The Healthcare of Vulnerable Populations within Rural Societies: A Systematic Review

Kattiria M. Gonzalez, MS, PhD Student, RN[1]

Molly J. Shaughnessy, BS, MBA, PhD Student, RN[2]

Edwin-Nikko R. Kabigting, MS, PhD Candidate, RN[3]

Donna Tomasulo West, MS, PhD Student, RN, NP[4]

Jacqueline Callari Robinson, BS, PhD Student, RN[5]

Qimin Chen, BS, Master's Degree Student, RN[6]

Pamela Stewart Fahs, PhD, RN[7]

[1] PhD Student, Decker School of Nursing, Binghamton University, kgonza33@binghamton.edu

[2] PhD Student, Decker School of Nursing, Binghamton University, mshaugh2@binghamton.edu

[3] PhD Candidate, Decker School of Nursing, Binghamton University, ekabigt1@binghamton.edu

[4] PhD Student, Decker School of Nursing, Binghamton University, dwest3@binghamton.edu

[5] PhD Student, Decker School of Nursing, Binghamton University, jcallar1@binghamton.edu

[6] Master's Degree Student, Decker School of Nursing, Binghamton University, qchen20@binghamton.edu

[7] Associate Dean, Professor, Director of PhD Programs, and Decker Chair in Rural Nursing, Decker School of Nursing, Binghamton University, psfahs@binghamton.edu

Abstract

Purpose: To synthesize the recent research on vulnerable populations within United States (US) rural society regarding healthcare, healthcare policy, and health systems. Additionally, a

healthcare disparity model was utilized to organize the findings as a means of evaluating the current state of the science regarding vulnerabilities research in the field of rural health.

Methods: A systematic review of literature was conducted covering 46 articles published in the last five years on vulnerability within rural populations in the US and its territories. Instruments to evaluate both quantitative and qualitative scientific merit were utilized in this review.

Findings: Analysis of the state of the science indicates that studies that scored well on measures of scientific merit were conducted on some of the most vulnerable populations within rural society. Most of this work remains at a descriptive level, rural is only operationally defined approximately 1/3 of the time, and seldom is there a clear definition of the term vulnerable. The findings of this review support the model depicting how healthcare accessibility and quality, along with healthcare needs can reflect the level of vulnerability of rural populations.

Conclusions: Using the combination of the search terms "vulnerable" and "rural" failed to produce any studies on the subject of telehealth. Telehealth is an area that needs to be specifically studied for vulnerable populations in rural society. There is a need for rural health research that provides interventions and includes measurement of social determinants of health.

Keywords: Rural, Vulnerable, Social determinants of health

The Healthcare of Vulnerable Populations within Rural Societies: A Systematic Review

The purpose of this literature review is two-fold. The first purpose is to synthesize the findings of research for the past five years related to vulnerable populations within rural society in the US. Additionally, the findings will be discussed within the Dynamic Multi-Vulnerability Health Care Disparities model (Grabovschi, Loignon, & Fortin, 2013).

Healthcare Disparities and Vulnerability in Rural America

Healthcare disparities continue to be a significant issue in the US (Crosby, Wendel, Vanderpool, & Casey, 2012; Penman-Aguilar et al., 2016). The inequality that various groups of Americans face concerning their ability to access timely, quality healthcare is driven by many individual, societal, and environmental factors such as race/ethnicity, socioeconomic status, level of educational attainment, provider availability, and more. Social determinants of health encompass the place in which people live as well as their socioeconomic status and barriers to quality healthcare. The vulnerability of rural dwellers changes in relation to social determinants of health as well as to the extent of the lack of accessibility to healthcare for individuals and communities (Fahs, 2017).

Subgroups within the American population that have an elevated risk for experiencing healthcare disparities are generally described as vulnerable (De Chesnay & Anderson, 2016; Shi & Stevens, 2010). Rural dwellers, for example, may be considered a vulnerable population due to their increased likelihood of experiencing barriers to accessing quality healthcare. These healthcare disparities are often accentuated by rural dwellers' geographic isolation and residence in medically underserved areas (MUA) (Crosby et al., 2012). The Centers for Disease Control and Prevention (CDC) announced that "Americans living in rural areas are more likely to die from five leading causes than their urban counterparts" (Centers for Disease Control and Prevention, n.d., para 1). The basis for this statement was a report focused on the leading nonmetropolitan and metropolitan causes of death in the US (Moy et al., 2017). While this literature review will show that much work has been done to advance understanding of healthcare for rural Americans, there

is still much to accomplish.

The development of knowledge in the field of rural health should involve an exploration of the dynamics between healthcare needs, access, and vulnerability to healthcare disparities in rural Americans. To organize this exploration, a structured approach was used. The dynamic multi-vulnerability model of healthcare disparities was selected for this application (Grabovschi et al., 2013). This model (Figure 1) was created based on Hart's oft-cited description of the Inverse Care Law, which states that "the availability of good medical care tends to vary inversely with the need of the population served" (Hart, 1971, p. 412). The vulnerability model is a right triangle wherein the horizontal axis (base) represents the degree of healthcare accessibility and quality and the vertical axis represents healthcare needs; the hypotenuse of the triangle reflects the level of vulnerability (Grabovschi et al., 2013). According to the model, an individual who experiences multiple vulnerability factors would be more likely to have high healthcare needs and low access to quality care. Barriers to healthcare access in rural settings often include lack of insurance coverage and distance from services. Rural residents are more likely to be uninsured compared to urban dwellers (Barker, Londeree, McBride, Kemper, & Mueller, 2013; Soni, Hendryx, & Simon, 2017). With regard to distance, "many rural residents must travel more than 30 minutes to access healthcare services, … in a setting where public transportation is not available and poverty is at its peak, travel to prevention and self-management resources can be even more burdensome" (Warren & Smalley, 2014, p. xiii).

While Grabovschi and colleagues (2013) acknowledge that the inverse care law (Hart, 1971) focuses on vulnerability related to low socioeconomic status, the Grabovschi et al. (2013) model includes many other patient related factors that impact vulnerability and may co-exist in a single

patient. These factors can be categorized into either inborn or acquired individual traits as well as factors related to the physical environment or broader socioeconomic environment (Grabovschi et al., 2013). For example, race would be considered inborn, lifestyle would be acquired, pollution would be categorized as a factor from the physical environment, and culture would be related to the broader socioeconomic environment; all of which are social determinants of health.

Method

The search was conducted using EBSCO host and included the following databases: Medline full text, PsycINFO, CINAHL Complete, and PsycARTICLES. Studies were limited to literature published between the dates of January 2012 to March 2017. To meet review criteria, articles had to be written in the English language, peer-reviewed, and based on research conducted in the US and its territories. Articles related to healthcare as well as healthcare policy and health systems were reviewed. Research that was conducted outside of the US and its territories, those that specifically discussed patient electronic health records (EHRs), systematic reviews, and dissertations were excluded. Search terms used were "rural" and "vulnerable". If both keywords were not expressed in either the title or abstract, the article was reviewed manually to determine inclusion. Using the above criteria, journals specific to rural health in the US were also searched. A total of 51 articles were included for review after the exclusion of dissertations, articles that were duplicates, meta-analysis or systematic review and those with topics including EHRs as well as studies conducted outside of the US. A systematic review method was carried out and each article was evaluated for scientific merit. Five articles (10%) were excluded from review due to poor scientific merit, leaving a final count of 46 articles (see Figure 2).

Thirteen healthcare providers planned and conducted the search. Each reviewed a subset of up to four articles. One author (blinded) read all articles and the accompanying review forms for detail accuracy. In order to address inter-rater reliability, two additional providers independently reviewed eight of these articles.

Levels of Evidence

The level of evidence for each article reviewed was identified using a system that is primarily based on study design (Fineout-Overholt, Melnyk, Stillwell, & Williamson, 2010). Levels of evidence in this system range from I to VII. Systematic reviews or meta-analyses are considered the highest level of evidence. Expert opinion is the lowest level. Levels of evidence considered in this review included Level II - randomized-control trials (RCT), Level III - quasi-experimental studies, Level IV- cohort or case controlled studies and Level VI, descriptive studies using either quantitative or qualitative methods. For this analysis, systematic quantitative or qualitative reviews (Level I or V) were excluded since the project is focused on creating a systematic review. Additionally, expert opinion pieces (VII) were excluded.

Scientific Merit

Scientific merit was evaluated using two different tools depending method. Studies that were quantitative were evaluated using a system with eight rated areas, with each item scored from 0 – 3 points. The highest possible score on the quantitative scoring grid was 24 points (Association of Women's Health Obstetric and Neonatal Nurses, 2003). A rating of 18 or higher was considered to be good quality. Articles that scored 13-17 were rated as fair. Articles that were given a score of 12 or below were rated as poor quality, lacking scientific merit, and were eliminated from the review. The eight areas considered in scoring were: problem/question, sample, literature review,

data collection/method, instrumentation, design validity, statistical analysis, and justification of conclusion.

Studies that were qualitative were evaluated using a similar scoring system developed specifically to evaluate qualitative work (Cesario, Morin, & Santa-Donato, 2002). The highest score that could be given on the qualitative scoring grid was 27. A score of 23 or higher was rated as good quality. Scores of 15-22 were rated to be of fair quality. Those articles that did not meet the criteria for scientific merit, i.e., scores of 14 or less, were eliminated from the review. Five areas considered in scoring included: descriptive vividness, methodological congruence (rigor in documentation, procedural rigor, ethical rigor and confirmability), analytical preciseness, theoretical connectedness, and heuristic relevance (intuitive recognition, relationship to existing body of knowledge, and applicability). There is no scoring system specifically for mixed methods, thus the articles were scored using the method most prevalent in the research report.

Theory

Use of theory was evaluated using the guidelines to judge whether there was minimal, insufficient, or adequate use of models for theory testing (Silva, 1986). Minimal use meant identifying a theoretical framework for a study but not indicating how it was used. Insufficient use of theory indicated that a theoretical model was used to organize the research. Studies were considered to have adequate use if they explicitly tested theory.

Findings

Although factors such as low socioeconomic status, minority race/ethnicity, and advanced age were not always explicitly indicated in the 46 articles reviewed as being linked to vulnerability, the categorization of these factors explicated by Grabovschi et al. (2013) aided in determining their

presence in the various studies. All of the 46 articles investigated an issue in rural healthcare that involved a patient population with at least one vulnerability factor, with one exception. This stand-alone study focused on provider performance in critical access hospitals, thereby evaluating access to quality acute care in a rural setting (Coleman, Baker, Gallo, & Slonim, 2012). In examining the remaining 45 studies, it was clear that certain vulnerability factors, such as low socioeconomic status, received significant attention from rural health researchers, while other factors such as smoking received far less (see Table 1).

For the sake of concision, only aspects of vulnerability present in three or more studies were included in Table 1 in order to illustrate the most highly studied factors. Vulnerability factors found in the reviewed articles but not included in Table 1 included lack of social connection (Baernholdt, Yan, Hinton, Rose, & Mattos, 2012; Galloway & Henry, 2014), unsafe environment (Carter-Edwards et al., 2015; Klein, Liber, Kauffman, Berman, & Ferketich, 2014), risky sexual behavior (Gullette, Booth, Wright, Montgomery, & Stewart, 2014; Kogan, Cho, & Oshri, 2016), uninsured status (Buerhaus, DesRoches, Dittus, & Donelan, 2015), farm worker status (Crain et al., 2012), immigrant status (Crain et al., 2012), sedentary lifestyle (Pahor et al., 2014), and living in a healthcare provider shortage area (Tuefel et al., 2012).

Overall, low socioeconomic status was the most frequently mentioned aspect of vulnerability; considered in 22 (47.8%) of the studies. Many studies (18, 39.1%) also focused on issues in rural healthcare faced by racial/ethnic minority groups. After low socioeconomic status and racial/ethnic minority, the four other aspects of vulnerability that were most often discussed were chronic physical or mental illness (11, 23.9%), low education (11, 23.9%), old age (8, 17.4%), and youth (8, 17.4%). Details of each study reviewed may be seen in Table 2.

Many of the articles reviewed focused on rural populations with multiple vulnerability factors. For instance, Wenzel et al. (2012) examined the resource needs of older African-Americans with cancer and Wilhelm et al. (2015) studied low-income Mexican-American mothers with low educational attainment during the postpartum period. Some of these studies appeared to provide support to Grabovschi and colleagues' (2013) dynamic vulnerability model of health care. This model illustrates the relationship between healthcare needs, vulnerability factors, and access to quality care. Across all of the research examined, the populations studied involved rural dwellers, who often contend with reduced access to timely, quality healthcare (Crosby et al., 2012; Fahs, 2017). In many cases the articles reviewed indicated that rural groups with multiple vulnerability factors faced additional barriers to receiving needed care. For instance, Crain et al. (2012) discussed the high mental health care needs of immigrant Latino farmworkers residing in a rural area described as "poorly equipped to serve [them]" (p. 277). In this example, the population studied had high healthcare needs, multiple vulnerability factors, and poor access to quality care, which corresponds to the relationship illustrated by Grabovschi et al.'s (2013) model. Banks et al. (2016) described specifically how poverty prevented those with chronic illnesses in central Appalachia from keeping extra medication, food, and water on hand in case of emergency, making them particularly vulnerable to environmental disasters. Many other articles, however, did not provide enough information to determine the veracity or usefulness of the model. Some articles, for instance, focused only on lack of access to care for rural dwellers but did not discuss whether there was any increased need for healthcare services in the population studied (Hsia & Shen, 2016; Jones & Jerman, 2013). Ultimately though, the literature supported the view that many vulnerability factors constitute barriers to timely, quality healthcare for rural residents.

Level of Evidence and Scientific Merit

The level of evidence of research for this review ranged from II (RCT) to VI (qualitative or descriptive studies). The majority (37, 80%) of the papers evaluated were quantitative. The predominant design used was descriptive correlational. In this review, the scientific merit for qualitative studies had scores ranging from a high of 22 to a low of 19 points, out of a possible 27. Quantitative study merit scores ranged from a high of 22 points to a low of 13, out of a possible 24. The rating ranges for both quantitative and qualitative studies reflect only the 46 articles included after 5 were removed for questionable scientific merit upon review (See Figure 2). Inter-rater reliability was affirmed with two additional health care providers, blinded to the initial review, correctly identifying scientific merit categories in their redundant review of 8 of the original 56 articles. Those articles rated as having insufficient scientific merit were kept in the pool for testing for inter-rater reliability to assure that the scoring used for scientific merit would be replicable by other reviewers.

Sample and Sample Size of Studies

For all articles, sample sizes ranged from a low of 10 to a high of 30,874. Specifically, for quantitative studies, sample size ranged from a low of 28 to the largest study of 30,874 participants. For qualitative studies, the sample sizes ranged from 10 to 48. Although sample sizes varied considerably, only one of the articles calculated power analysis (Komro et al., 2015). A power analysis is frequently used in well-grounded quantitative research to limit the possibility of error between proposed hypothesis and findings. Komro et al. (2015) used power analysis in their study to justify adding towns to their sample size, which were not included in the original research design.

Rural factors

Rural factors were evaluated and subdivided into three criteria: objective measures, implied but not defined, or not specified. Approximately ⅓ (33%) of the articles fell into each of these categories. Objective measures included identifications by population density and land use such as US Census Bureau classifications (Ratcliffe, Burd, Holder, & Fields, 2016); or measures reflective of municipality boundaries and land use or methods developed for economical purposes such as the Rural Urban Continuum Codes (RUCCs) or the Rural Urban Commuting Codes (RUCAs) in the articles reviewed (United States Department of Agriculture, n.d.a., n.d.b.). Additionally, rural was used as a location as well as to identify issues of access to healthcare that are prevalent among this population (Winters, 2013). Table 2 indicates whether a definition of rural was provided in the articles reviewed.

Health Issue Examined

Thirteen primary topics emerged; the most common category was cancer detection and prevention. Specifically, studies most frequently addressed colorectal and breast cancer. The next most researched topic was access to healthcare. Other issues that were explored in at least three articles included: rural vs. urban differences, mental health, tobacco control and policy, health promotion and wellness, and risky behaviors. Topics that were only addressed once included discrimination and medical mistrust, rural coding schemas, rural infrastructures, the role of the provider, hazards, cardiovascular health, pain management, and pregnancy care.

Theory

Utilizing the classification system for adequacy of theory (Silva, 1986) only one study was identified has having adequate use (López-Cevallos, Harvey, & Warren, 2014). López-Cevallos

et al. (2014) utilized the Behavioral Model of Vulnerable Populations to frame their study, which evaluated the associations between medical mistrust, perceived discrimination, and satisfaction with healthcare. LeMasters et al. (2014) used the Health Belief Model to describe and organize their study, which guidelines label as insufficient use of theory. One study developed a new conceptual model from their findings (Carter-Edwards et al., 2015). Based on Silva's (1986) explanation of theory use in research articles, the majority (98%) of articles reviewed were classified as having no or minimal use of theory.

Limitations

Limitations were identified during this review. All the reviewed articles were based on research in the US and written in the English language. This deliberate restriction to US studies has the benefit of a clear focus on vulnerable populations within US rural society; however; this may be seen as a limitation as the findings of this review are less generalizable to the global rural healthcare field. Furthermore, there may be significant information related to this topic that could be obtained from research in other countries that was not included in the review.

Only three (6.5%) of the articles reviewed involved true experimental designs. Higher levels of evidence often indicate interventions are being conducted and tested. Among all articles, the use of theoretical frameworks was limited, thus limiting the contribution to the development of science.

Two-thirds of the articles did not use objective definitions of "rural", making comparisons between populations less reliable. Only one article defined "vulnerable" operationally, thus in the majority of studies it was the researchers' interpretation of factors that determined what was vulnerable (Horney et al., 2013). This lack of a clear definition adds more subjectivity than

necessary had operational definitions been provided. Rural and vulnerable, as the only two search terms, was a limitation; however, this provided reasonable limits on the numbers of articles identified. Additional search terms, such as disparities, social determinants of health and underserved may produce different results. All articles reviewed were published in a peer-reviewed journal. Risk bias was not assessed across studies. Surprisingly, there were no telehealth studies that emerged during the search.

Discussion

The use of theory testing adds to the scientific knowledge base (Silva, 1986). Thus, the absence of cited theories in most articles may indicate a lack of use or inadequate significance to theory testing. Alternatively, the preponderance of atheoretical research could be an indication of journal page limits and the need for concise writing to meet those requirements. The overreliance on descriptive correlational designs also restricts the appropriateness of theory testing. Ideally, studies should incorporate theories and theoretical applications pertinent to rural populations. Few disciplines have developed a theory to describe, explain and predict how rurality may influence the acceptance of healthcare within rural populations. One exception is the work on Rural Nursing theory (RNT) that has been in the nursing literature since the late 1980's (Long & Weinert, 1989). Thus, it was surprising to find that RNT was not mentioned in articles uncovered in this search.

Conclusion

This systematic literature review supports the premise that there are multiple vulnerable populations within rural society. The model used provided a way to view the types of vulnerabilities explored in the rural healthcare literature (Grabovschi et al., 2013). Some of the identified vulnerability is related to quality and access to care for rural dwellers and offers ideas

for further research and/or practice. According to the NC Rural Health Research Program, since 2010, 81 rural hospitals have closed (North Carolina Rural Health Research Program, n.d.). The uncertainty in the insurance markets may potentially have a catastrophic effect on the access and quality of healthcare for the vulnerable, particularly within rural communities. Thus, there is a risk of increasing the vulnerabilities within rural society in the future if access to healthcare is further compromised for rural dwellers.

Future research should adequately operationalize the use of the terms rural and vulnerable to ensure that research findings are applicable to the rural community. Studies regarding telehealth may want to use a keyword of vulnerable to assure that the research surfaces in reviews for the vulnerable within rural society.

Rural dwellers who have a chronic illness, are older, disabled, pregnant, smokers, or have substance abuse issues are likely to have increased healthcare needs. The research indicates that when these vulnerabilities combine with barriers to receiving quality care, such as poverty, lack of insurance, minority race/ethnicity, and residence in a medically underserved area, then healthcare disparities are likely to result. The literature on vulnerable, rural populations in the context of healthcare over the past five years has illuminated the extent of the needs of various vulnerable groups. While the bulk of the literature is descriptive rather than aimed at evaluating interventions, it does provide some of the background knowledge needed to move the science closer to addressing the disparities present in healthcare in the United States. Future research should be concentrated on intervention development and testing, with high levels of scientific merit, in order to close the gaps in healthcare quality experienced by vulnerable, rural groups.

This systematic review provides a clearer understanding of the state of the science on

vulnerable populations within rural societies. Furthermore, the findings of this review support the applicability of the Vulnerability model (Grabovschi et al., 2013) for use in rural health research focused on vulnerable populations.

Acknowledgements

Christopher Matthews, RN, MS, FNP, Christine Fuller, RN, MS, FNP, Don Hill RN, MS, FNP, Margaret Decker, RN, MS, and Reham Yasin, RN, BS who were students in Nurs. 621 / Nurs 622 at Binghamton University in Spring 2017.

References

Adams, S. A., Choi, S. K., Khang, L., Campbell, D. A., Friedman, D. B., Eberth, J. M., . . . Yip, M. P. (2015). Decreased cancer mortality-to-incidence ratios with increased accessibility of federally qualified health centers. *Journal of Community Health, 40*(4), 633-641. https://doi.org/10.1007/s10900-014-9978-8

Association of Women's Health Obstetric and Neonatal Nurses. (2003). *Evidence-based clinical practice guideline: Cardiovascular health for women: primary prevention*. Washington DC.

Atav, A. S., & Darling, R. (2012). Comparison of coding schemas for rural-urban designations with New York state counties and birth outcomes as exemplars. *Online Journal of Rural Nursing and Health Care, 12*(1), 29-39.

Baernholdt, M., Yan, G., Hinton, I., Rose, K., & Mattos, M. (2012). Quality of life in rural and urban adults 65 years and older: findings from the National Health and Nutrition Examination Survey. *The Journal of Rural Health, 28*(4), 339-347. https://doi.org/10.1111/j.1748-0361.2011.00403.x

Banks, L. H., Davenport, L. A., Hayes, M. H., McArthur, M. A., Toro, S. N., King, C. E., &

Vazirani, H. M. (2016). Disaster impact on impoverished area of US: An inter-professional mixed method study. *Prehospital and Disaster Medicine, 31*(6), 583-592. https://doi.org/10.1017/S1049023X1600090X

Bardach, S. H., Schoenberg, N. E., Fleming, S. T., & Hatcher, J. (2012). The relationship between colorectal cancer screening adherence and knowledge among vulnerable rural residents of Appalachian Kentucky. *Cancer Nursing, 35*(4), 288.

Barker, A. R., Londeree, J. K., McBride, T. D., Kemper, L. M., & Mueller, K. (2013). The uninsured: An analysis by income and geography. *Rural Policy Brief* (2013 6), 1-4.

Bernstein, J., Gebel, C., Vargas, C., Geltman, P., Walter, A., Garcia, R. I., & Tinanoff, N. (2016). Integration of oral health into the well-child visit at Federally Qualified Health Centers: Study of 6 clinics, August 2014–March 2015. *Preventing Chronic Disease, 13*, E58. https://doi.org/10.5888/pcd13.160066

Buerhaus, P. I., DesRoches, C. M., Dittus, R., & Donelan, K. (2015). Practice characteristics of primary care nurse practitioners and physicians. *Nursing Outlook, 63*(2), 144-153. https://doi.org/10.1016/j.outlook.2014.08.008

Carter-Edwards, L., Lowe-Wilson, A., Mouw, M. S., Jeon, J. Y., Baber, C. R., Vu, M. B., & Bethell, M. (2015). Community member and stakeholder perspectives on a healthy environment initiative in North Carolina. *Preventing Chronic Disease, 12*, E127. https://doi.org/10.5888/pcd12.140595

Centers for Disease Control and Prevention. (n.d.). Strategies for reducing health disparities: Selected CDC-sponsored interventions, United States, 2016. Retrieved from https://www.cdc.gov/media/releases/2017/p0112-rural-death-risk.html

Cesario, S., Morin, K., & Santa-Donato, A. (2002). Evaluating the level of evidence of qualitative research. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN, 31*(6), 708-714.

Coleman, N. E., Baker, D., Gallo, J., & Slonim, A. D. (2012). Critical outcomes: Clinical and team performance across acute illness scenarios in emergency departments of critical access hospitals. *Journal for Healthcare Quality, 34*(3), 7-15. https://doi.org/10.1111/j.1945-1474.2011.00141.x

Crain, R., Grzywacz, J. G., Schwantes, M., Isom, S., Quandt, S. A., & Arcury, T. A. (2012). Correlates of mental health among Latino farmworkers in North Carolina. *The Journal of Rural Health, 28*(3), 277-285. https://doi.org/10.1111/j.1748-0361.2011.00401.x

Crosby, R. A., Wendel, M. L., Vanderpool, R. C., & Casey, B. R. (Eds.). (2012). *Rural populations and health: Determinants, disparities, and solutions*. San Francisco, CA: Jossey-Bass.

De Chesnay, M., & Anderson, B. A. (2016). *Caring for the vulnerable: Perspectives in nursing theory, practice, and research* (4th ed.). MA: Jones & Bartlett Learning.

DeMattei, R. R., Allen, J., & Goss, B. (2012). A service-learning project to eliminate barriers to oral care for children with special health care needs. *The Journal of School Nursing, 28*(3), 168-174. https://doi.org/10.1177/1059840511432473

Eshofonie, A. O., Lin, H., Valcin, R. P., Martin, L. R., & Grunenwald, P. E. (2015). An outbreak of pertussis in rural Texas: an example of the resurgence of the disease in the United States. *Journal of Community Health, 40*(1), 88-91. https://doi.org/10.1007/s10900-014-9902-2

Fahs, P. S. (2017). Social determinants of health and rural nursing - Editorial. *Online Journal of Rural Nursing and Health Care, 17*(1), 1-2. https://doi.org/10.14574/ojrnhc.v17i1.452

Fan, Z. J., Foley, M. P., Rauser, E., Bonauto, D. K., & Silverstein, B. A. (2013). Effects of residential location and work-commuting on long-term work disability. *Journal of Occupational Rehabilitation, 23*(4), 610-620. https://doi.org/10.1007/s10926-013-9424-2

Faul, A. C. (2014). Understanding context in a diabetes-related healthy eating initiative in rural America. *Educational Gerontology, 40*(4), 287-300. https://doi.org/10.1080/03601277.2014.852938

Feltner, F. J., Ely, G. E., Whitler, E. T., Gross, D., & Dignan, M. (2012). Effectiveness of community health workers in providing outreach and education for colorectal cancer screening in Appalachian Kentucky. *Social Work in Health Care, 51*(5), 430-440. https://doi.org/10.1080/00981389.2012.657296

Fineout-Overholt, E., Melnyk, B. M., Stillwell, S. B., & Williamson, K. M. (2010). Evidence-based practice step by step: Critical appraisal of the evidence: part I. *The American Journal of Nursing, 110*(7), 47-52.

Galloway, A. P., & Henry, M. (2014). Relationships between social connectedness and spirituality and depression and perceived health status of rural residents. *Online Journal of Rural Nursing and Health Care, 14*(2), 43-79. https://doi.org/10.14574/ojrnhc.v14i2.325

Goldman, L. E., Walker, R., Hubbard, R., Kerlikowske, K., & Consortium, B. C. S. (2013). Timeliness of abnormal screening and diagnostic mammography follow-up at facilities serving vulnerable women. *Medical Care, 51*(4), 307. https://doi.org/10.1097/MLR.0b013e318280f04c

Goldman, L. E., Walker, R., Miglioretti, D. L., Smith-Bindman, R., & Kerlikowske, K. (2012). Facility characteristics do not explain higher false positive rates in diagnostic mammography

at facilities serving vulnerable women. *Medical Care, 50*(3), 210 -216. https://doi.org/10.1097/MLR.0b013e3182407c8a

Grabovschi, C., Loignon, C., & Fortin, M. (2013). Mapping the concept of vulnerability related to health care disparities: a scoping review. *BMC Health Services Research, 13*(1), 94. https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-13-94

Gruca, T. S., Nam, I., & Tracy, R. (2014). Trends in medical oncology outreach clinics in rural areas. *Journal of Oncology Practice, 10*(5), e313-e320. https://doi.org/10.1200/JOP.2013.001350

Gullette, D., Booth, B. M., Wright, P. B., Montgomery, B. E., & Stewart, K. E. (2014). Sexual sensation seeking, transactional sex, and rural African American cocaine users. *Journal of the Association of Nurses in AIDS Care, 25*(4), 289-296. https://doi.org/10.1016/j.jana.2013.07.008

Hart, J. T. (1971). The inverse care law. *The Lancet, 297*(7696), 405-412.

Horney, J. A., Nguyen, M., Cooper, J., Simon, M., Ricchetti-Masterson, K., Grabich, S., . . . Berke, P. (2013). Accounting for vulnerable populations in rural hazard mitigation plans: Results of a survey of emergency managers. *Journal of Emergency Management, 11*(3), 205-211.

Hsia, R. Y., & Shen, Y. C. (2016). Percutaneous coronary intervention in the United States: Risk factors for untimely access. *Health Services Research, 51*(2), 592-609. https://doi.org/10.1111/1475-6773.12335

Jablonski, K., & Duke, G. (2012). Pain management in persons who are terminally ill in rural acute care: Barriers and facilitators. *Journal of Hospice & Palliative Nursing, 14*(8), 533-540.

Jones, R. K., & Jerman, J. (2013). How far did US women travel for abortion services in 2008?

Journal of Women's Health, 22(8), 706-713. https://doi.org/10.1089/jwh.2013.428z

Joyce, H. D., Fontanella, C. A., & Phillips, G. (2013). Continuity of care and adherence to antidepressant treatment among Medicaid-covered youth. *Social Work in Mental Health, 11*(3), 267-287. https://doi.org/10.1080/15332985.2012.749826

Joynt, K. E., Orav, E. J., & Jha, A. K. (2013). Mortality rates for Medicare beneficiaries admitted to critical access and non–critical access hospitals, 2002-2010. *JAMA, 309*(13), 1379-1387. https://doi.org/10.1001/jama.2013.2366

Klein, E. G., Liber, A. C., Kauffman, R. M., Berman, M., & Ferketich, A. K. (2014). Local smoke-free policy experiences in Appalachian communities. *Journal of Community Health, 39*(1), 11-16. https://doi.org/10.1007/s10900-013-9733-6

Kogan, S. M., Cho, J., & Oshri, A. (2016). The influence of childhood adversity on rural black men's sexual risk behavior. *Annals of Behavioral Medicine, 50*(6), 813-822. https://doi.org/10.1007/s12160-016-9807-7

Komro, K. A., Wagenaar, A. C., Boyd, M., Boyd, B., Kominsky, T., Pettigrew, D., . . . Molina, M. M. (2015). Prevention trial in the Cherokee Nation: Design of a randomized community trial. *Prevention Science, 16*(2), 291-300. https://doi.org10.1007/s11121-014-0478-y

Krukowski, R. A., McSweeney, J., Sparks, C., & West, D. S. (2012). Qualitative study of influences on food store choice. *Appetite, 59*(2), 510-516. https://doi.org/10.1016/j.appet.2012.06.019

LeMasters, T., Madhavan, S., Atkins, E., Vyas, A., Remick, S., & Vona-Davis, L. (2014). "Don't Know" and accuracy of breast cancer risk perceptions among appalachian women attending a mobile mammography program: Implications for educational interventions and

patient empowerment. *Journal of Cancer Education, 29*(4), 669-679. https://doi.org/10.1007/s13187-014-0621-2

Long, K. A., & Weinert, C. (1989). Rural nursing: Developing the theory base. *Scholarly Inquiry for Nursing Practice, 3*(2), 113-127.

López-Cevallos, D. F., Harvey, S. M., & Warren, J. T. (2014). Medical mistrust, perceived discrimination, and satisfaction with health care among young-adult rural Latinos. *The Journal of Rural Health, 30*(4), 344-351. https://doi.org/10.1111/jrh.12063

Lutfiyya, M. N., McCullough, J. E., & Lipsky, M. S. (2012). Health service deficits and school-aged children with asthma: A population-based study using data from the 2007-2008 national survey of child health. *Journal of the National Medical Association, 104*(5-6), 275-285.

Moy, E., Garcia, M. C., Bastian, B., Rossen, L. M., Ingram, D. D., Faul, M., . . . Iademarco, M. F. (2017). Leading causes of death in nonmetropolitan and metropolitan areas—United States, 1999–2014. *MMWR. Surveillance Summaries, 66*(1).

North Carolina Rural Health Research Program. (n.d.). 81 Rural Hospital Closures: January 2010 – Present. Retrieved from http://www.shepscenter.unc.edu/programs-projects/rural-health/rural-hospital-closures/

Oser, C. B., Biebel, E. P., Pullen, E., & Harp, K. L. H. (2013). Causes, consequences, and prevention of burnout among substance abuse treatment counselors: A rural versus urban comparison. *Journal of Psychoactive Drugs, 45*(1), 17-27.

Pahor, M., Guralnik, J. M., Ambrosius, W. T., Blair, S., Bonds, D. E., Church, T. S., . . . Williamson, J. D. (2014). Effect of structured physical activity on prevention of major mobility disability in older adults: The LIFE study randomized clinical trial. *JAMA, 311*(23),

2387-2396. https://doi.org/10.1001/jama.2014.5616

Penman-Aguilar, A., Bouye, K., Liburd, L. C., Satterfield, D., DeBruyn, L., Santos, M., . . . Bhaumik, U. (2016). Strategies for reducing health disparities—selected CDC-sponsored interventions, United States, 2016. *Morbidity and Mortality Weekly Reader [MMWR], 65*(Supplement 1), 1-72.

Phillippi, J. C., & Myers, C. R. (2013). Reasons women in Appalachia decline CenteringPregnancy care. *Journal of Midwifery & Women's Health, 58*(5), 516-522. https://doi.org/10.1111/jmwh.12033

Ratcliffe, M., Burd, C., Holder, K., & Fields, A. (2016). *Defining rural at the US Census Bureau: American community survey and geography brief* [PDF document]. Retrieved from https://www2.census.gov/geo/pdfs/reference/ua/Defining_Rural.pdf

Samra, H. A., McGrath, J. M., Wey, H., Bette, S., Sheri, F., & Beverly, J. (2013). The influence of geographic isolation on late preterm infant and mother outcomes. *Advances in Neonatal Care, 13*(3), 205-215. https://doi.org/10.1097/ANC.0b013e318285fd58

Scogin, F., Morthland, M., DiNapoli, E. A., LaRocca, M., & Chaplin, W. (2016). Pleasant events, hopelessness, and quality of life in rural older adults. *The Journal of Rural Health, 32*(1), 102-109. https://doi.org/10.1111/jrh.12130

Shaw, M. R., Grant, T., Barbosa-Leiker, C., Fleming, S. E., Henley, S., & Graham, J. C. (2015). Intervention with substance-abusing mothers: Are there rural–urban differences? *The American Journal on Addictions, 24*(2), 144-152. https://doi.org/10.1111/ajad.12155

Shi, L., & Stevens, G. D. (2010). *Vulnerable populations in the United States* (Vol. 23): John Wiley & Sons.

Silva, M. C. (1986). Research testing nursing theory: State of the art. *Advances in Nursing Science, 9*(1), 1-11.

Soni, A., Hendryx, M., & Simon, K. (2017). Medicaid expansion under the Affordable Care Act and insurance coverage in rural and urban Areas. *The Journal of Rural Health, 33*(2), 217-226. https://doi.org/10.1111/jrh.12234

Tarasenko, Y. N., Fleming, S. T., & Schoenberg, N. E. (2014). The relationship between perceived burden of chronic conditions and colorectal cancer screening among Appalachian residents. *The Journal of Rural Health, 30*(1), 40-49. https://doi.org/10.1111/jrh.12035

Teufel, J. A., Werner, D., Goffinet, D., Thorne, W., Brown, S. L., & Gettinger, L. (2012). Rural medical-legal partnership and advocacy: A three-year follow-up study. *Journal of Health Care for the Poor and Underserved, 23*(2), 705-714. https://doi.org/10.1353/hpu.2012.0038

United States Department of Agriculture. (n.d.a.). *Rural Urban Continuum Codes*. Retrieved from https://www.ers.usda.gov/data-products/rural-urban-continuum-codes//

United States Department of Agriculture. (n.d.b.). *Rural-Urban Commuting Area Codes*. Retrieved from https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx

Vyas, A., Madhavan, S., Kelly, K., Metzger, A., Schreiman, J., & Remick, S. (2013). Do Appalachian women attending a mobile mammography program differ from those visiting a stationary mammography facility? *Journal of Community Health, 38*(4), 698-706. https://doi.org/0.1007/s10900-013-9667-z

Warren, J., & Smalley, K. B. (2014). *Rural public health: Best practices and preventive models*. New York, NY: Springer.

Wenzel, J., Jones, R. A., Klimmek, R., Krumm, S., Darrell, L. P., Song, D., . . . Ford, J. G. (2012). Cancer support and resource needs among African American older adults. *Clinical Journal of Oncology Nursing, 16*(4), 372-377.

Wewers, M. E., Salsberry, P. J., Ferketich, A. K., Ahijevych, K. L., Hood, N. E., & Paskett, E. D. (2012). Risk factors for smoking in rural women. *Journal of Women's Health, 21*(5), 548-556. doi:10.1089/jwh.2011.3183

Whitaker, R. G., Reiter, K. L., Weinberger, M., & Stearns, S. C. (2013). Colorectal cancer surgery outcomes for vulnerable patients in safety-net versus non-safety-net hospitals. *Journal of Health Care for the Poor and Underserved, 24*(2), 718-729. https://doi.org10.1353/hpu.2013.0062

Wilhelm, S. L., Aguirre, T. M., Koehler, A. E., & Rodehorst, T. K. (2015). Evaluating motivational interviewing to promote breastfeeding by rural Mexican-American mothers: The challenge of Attrition. *Issues in Comprehensive Pediatric Nursing, 38*(1), 7-21. https://doi.org/10.3109/01460862.2014.971977

Winters, C. A. (2013). *Rural Nursing: Concepts, theory, and practice* (4th ed.). New York: Springer.

Figure 1

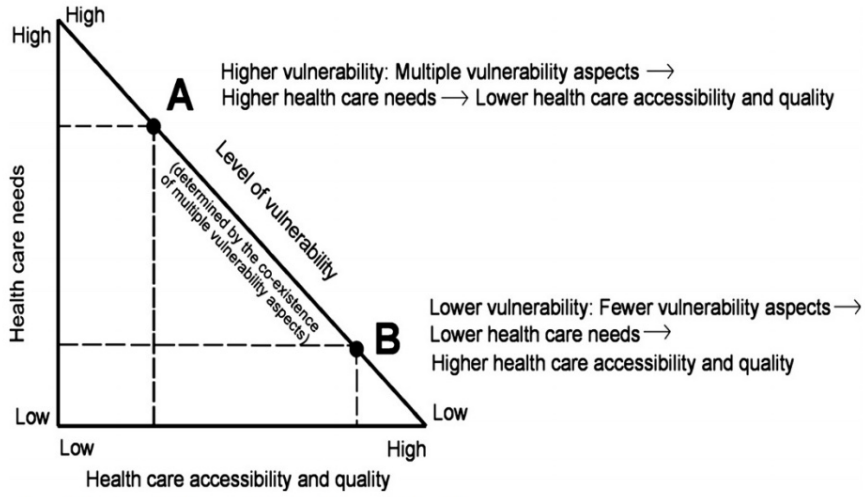

Figure 1 The dynamic multi-vulnerability model of health care disparities.

Reproduced with permission of C. Grabovschi (May 2017).
Grabovschi, C., Loignon, C., & Fortin, M. (2013). Mapping the concept of vulnerability related to health care disparities: a scoping review. *BMC Health Services Research, 13*(1), 94. https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-13-94

Figure 2

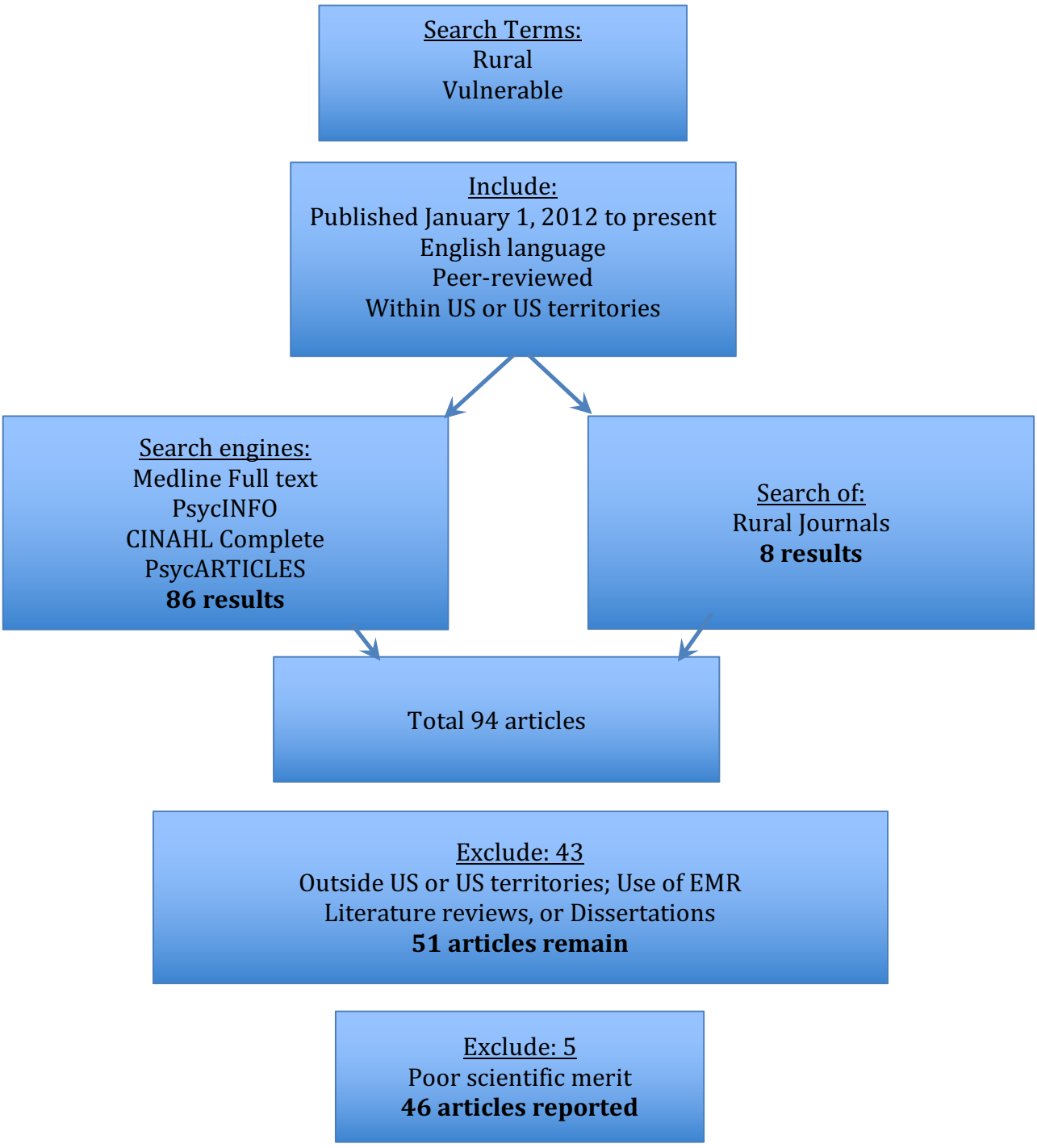
Search Terms:
Rural
Vulnerable
Include:
Published January 1, 2012 to present
English language
Peer-reviewed
Within US or US territories
Search engines:
Medline Full text
PsycINFO
CINAHL Complete
PsycARTICLES
86 results
Search of:
Rural Journals
8 results
Total 94 articles
Exclude: 43
Outside US or US territories; Use of EMR
Literature reviews, or Dissertations
51 articles remain
Exclude: 5
Poor scientific merit
46 articles reported

Table 1
Vulnerabilities within the Literature

Aspects of Vulnerability Considered	**Included papers, n (%)**
Low socioeconomic status	22 (47.8%)
Racial/Ethnic Minority	18 (39.1%)
Chronic physical or mental illness	11 (23.9%)
Low level of education	11 (23.9%)
Old age	8 (17.4%)
Youth	8 (17.4%)
Residence in medically underserved area	6 (13.0%)
Disability	5 (10.9%)
Pregnancy	4 (8.7%)
Smoking	3 (6.5%)
Substance Abuse	3 (6.5%)

Table 2

Details of Studies from Vulnerable Populations in Rural Society Systematic Review

Citation Findings	Location	Scientific merit / Design	Sample	Defined Rural	Vulnerable factors	Level of Evidence
Adams et al. (2015)	United States	18 Quantitative Descriptive	7,240 Federal Qualified Health Center (FQHC) sites in 1,612 counties	Yes	Medically underserved areas (MUA), income, minority	VI
Breast, cervical and prostate cancer MIR differed significantly across FQHC access.						
Atav and Darling (2012)	New York	16 Quantitative Descriptive Correlation	infants (day of birth, rural NYS counties)	Yes	Pregnancy, Infancy, low birthweight	VI
Rural coding schemas demonstrated variation in results.						
Baernholdt, et al. (2012)	United States	19 Quantitative Retrospective	911 adult (age >65)	Yes	Minority, elder, lack of social connectedness, chronic illness	IV
Older adults reported positive Health Quality of Life (HQOL). Lower social function and HQOL was found in rural dwellers. Minority made a difference on 2 HQOL subscales.						
Banks et al. (2016)	Appalachia	26 Qualitative		Yes	Income	VI
Community had instinctive ability to preserve and utilize resources to overcome adversity in their vulnerability.						
Bardach et al. (2012)	Kentucky	19 Quantitative Descriptive-Correlation	1,096 (age 50-76)	Yes	Income, Education	VI
Fewer accurate responses were associated with lower colorectal cancer guidelines and screenings.						
Bernstein et al. (2016)	Maryland & Massachusetts	24 Qualitative	39 participants at 6 clinics in 2 states.	No	Income, Youth	VI
Significant barriers to integration of oral care with primary care and Federal Qualified Health Centers.						
Buerhaus et al. (2015)	United States	22 Quantitative Cross Sectional	972 clinicians (random, survey)	No	Minority, Uninsured, Language	VI
Primary Care Nurse Practitioners are more likely than Primary Care Medical Doctors to practice in rural primary care, in a wider range of settings, treat Medicaid recipients, and vulnerable populations.						

Citation Findings	Location	Scientific merit / Design	Sample	Defined Rural	Vulnerable factors	Level of Evidence
Carter-Edwards et al. (2015)	North Carolina	22 Qualitative	45	No	Income, Minority, Elders, Youth, Chronic illness, Education, Disability, Unsafe environment, Smoking	VI
Identified smoke-free considerations for structural, environmental, and policy health promotion initiatives.						
Coleman et al. (2012)	Virginia	17 Quantitative	10 clinical teams of ED staff	Yes	only rural	VI
Team and clinical scores were not significant between hospitals. Significant correlations with team and clinical scores were seen in acute coronary syndrome, abdominal aortic aneurysm, and non-accidental trauma.						
Crain et al. (2012)	North Carolina	19 Quantitative Descriptive Correlation	69 farmworkers (farm camps)	Yes	Minority, Chronic illness, Farm workers, Immigrant status, Education	IV
Rural health care providers are likely to confront poor mental health when providing care to Latino farmworkers.						
DeMattei et al. (2012)	Illinois	14 Quantitative Descriptive Correlation	234 children (attend special education school)	No	Youth, Disability	IV
Positive benefits were found for special needs children and oral health care experiences were found for dental hygiene students.						
Eshofonie et al. (2015)	Texas	15 Quantitative Descriptive Ex-Post Facto	34 cases (2012, pertussis dx)	No	Youth	IV
Pertussis increase in one county in 2012 compared to 2009-2011. All cases were vaccinated; closeness to schedule not examined.						
Fan et al. (2013)	Washington	13 Quantitative Cohort	149,110 (work injury)	Yes	Disability	IV
Claim rates could improve evaluation of the effect of geographic difference on disability.						
Faul (2014)	Kentucky	17 Quantitative Cross Sectional	296 adult (>50 yr., low-income community)	No	Income, elders	VI

Citation Findings	Location	Scientific merit / Design	Sample	Defined Rural	Vulnerable factors	Level of Evidence
Major barriers related to access to healthy food and affordability.						
Feltner et al. (2012)	Kentucky	16 Quantitative Pre-post	637 (age ≥ 50, risk of colorectal cancer	Yes	MUA, Income	VI
Community health workers are effective at increasing colorectal cancer (CRC) screening and knowledge of CRC.						
Galloway and Henry (2014)	Colorado	16 Quantitative Cross-sectional	144	Yes	Lack of social connectedness	VI
Social connectedness is important for patient centered care.						
Goldman at al. (2013)	North Carolina, Vermont, California & New Hampshire	22 Quantitative Descriptive Correlation	30,874 females (age >65, Medicare, abnormal mammogram. Rural and urban.	Yes	Income, Minority, Education.	IV
No differences found in the explanation of false positive mammography results for vulnerable women.						
Goldman et al. (2012) (7 states)	Seven unspecified states	21 Quantitative Retrospective Observation	139 facilities (women 40-80 yr.)	Yes	Income, Minority, Education.	IV
A higher percentage of women using low-income and rural serving facilities did not undergo recommended follow-up care.						
Gruca et al. (2014)	Iowa	19 Quantitative Retrospective Observation	Visiting Consultant Database (2,172 oncology clinics)	Yes	Chronic illness	IV
Visiting consultant clinic days staffed by Iowa physicians increased access to cancer care for rural cancer patients.						
Gullette et al. (2014)	Arizona	19 Quantitative Non-experimental Descriptive	251	Yes	Income, Minority, Chronic illness, Risky Sexual Behavior	VI
Identified that sexual sensation seeking is associated with transactional sex.						

Citation Findings	Location	Scientific merit / Design	Sample	Defined Rural	Vulnerable factors	Level of Evidence
Horney et al. (2013)	Alaska, Florida, Georgia, North Carolina, South Carolina & Tennessee	13 Quantitative Descriptive	76 emergency planners in FEMA Region IV	Yes	Vulnerability defined by US Census	VI
Some vulnerabilities were overestimated by planners and others were not identified or underestimated.						
Hsia and Shen (2016)	United States	20 Quantitative Non-experimental correlation	1,738 PCI Centers	Yes	Income, Minority	VI
Timely access to percutaneous coronary intervention (PCI), gold standard, A majority (58%) of rural residents live >60 minutes from a PCI hospital.						
Jablonski and Duke (2012)	Texas	22 Qualitative	10 nurses	No	Elders, Chronic illness	VI
Perceived barriers to pain management include judgmental attitudes, lack of knowledge and skills, authoritative boundaries, and fears related pain management.						
Jones and Jerman (2013)	United States	16 Quantitative Descriptive Correlation	8,338 abortion patients	Yes	MUA, Pregnancy	IV
There is a burden on poor rural women to access abortion services.						
Joyce et al. (2013)	Ohio	16 Quantitative Retrospective longitudinal cohort	1650 (Medicaid, age 5-17, depression treatment)	Yes	Income, Youth, Chronic illness	IV
Inadequate follow-up was associated with being an adolescent, being disabled, and rural.						
Joynt et al. (2013)	United States	20 Quantitative Retrospective Observation	3968 US hospitals (acute care, Medicare, American Hospital Association data)	Yes	Chronic illness	VI

Citation Findings	Location	Scientific merit / Design	Sample	Defined Rural	Vulnerable factors	Level of Evidence
Mortality rates of Critical Access Hospitals (CAH) and non-CAH were similar in 2002, but CAH had higher mortality rate in 2010.						
Klein et al. (2014)	Appalachia	22 Qualitative descriptive design	27 participants	Yes	Unsafe environment, Smoking	VI
Identified themes on the barriers and facilitating factors in local smoke-free policy adoption.						
Kogan et al. (2016)	Georgia	20 Quantitative descriptive	505 AA Men	Yes	Minority, Adverse Childhood Experience, Risky Sexual Behavior	VI
Neglect is a predictor for risky behavior. Relational schemas predicted the effect of adversity and neglect on risky sexual behaviors.						
Komro et al. (2015)	Oklahoma	19 Quantitative Cohort Part of RTC	1,562 students (9th & 10th grade)	No	Minority, Youth, Substance Abuse	IV
Indicate a problem with increases in underage drinking and an ease of purchasing alcohol for minority youth.						
Krukowski et al. (2012)	Arizona	19 Quantitative descriptive	48 participants	Yes	Minority	VI
Primary food stores are picked based on proximity, food availability and quality of food, and store characteristics.						
LeMasters et al. (2014)	West Virginia	18 Quantitative Descriptive Correlation	1,182 Women 40 yrs. and older using Bonnie's Bus mammography screening.	Yes	MUA, Income, Education.	VI
Women responding, “don’t know” to 5 yr. risk were more likely to be less educated, lower income, insured by Medicaid and less knowledge about breast cancer.						
López- Cevallos et al. (2014)	Oregon	20 Quantitative Cross Section	Latino, 18-25 yr. (387)	Yes	Minority	VI
Medical mistrust was significantly associated with satisfaction with health care.						

Citation Findings	Location	Scientific merit / Design	Sample	Defined Rural	Vulnerable factors	Level of Evidence
Lutfiyya et al. (2012)	United States	17 Quantitative Descriptive Correlation	5-17yr, asthma, National Survey of Child Health (68,634)	Yes	Income, Minority, Youth, Chronic illness	VI
Hispanic and low-income school-aged children with asthma have greater odds of experiencing health service deficits.						
Oser et al. (2013)	Kentucky	27 Qualitative	substance abuse treatment counselor (28)	Yes	Substance Abuse	VI
Causes, consequences, and prevention of burnout of substance abuse counselors: rural vs. urban comparison.						
Pahor et al. (2014) (multisite)	Florida, Illinois, Louisiana, Pennsylvania, Massachusetts, North Carolina, Connecticut, California	22 Quantitative RCT	age 70-89, sedentary lifestyle (1,635)	No	Elders, Disability, Sedentary Lifestyle	II
Persistent mobility was lower in the physical activity (PA) group. More adverse events were reported by those in PA than in higher education group.						
Phillippi and Myers (2013)	Southern United States	25 Qualitative	Women, rural birthing center (29)	Yes	Pregnancy	VI
Reasons women did not use Centering Pregnancy Care(CPC): preferred one-on-one care, experienced barriers to CPC participation, and did not know about group care.						
Samra et al. (2013)	Midwestern	19 Quantitative Descriptive Correlation	mother/infant dyads (28)	Yes	MUA, Postpartum	IV
Remote access to appropriate healthcare services elicits concerns for the late preterm infants.						
Scogin et al. (2016)	Alaska	17 Quantitative Retrospective	rural adult, ≥ 65 (134)	Yes	Minority, Elders	VI

Citation Findings	Location	Scientific merit / Design	Sample	Defined Rural	Vulnerable factors	Level of Evidence
Engagement in pleasant events and hopelessness mediate how elderly view quality of life.						
Shaw et al. (2015)	Washington	22 Quantitative Descriptive Correlation	Women, complete PCAP with consent (773)	Yes	Substance Abuse, Pregnancy	IV
Rural dwellers reported more binge drinking and alcohol abuse at intake and program exit.						
Tarasenko et al. (2014)	Kentucky	19 Quantitative Cross Sectional	age 50-75 (1,012)	Yes	Income, Chronic, Low ed.	VI
Those with multiple morbidity (MM) believe comorbidities burdened factors regarding colorectal cancer screenings (CRCS). Rural residents reported fewer burdens; however, the overall negative association of MM and CRCS remained.						
Teufel et al. (2012)	Illinois	18 Quantitative Longitudinal	cases (1152)	Yes	HPSA & MUA, Income	VI
Rural medical legal partnerships help eliminate barriers to healthcare of vulnerable and underserved.						
Vyas et al. (2013)	West Virginia	19 Quantitative Cross-section	Female, age 40-88 (2,265)	Yes	Income	IV
Bonnie's Bus mammography screening eliminated barriers to screening underserved.						
Wenzel et al. (2012)	Central Virginia and eastern Maryland	27 Qualitative	AA older adults, age 75-81(48)	No	Income, Minority, Elders, Chronic, Education.	VI
Older African Americans' financial barriers to care are insufficiently addressed even with insurance.						
Wewers et al. (2012)	Ohio	18 Quantitative Descriptive Correlation	rural women (570)	Yes	Income, Education., Smoking	VI
Low socioeconomic position (SEP) women were more likely to smoke compared to high SEP women. Other smoking associated factors included age, depression and early first pregnancy.						

Citation Findings	Location	Scientific merit / Design	Sample	Defined Rural	Vulnerable factors	Level of Evidence
Whitaker et al. (2013)	United States	15 Quantitative Retrospective Observation	Patients, age >40, dx colorectal cancer, had color/rectal surgery (62,206)	No	Income, Uninsured	VI
Odds ratio showed vulnerable population 1.4 times more likely to have increased length of stay.						
Wilhelm et al. (2015)	Nebraska	15 Quantitative RCT	Mothers, age 15-50 (53)	No	Income, Minority, Education, Postpartum period	II
Rural Mexican American mothers indicated an intention and confidence in breastfeeding; most did not breastfeed for 6 months.						

Abbreviations: abdominal aortic aneurysm (AAA); African American (AA); Appalachian / Appalachia (App); Centering Pregnancy care (CPC); Centering Pregnancy (CP); Critical Access Hospital (CAH); community health workers (CHW); colorectal cancer /screenings(CRC / CRCS);; dental health (DH); federal qualified health center (FQHC); health education program (H.Ed); health quality of life (HQOL);health professional shortage area (HPSA); length of stay (LOS); mortality-to-incidence ratio (MIR); Medically Underserved area (MUA);medical-legal partnership (MLP); Mexican American (MA); multiple morbidity (MM); odds ratio (OR); percutaneous coronary intervention (PCI); primary care medical doctor (PCMD); primary care nurse practitioner (PCNP), physical activity (PA); quality of life (QoLI); Randomized-controlled trial (RCT) socioeconomic position (SEP); visiting consultant clinic (VCC); visiting consultant database (VCD). Rural codes 1 = topographical definitions such as RUCC, RUCA etc.; 2 = conceptual not operational definition; and 3 = no definition.