census Bureau; urbanicity of county based on proportion of county residents living in an urbanized area or town with population of ≥2,500 | Age | Low | Suicide rate (+); R>U<br>Interaction between urbanicity and number of providers (-) (no association with suicide rate) |
| Gibbons, 2005[67]<br>Cross-sectional | N = 91,673<br>Inclusion: all individuals who committed suicide<br>Nationwide | National Vital Statistics (CDC) 1996-98 (suicide rates)<br>IMS Health, Inc (antidepressant medication prescriptions) | Based on county population | Model 1: Age, gender, race<br>Model 2: Added income<br>Model 3: Added county mean drug prescription for each class of drugs | Low | Suicide rate (NR); smaller population counties>larger population counties<br>Ratio of non-tricyclic antidepressants to tricyclic antidepressants (NR); larger population counties>smaller population counties |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| ***Utilization*** | | | | | | |
| Hauenstein, 2006[87]<br>Cross-sectional | N = 32,319<br>Inclusion: civilian, non-institutionalized, 18-64 yrs<br>Nationwide | Medical Expenditure Panel Survey (MEPS), 1996-2000 data<br>Response: 73%-78% (varied by panel) | Rural-Urban Continuum Codes 1994; collapsed to metropolitan, non-metropolitan least rural, or non-metropolitan most rural | Gender, age, income-to-needs ratio, schooling, geographic region, mental health, physical health, marital status, number of children, usual source of care, insurance type, year | Moderate | Any mental health visit (+); U>most R and least R>most R for women<br>Specialized mental health visit (+) U>most R for women and men |
| Petterson, 2009[86]<br>Cross-sectional | N = 36,288<br>Inclusion: civilian, non-institutionalized, ≥18 yrs; non-Hispanic white, African American, Mexican American<br>Nationwide | Medical Expenditure Panel Survey (MEPS) 1996-2000 data<br>Response: 73%-78% (varied by panel) | Rural-Urban Continuum Codes 1994; collapsed to metropolitan, non-metropolitan least rural, or non-metropolitan most rural | Self-reported mental and physical health, gender, age, education, employment status, marital status, income-to-needs ratio, health insurance | Moderate | Receipt of any mental health service:<br>(+); African American < non-Hispanic white in any location<br>(+); Mexican American < non-Hispanic white, urban and least rural non-MSA only<br>Receipt of specialty mental health service:<br>(+) African American < non-Hispanic white in urban and least rural locations<br>(+) Mexican American <non-Hispanic white in Urban location only |
| Petterson, 2003[85]<br>Cross-sectional | N = 2,381<br>Inclusion: ≥ 1 visit of any mental health treatment during calendar year, civilian, non-institutionalized, 18-64 yrs<br>Nationwide | Medical Expenditure Panel Survey (MEPS) 1996-98 data<br>Response: 78% | Rural-Urban Continuum Codes 1993; collapsed to metropolitan or non-metropolitan | Gender, race/ethnicity, age, education, employment status, marital status, income-to-needs ratio, health insurance, mental health, physical health | Moderate | Any or specialized mental health visit:<br>(+); U>R if reported mental health was good or fair#<br>(-) if reported mental health was poor#<br>Mental health care use (-); trend for U>R<br>Ever hospitalized in calendar year (-)<br>Ever saw a medical doctor (-)<br>Primarily saw a medical doctor (-)<br>#Unadjusted analysis |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Wang, 2005[88]<br>Cross-sectional | N = 9,282 (interviewed)<br>Inclusion: ages 18+, English speaking<br>Nationwide | National Comorbidity Survey Replication (NCS-R), 2001-2003 (face-to-face interviews)<br>Response: 71% | U.S. Census Bureau, 2000; large (≥ 2 million) and small central city, large (≥ 2 million) and small suburbs or central city, adjacent area, rural area | Age, gender, race/ethnicity, education, marital status, family income, health insurance | Moderate/<br>High | Odds of receiving any mental health treatment in prior 12 months (+); rural<all non-rural<br>Odds of receiving specialty mental health treatment in prior 12 months (+); rural<all non-rural except suburb <2 million<br>Mental health treatment adequacy:<br>(+); rural>all non-rural for mental health specialty treatment<br>(-); any service use, general medical, and non-health care treatment |

*See Methods section for explanation
**U=Urban; R=Rural; (+)=difference statistically significant; (-)=difference not statistically significant; (NR)=statistical significance not reported

## Appendix C, Table 9. Use of Medication

| Author, Year, Study Design | Characteristics of Study Population (Sample Size, Inclusion/Exclusion, Region of United States) | Data Source and Year(s) of Sampling (if applicable) Response rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Dellasega, 1999[56]<br>Prospective/ Longitudinal | N = 32<br>Elderly patients admitted to a large tertiary care center for cardiac condition.<br>Specific inclusion criteria: 1) 65 or older; 2) has medical or surgical cardiac condition as primary diagnosis; 3) cognitively intact; 4) being discharged from hospital<br>Pennsylvania | Medical records and telephone interviews<br>Response rate: 50% | Seven-level county designations established by the Pennsylvania Department of Aging Rural Services Task Force merged into two categories (i.e., rural vs. urban) | Age, gender, severity of illness | Low | Number of medications (+); U>R |
| Fillenbuam, 1993[89]<br>Correlational | N = 3,973<br>Individuals 65 or older who are identified as black or white<br>Piedmont area of North Carolina | Duke Established Populations for Epidemiologic Studies of the Elderly, 1986-1987<br>Response rate: 80.3% (black); 87.2% white | U.S. Census Bureau Definition | Gender, marital status, age, education, functional status, medical status, self-rated health, number of medical visits in past year, continuity of care, overnight hospitalization in past year, insurance status, income | Low/<br>Moderate | Medication use - elderly whites (+);U>R<br>Medication use - elderly blacks (-) |
| Hanlon, 1996[90]<br>Cross-sectional | N = 4,110<br>Individuals 65 or older who are identify as black or white<br>Piedmont area of North Carolina | Duke Established Populations for Epidemiologic Studies of the Elderly, 1986-1987<br>Response rate: 80.3% (black); 87.2% white | U.S. Census Bureau Definition | Age, race, gender, education, functional status, number of functional limitations, chronic disease status, number of health visits in past year, hospitalization in past year, continuity of care, Medicaid status | Low/<br>Moderate | Prescription medication use (+); U>R<br>Number of non-prescription medications (+); U>R<br>Use of non-prescription medications (-) |
| Lago, 1993[91]<br>Cross-sectional | N = 18,641<br>Elderly enrolled in the Pennsylvania Pharmaceutical Assistance Contract for the Elderly (PACE)<br>Pennsylvania | Claims data for PACE beneficiaries, 1984-1988; Medicare health services records; County-level demographic and health services resources databases | Human Resources Profile County Code from 1980 census data in Area Resource File (ARF; 10 levels depicting degree of rurality) | Age; gender; race; income; marital status; physicians, pharmacies, hospital beds, and nursing home beds per 1,000 population; outpatient physician visits; any physician visits, inpatient days, or any hospital day in past month | Moderate | Monthly claims(-); HR, U |

| Author, Year, Study Design | Characteristics of Study Population (Sample Size, Inclusion/Exclusion, Region of United States) | Data Source and Year(s) of Sampling (if applicable) Response rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Lillard, 1999[92]<br>Cross-sectional | N = 910<br>Medicare enrollees ages 66 or older<br>Excluded individuals covered by HMOs or institutionalized<br>National | 1990 Elderly Health Supplement to the Panel Study of Income Dynamics (PSID), a nationally representative telephone/mail survey<br>Response rate: 99% (telephone survey); 74%(mail survey) | Area Resource File (Department of Health and Human Services) | Age, gender, race, marital status, education, income, current health status, insurance status | Low | Twelve-month medication use: (-)<br>Prescription cost (+); U>R |
| Mueller, 2004[93]<br>Cross-sectional | N = 32,465,895<br>Noninstitutionalized Medicare beneficiaries 65 or older<br>National | 1997 Medicare Current Beneficiary Survey; 1996 Medical Expenditure Panel Survey | Rural: any place of residence not in a Metropolitan Statistical Area (MSA) | Insurance status | Low/'<br>Moderate | Total drug expenditures (-)<br>Prescriptions filled (+); R>Uninsured U<br>Prescriptions filled (+): Insured R>insured U |
| Rogowski, 1997[95]<br>Cross-sectional | N = 996<br>Noninstitutionalized Medicare enrollees ages 66 or older<br>National | Panel Study of Income Dynamics (PSID), 1990<br>Response rate: 99% (telephone survey); 74% (mail survey) | Rural: any place of residence not in a MSA | Age, education, gender, race, marital status, income, insurance status, health status | Low | Percentage of family income spent on medications (-) |
| Xu, 2003[94]<br>Cross-sectional | N = 3,498<br>Noninstitutionalized elderly<br>West Texas | Telephone survey, 2000<br>Response rate: 71% (phase 1); 89.3% (phase 2); 53.2% (both phase 1 and 2) | Urban (counties in MSA)<br>Rural (counties outside MSA or population < 50,000)<br>Frontier (counties with < 7 people/ square mile) | Race, age, gender, employment, income, insurance, usual source of care, physical and mental health-related quality of life, several health beliefs | Low | Odds of prescription drug use (-) R,U; (+) U>F<br>Usual pharmacy (-) R,U; (+) U>F<br>e |

*See Methods section for explanation
**U=Urban; R=Rural; HR=Highly rural; F=Frontier; (+)=difference statistically significant; (-)=difference not statistically significant

## Appendix C, Table 10. Medical Procedures and Diagnostic Tests

| Author, Year, Study Design | Characteristics of Study Population (Sample Size, Inclusion/Exclusion, Region of United States) | Data Source and Year(s) of Sampling (if applicable) Response rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Escarce et al., 1993[97]<br>Cross-sectional | N = 1,204,022<br>Inclusion: Medicare enrollees 65+ years<br>Exclusion: end-stage renal disease, covered by an HMO<br>National | Health Care Finance Administration (HCFA) Medicare Part B Annual Data Beneficiary File, 1986<br>HCFA Health Insurance Skeleton Eligibility Write-off File, 1986 | Rural: living in a nonmetropolitan county<br>Urban: living in a metropolitan county | Age, gender | Low | Rurality and race interaction (+); white-black relative risks for services were higher in rural areas for 12 of 32 studied services (including 8 of 14 outpatient services) |
| Miller et al., 1995[96]<br>Cross-sectional | N = 31,100,000<br>Medicare Part B beneficiaries<br>Excluded those enrolled in HMOs<br>National | Medicare Part B Annual Data File, 1990<br>Health Insurance Eligibility Write-off File, 1990 | Rural areas are the non-MSA areas of states. Urban areas are subdivided into small MSAs (less than 250,000 inhabitants), large MSAs (250,000 to 3 million), and very large MSAs (3 million or more). | Age, race, gender | Low | Physician utilization (+); R<U (particularly consultations, psychiatric visits, emergency department visits, imaging services, and laboratory tests) |

*See Methods section for explanation
**U=Urban; R=Rural; (+)=difference statistically significant; (-)=difference not statistically significant

## Appendix C, Table 11. Medical Appointments with Providers

| Author, Year, Study Design | Characteristics of Study Population (Sample Size, Inclusion/Exclusion, Region of United States) | Data Source and Year(s) of Sampling (if applicable) Response rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Blazer, 1995[98]<br>Cross-sectional | N = 4,162 (4,001 respondents)<br>Inclusion: ages 65+ years; resident of 1 of 5 counties<br>1 urban and 4 rural counties in North Carolina | Duke Established Populations for Epidemiologic Studies of the Elderly, 1986-1987<br>Response rate: 80% | US Bureau of the Census: rural is county with fewer than 2,500 inhabitants<br>Also classified counties as rural or urban | Race/ethnicity, self-rated health, the health index, age, gender, education, marital status, employment status, income, Medicare coverage, Medicaid coverage, private insurance | Low/<br>Moderate | Ambulatory care visits (-) |
| Fortney, 2002[105]<br>Cross-sectional | N = 355,452<br>Inclusion: primary care patients treated at 38 Community-Based Outpatient Clinics (CBOCs) or 32 parent VA Medical Centers (VAMCs)<br>CBOCs and VAMCs from 16 Veterans Integrated Services Networks (VISNs) | Austin Automatic Center (AAC) outpatient file, 1995-1998 | Comparisons focused on CBOCs vs. VAMCs | Age, gender, marital status, ethnicity, service-connected, percent service connected, VA service use in prior year | Moderate | Primary care encounters (+); CBOC>VAMC<br>Specialty care encounters (+); CBOC<VAMC<br>Number of days to follow-up care for hospitalization or inpatient psychiatric treatment (-) |
| Glover, 2004[100]<br>Cross-sectional | N = 50,993 (9,778 or 19% rural)<br>Inclusion: ages 18-64<br>Nationwide | National Health Interview Surveys, 1999-2000<br>Response: 81% (1999) and 83% (2000) | Urban: Metropolitan Statistical Area<br>Rural: Non-MSA | Race/ethnicity, gender, age, region of residence, interview language, limitations in activities, self-reported health status, education, employment, family size, income, marital status, insurance | Moderate | Health care use in past 12 months (-) (within urban and rural, minorities less likely to have visit (+)) |
| Himes & Rutrough, 1994[101]<br>Cross-sectional | N = 11,101<br>Inclusion: non-institutionalized persons ages 65 and older<br>Nationwide | National Health Interview Survey (Supplement on Aging), 1984 | Four categories: Metropolitan central city residents (within SMSAs); metropolitan noncentral city residents; nonmetropolitan nonfarm residents (outside SMSA); nonmetropolitan farm residents | Age, gender, ethnicity, marital status, education, health status, limitations in activities of daily living, living arrangement, poverty, region of U.S., bed disability days | Moderate | Physician visit in past year (+); non-metro<metro |

| Author, Year, Study Design | Characteristics of Study Population (Sample Size, Inclusion/Exclusion, Region of United States) | Data Source and Year(s) of Sampling (if applicable) Response rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Larson & Fleishman, 2003[102]<br>Cross-sectional | N = 14,997<br>Inclusion: persons 18+ in second round interviews<br>Exclusion: missing data for the independent variables, or died, became institutionalized, or moved out of the country in 1996<br>Nationwide | Medical Expenditure Panel Survey, 1996 | Nine-category Urban Influence Codes: Large MSA with 1million or more; small MSA with less than 1 million; adjacent large MSA with city of 10K or more; adjacent large MSA with city less than 10K; adjacent small MSA with city of 10K or more; adjacent small MSA with city less than 10K; not adjacent with city of 10K or more; not adjacent with city between 2.5-10K; non-adjacent with no town more than 2.5K | Gender, ethnicity, education, age, insurance, family income, self-reported health, priority condition, limitations in activities of daily living or instrumental activities of daily living, physician availability, region, has usual source of care | Moderate | Any ambulatory care visit (+); adjacent large MSA (with city <10k or > 10k) < MSA with ≥ 1million<br>Any ambulatory care visit (-): most rural vs. most urban<br>Number of ambulatory care visits (+); most rural < large MSA |
| Maciejewski, 2007[104]<br>Cross-sectional | N = 63,478<br>Inclusion: primary care patients treated at one of 108 Community-Based Outpatient Clinics (CBOCs) and/or one of 72 parent VA Medical Centers (VAMCs) | VA FY2000 Outpatient Care File; VA FY2000 Patient Treatment File; VA FY2000 and FY2001 Decision Support System Outpatient and Inpatient National Extracts | Compared VAMC patients, CBOC patients, and crossover patients | Age, gender, race, marital status, eligibility for free care, service-related disability, DCG risk score, distance to usual source of care | High | Primary care visits (+); CBOC>VAMC<br>Specialty care visits (+); CBOC<VAMC<br>Total outpatient expenditures (+); CBOC<VAMC |
| McConnel & Zetzman, 1993[99]<br>Cohort | N = 3,350<br>Inclusion: individuals 55 and older<br>Exclusion: died, moved, could not be re-interviewed, or had missing data on relevant variables<br>Nationwide | National Center for Health Statistics' Longitudinal Study of Aging, 1984-1986<br>Area Resource File, 1987 | U.S. Department of Agriculture (1989) 10-level County Adjacency Codes to create three categories: major urban (MSA counties), less urban (non-MSA counties with towns larger than 2.5K), and rural (non-MSA counties with towns with fewer than 2.5K) | Age, gender, ethnicity, living arrangement, social contact, education, prior service use, Medicaid eligibility, limitations in activities of daily living, health status, chronic conditions, and availability of hospital beds, physicians, and nursing home beds. | Low | Use of physician services (-) |

| Author, Year, Study Design | Characteristics of Study Population (Sample Size, Inclusion/Exclusion, Region of United States) | Data Source and Year(s) of Sampling (if applicable) Response rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Mueller, 1998[103]<br>Cross-sectional | N = 112,246<br>Inclusion: respondents under 65<br>Nationwide | National Health Interview Survey, 1992<br>Response rate: 95.7% | Urban: central or noncentral cities located within a MSA<br>Rural: outside a MSA, either on a farm or not | Age, gender, self-reported health status, presence of acute or chronic health problems, ethnicity, family size, education, insurance status, income, region of country | Moderate | Physician visit in past 12 months:<br>(+); any R<U White (except R African American) |
| Saag et al., 1998[29]<br>Cross-sectional | N = 787<br>Inclusion: home-dwelling elderly (age > 65 years), ≥ 1 of the indicator conditions, resident of state's 12 most rural and 10 most urban counties<br>Iowa | Population based phone survey evaluating six common chronic indicator conditions (arthritis, hypertension, cardiac disease, diabetes mellitus, peptic ulcer disease, and chronic obstructive pulmonary disease)<br>Response: 57% | U.S. Department of Agriculture continuum codes.<br>Urban: metro areas with > 250,000 residents<br>Rural: <2,500 residents in a single incorporated place and not adjacent to metro areas | Age, gender, education beyond high school, living on a farm, alcohol use, smoking in the past, medical advice needed in the past year, supplemental private insurance, medication coverage, Medicaid, VA clinic in the past year, Distance from physician, congregate meals, Use of Meals on Wheels, Homemaker service | Low | Number of physician visits (-) |
| Weeks et al., 2005[8]<br>Cohort | N = 67,985 (1997); 51,899 (1998); 56,833 (1999)<br>Inclusion: male veterans 65 years or older and enrolled in Medicare fee-for-service plans<br>New England | VHA's Patient Treatment File and Outpatient Clinic File, 1995-1999<br>Medicare Denominator, 100% MEDPAR, Outpatient, and Physician Supply files, 1997-1999 | Department of Agriculture Rural/Urban Commuting Area (RUCA) Code; grouped into urban (RUCA codes 1-6) and rural (RUCA codes 7-10) | Age, gender, living in the northern or southern states of New England, number of VHA and Medicare inpatient admissions | Moderate | Primary, specialist, and mental health visits (+); R<U (across all three study years ) |

*See Methods section for explanation
**U=Urban; R=Rural; HR=Highly rural; F=Frontier; (+)=difference statistically significant; (-)=difference not statistically significant

## Appendix C, Table 12. Usual Source of Care

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/ Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Meza, 2006[106]<br>Cross-sectional | N = 3,871<br>Inclusion: Department of Defense beneficiaries, active duty, uniformed services<br>Nationwide | Health Care Survey of DoD Beneficiearies (HCSDB) – mailed survey 2002<br>Response: 29% | US Census Bureau – metropolitan (metro), adjacent to metropolitan (adj), or nonadjacent (non adj) | Age, service category, marital status, self-reported health status, race, rank, gender, utilization, years in health plan, health plan, indicator of other health plan | Low | Rating of health plan, rating of health care, getting care quickly (+); Adj or non-adj> Metro<br>Getting needed care (+); Metro>Adj or non-adj |
| Blazer, 1995[98]<br>Cross-sectional | N = 4,162 (2,152 or 47% rural); 4001 with complete data<br>Inclusion: >65 yrs, resident of 1 urban or 4 rural counties<br>North Carolina | Stratified (race & residence) random sample-Duke Established Populations for Epidemiologic Study of the Elderly survey, 1986-87<br>Response: 80% | US Bureau of the Census<br>Rural: fewer than 2,500 inhabitants<br>Also classified counties as rural or urban | Race/ethnicity, self-rated health, health index, age, gender, education, marital status, employment, income, Medicare and Medicaid coverage, private insurance | Low/<br>Moderate | Usual source of care (-)<br>Usually sees same provider(+); R>U<br>Put off care due to not knowing where to go (-)<br>Put off care due to transportation difficulties (-)<br>Put off care due to cost (+); R>U |
| Borders, 2004[107]<br>Cross-sectional | N = 2,097<br>Inclusion: community dwelling, age ≥65, Hispanic or non-Hispanic white<br>West Texas | Telephone survey<br>Response: 53% | Rural: county with fewer than 50,000 persons<br>Frontier: county with fewer than 50,000 persons and fewer than 7 persons/mi$^2$ | Age, gender, ethnicity, marital status, education, economic factors, insurance, chronic conditions | Low/<br>Moderate | Always/usually see personal doctor/nurse (-)<br>Always/usually able to obtain care without a long wait (-) |
| Glover, 2004[100]<br>Cross-sectional | N = 50,993 (9,778 or 19% rural)<br>Inclusion: ages 18-64<br>Nationwide | National Health Interview Surveys, 1999-2000<br>Response: 81% (1999) and 83% (2000) | Rural: any place of residence not in a Metropolitan Statistical Area | Race/ethnicity, gender, age, interview language, region of residence, limitation of activities, self-reported health status, education, employment, family size, income, marital status, insurance | Low/<br>Moderate | Usual source of care (-) (in rural and urban areas Hispanic adults less likely than white adults to have usual source of care)<br>Health care use in past 12 months (-) |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/ Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Koopman, 2006[48]<br>Cross-sectional | N = 947<br>Inclusion: US civilian, ≥20 years, non-institutionalized, participated in NHANES III: household adult, examination, and laboratory data files<br>Exclusion: did not participate in all three parts of the survey<br>Nationwide | Third National Health and Nutrition Examination Survey (NHANES III) 1988-1994 | Urban: MSA<br>Rural: Non-MSA | Gender, age, BMI, perceived health status, income, insurance status, education, usual place of care, # times seeing physician in past year, duration of diabetes | Moderate | Usual source of care (+); U Hispanic<R Hispanic, R White, U White#<br>#Unadjusted analysis |
| Larson, 2003[102]<br>Cross-sectional | N = 15,518 for geographic variation<br>N = 14,997 for regression<br>Inclusion: non-institutionalized, civilian, age 18 and older<br>Nationwide | Medical Expenditures Panel Survey (MEPS), 1996<br>Area Resource File (ARF) with Urban Influence Codes (UIC) | UICs by county – large (pop'l >1 million) or small metropolitan areas; non-metropolitan areas distinguished by adjacency and pop'l of largest city (>10,000) | Gender, ethnicity, education, age, insurance, family income, self-reported health, priority condition, limitations in activities of daily living or instrumental activities of daily living, physician availability, region, usual source of care | Moderate | Usual source of care (+); most R>most U (adj. to large MSA with city <10,000 also greater than most urban) |
| Rohrer, 2004[18]<br>Cross-sectional | N = 3,689 (1,983 or 54% rural)<br>N,=,3,680 for usual source of care outcome<br>Inclusion: ages 65 and older<br>West Texas | Texas Tech 5000 telephone survey, Sept.-Dec. 2000<br>Response: 57% | Rural: county with population less than 50,000 | Age, gender, ethnicity, resides in continuing care, health limitations, specific diagnoses, education, income, marital status, medical skepticism, religiousness, insurance status, employment, home ownership | Low | Personal doctor or nurse (-)<br>Usual place to go for care (-) |

*See Methods section for explanation
**U=Urban; R=Rural; (+)=difference statistically significant; (-)=difference not statistically significant

## Appendix C, Table 13. Provider Availability and Expertise

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Baldwin, 1999[117]<br>Cross-sectional | N = 4,003 physicians (619 or 15.5% rural); 382,776 patients of those physicians<br>Inclusion: physicians practicing in either rural or urban areas (not both); specialties with at least 10 physicians submitting claims in rural and urban locations; Medicare beneficiaries (65 and older)<br>Washington | Medicare Part B file (billed services), 1994<br>Health Care Financing Administration (HCFA) provider directory<br>Medicare beneficiary file | Rural Health Service Areas defined as physician practice addresses with ZIP codes closer to rural hospital than urban hospital | None | Low/<br>Moderate | Family physicians most likely to practice in rural area (25%); psychiatrists (5%), cardiologists (6%), gastroenterologist (8%) least likely#<br>Family physician age (+); R>U#<br>Patients/physician (+); R>U#<br>Outpatient visits/physician (+); R>U#<br>Diagnostic scope of practice similar except: urban general surgeons >CV disorders; rural general surgeons >GI disorders and urban obstetrician-gynecologists >care for menopausal symptoms; rural obstetrician-gynecologists >diagnoses outside specialty#<br>Procedure rates (+); R>U for family practice, internal medicine, general surgery#<br>#Unadjusted analysis |
| Biola, 2009[111]<br>Cross-sectional | N = 4,879 from 150 rural counties<br>Inclusion: English- or Spanish-speaking, age ≥18, lived in community for previous 12 months (1 person selected from each household reached)<br>Southeast (AL, AK, GA, LA, MS, SC, TX, WV) | Telephone survey 2002-2003; this report focused on question: How much do you agree with the statement: 'I feel there are enough doctors in my community?'<br>Response: 51% | Not reported<br>NOTE: counties selected by project leaders; typically higher poverty and unemployment rates, larger racial-ethnic minority proportions, and higher infant mortality rates than other rural counties in the state | Age, gender, race, education, children <18 years, self-reported health, health insurance status, travel time to care, problem with cost of care, ease of getting appointment, role of physician care, number of visits in past year, satisfaction with care, confidence in doctor's abilities, county characteristics | Low | Not enough physicians (+):<br>a. areas with fewer physicians/pop'l > areas with more physicians/pop'l<br>b. travel time to care more than 30 min > travel time to care less than 30 min |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Brown B, 2009[109]<br>Cross-sectional | N = 264 (132 self-reported rural)<br>Primary care physician assistants (PAs)<br>Nationwide | Web-based survey, 2008 (10 case-scenarios)<br>Response: 49% responded; 44% analyzed | Respondents self-reported rural or urban | None | Low | Mean score on 10 question case-scenario quiz (+); R>U#<br>PAs reporting they diagnose and treat 50-100% of skin complaints (+); R>U#<br>Cases referred to specialist per week (-)#<br>#Unadjusted analysis |
| Everett, 2009[113]<br>Cross-sectional | N = 6,803 (887 or 13% non-metropolitan)<br>Inclusion: graduated from high school in Wisconsin in 1957 or one of their siblings; stated they had usual source of care in 2004-05; specified a physician assistant (PA), nurse practitioner (NP), or physician (MD) with primary care specialty as usual provider<br>Wisconsin | Wisconsin Longitudinal Study (WLS) - telephone and mail survey 1993-94 for perceived health, 2004-05 survey defined sample and all other variables<br>Response: 80% for graduates, 78% for siblings (telephone); 88% for graduates and 81% for siblings (mailed survey to those who did telephone interview) | Office of Management and Budget (metropolitan, micropolitan, or nonmetropolitan) | Age, gender, marital status, education, personality traits, income, insurance, perceived health, number of diagnoses | Low/<br>Moderate | 306 (4.5%) use PA/NPs as usual source of care#<br>PA/NP as usual source of care (+); non-metro>metro, non-metro>micro<br>#Unadjusted analysis |
| Ferrer, 2007[110]<br>Cross-sectional | N = 34,403<br>Inclusion: all ages, non-institutionalized, able to link household component with office and outpatient facility face-to-face visits<br>Nationwide | MEPS, 2004<br>plus information from relevant clinicians<br>Response (to MEPS): 64% | Metropolitan Statistical Area (MSA) = urban, non-MSA = rural | Age, gender, income, insurance, race/ethnicity | Low/<br>Moderate | Odds of visiting family physician, nurse practitioner, and physician assistant (+); non-MSA>MSA<br>Odds of visiting general internist or non-surgical specialist (+); non-MSA<MSA |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Grumbach, 2003[112]<br>Cross-sectional | N = 33,673 clinicians (28,053 California [CA], 5,620 Washington [WA])<br>Inclusion: active in patient care, no longer in training, primary self-reported specialty of family/general practice, internal medicine, pediatrics, obstetrics/gynecology<br>California, Washington | AMA Physician Masterfile plus WA licensing board information and contacts with rural physicians (physician data)<br>Mailed survey (non-physician data)<br>Response: 64% (CA); 67% NPs in WA, 86% PAs in WA | CA: Medical Service Study Areas (MSSA); rural – population density <250 residents/mi$^2$ with no city of ≥50,000<br>WA: Rural Health Service Areas (HSA) and urban public health department zones; rural – core city or town non MSA or in MSA but >30 min from population base of ≥10,000<br>Census data | Clinician age, gender, and race/ethnicity | Low | 22% of Physician Assistants in CA practice in rural area; 28% in WA[#]<br>Odds of practicing in rural areas:<br>(+) family physicians, nurse practitioners, and physician assistants more likely relative to obstetricians/gynecologists<br>(+) Asian, African Americans, Latinos (CA only) less likely<br>(+) females less likely<br>[#]Unadjusted analysis |
| Gunderson, 2006[115]<br>Cross-sectional | N = 539 physicians who practiced in rural Florida<br>Inclusion: physicians who self-report treating elderly (primary care, psychiatry, surgery, specialists)<br>Florida | Mailed survey 2003<br>Response: 43% | Rural: one of 33 designated rural counties in Florida, practicing in rural areas of nonrural counties by Rural Urban Commuting Area codes, or Health Resources and Services Administration list of rural ZIP codes | None | Low | 55% reported decreased or eliminated patient services in past year including mental health, (35%), vaccine administration (29%), office-based surgeries (40%), Pap smears (24%), x-rays (24%), endoscopies (43%), and electrocardiograms (11%)[#]<br>Physicians in practice where ≥65% of patients were Medicare patients were more likely to reduce or eliminate services compared to those with <28.5% Medicare patients[#]<br>[#]Unadjusted analysis |
| Jones, 2008[114]<br>Cross-sectional | N = 254 counties<br>Inclusion: all counties in Texas<br>Texas | Texas Medical Board<br>US Census Bureau, 2007 | Frontier - ≤6 people per 2.6 km$^2$ | None | High | 17 counties had no licensed doctors or physician assistants[#]<br>Statewide: 1 physician assistant per 13.6 physicians<br>Frontier counties: 1 physician assistant per 2.3 physicians[#]<br>[#]Unadjusted analysis |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Laditka 2009[28]<br>Cross-sectional | Inclusion: all US counties<br>Nationwide | Area Resource File, 2002 | Urban Influence Codes, 2003 | None | High | Mean primary care physician supply (per 10,000 population):<br>*Metropolitan:* 17.8 (large), 16.9 (small)<br>*Micropolitan:* 12.3 (adj. to large metro), 13.1 (adj. to small metro)<br>*Rural:* 7.1 (adj.t o small metro), 7.2 (adj. to micro), 9.2 (not adj. to metro or micro)#<br>#Unadjusted analysis |
| Menachemi, 2006[116]<br>Cross-sectional | N = 308 family physicians (176 rural, 132 urban)<br>Florida | Mailed survey<br>Response: 42% | Rural: one of 33 designated rural counties in Florida, practicing in rural areas of nonrural counties by Rural Urban Commuting Area codes, or Health Resources and Services Administration list of rural ZIP codes | None | Low | Overall, 60% reported delivery of patient services decreased or eliminated in past year#<br>Types of services decreased or eliminated (-) (except for office-based surgeries)#<br>#Unadjusted analysis |
| Strickland, 1998[118]<br>Cross-sectional | N = 1,118 providers (1,079 with ZIP codes)<br>Inclusion: nurse practitioners (NP), certified nurse midwives (CNM), physician assistants (PA) residing or practicing in Georgia<br>Georgia | Mailed survey, 1994<br>Response: 62% | Metropolitan Statistical Area (MSA) = urban, non-MSA = rural | None | Low/<br>Moderate | NPs (n=554, 31% rural): older, fewer with bachelor's degree, fewer specialty credentials, more years in health care, more solo and clinic practice settings, fewer insured patients (+); R vs. U#<br>CNMs (n=73, 29% rural): fewer specialty credentials, more hours per week, more patients per hour (+); R vs. U#<br>PAs (n=452, 18% rural): older, fewer with bachelor's degree, more years in health care and years as PA, more patients each hour, more clinic practice settings, fewer insured patients (+); R vs. U#<br>#Unadjusted analysis |

| Author, Year, Study Design | Study Population (Sample Size, Inclusion/Exclusion, Region/Nationwide) | Data Source, Year(s) (if applicable) Response Rate (if applicable) | Definition of Urban/Rural | Covariates | Confidence Score* | Results** |
|---|---|---|---|---|---|---|
| Wilson, 2009[66]<br>Cross-sectional | N = 1,427 counties or county sets (contiguous, single state sets of counties merged to achieve population >50,000)<br>Inclusion: all US counties or county sets except Alaska, Hawaii, and 12 cities with changes in county definitions between 1980 and 2000<br>Nationwide | Numbers of rehabilitation therapists (physical [PT] or occupational [OT] therapists, speech-language pathologists [SLP]) from 1980 and 1990 ARF and 2000 EEO<br>Health Professional Shortage Area Data | US Office of Management and Budget (OMB) – metropolitan (metro): central county with ≥1 urbanized area and outlying counties economically tied to core county | None | Moderate/<br>High | PTs, OTs, or SLPs per 100,000 residents (NR); U>R#<br>PTs, OTs, or SLPs per 100,000 residents (NR); Non-shortage area > partial or total shortage area# |

*See Methods section for explanation
**U=Urban; R=Rural; (+)=difference statistically significant; (-)=difference not statistically significant