Published in final edited form as:

J Manipulative Physiol Ther. 2012 September ; 35(7): 515–524. doi:10.1016/j.jmpt.2012.07.010.

Chiropractic use, healthcare expenditures, and rural and non-rural health outcomes for individuals with arthritis

Ekele I. Enyinnaya, DC, MS [Postdoctoral Research Fellow],

Center for the Study of Complementary and Alternative Therapies, School of Nursing, University of Virginia, Charlottesville, VA, USA

Joel G. Anderson, PhD [Postdoctoral Research Fellow],

Center for the Study of Complementary and Alternative Therapies, School of Nursing, University of Virginia, Charlottesville, VA, USA

Elizabeth I. Merwin, PhD, RN, FAAN [Madge M. Jones Professor of Nursing, Director], and
Rural Health Care Research Center, School of Nursing, University of Virginia, Charlottesville, VA, USA

Ann Gill Taylor, EdD, RN, FAAN [Betty Norman Norris Professor of Nursing, Director]

Center for the Study of Complementary and Alternative Therapies, University of Virginia, Charlottesville, VA, USA

Abstract

Objective—Arthritis is considered the leading cause of disability among adults in the U.S. today and contributes substantially to the rising cost of healthcare. Residents of rural areas are especially affected. The purpose of this paper is to describe chiropractic use by rural and non-rural individuals with arthritis and to identify differences in other healthcare utilization and health status by those using chiropractic care plus conventional care or conventional care alone.

Methods—A longitudinal cohort from Panel 12 ($n = 12,440$) of the Medical Expenditure Panel Survey (MEPS) spanning 2007–2008 was selected for this study to represent changes in healthcare expenditures and utilization, and outcomes throughout this period. The population was stratified by self-reported physician-diagnosed arthritis and rural status and compared across demographics, health status, and healthcare utilization and expenditures, including use of chiropractic services plus conventional care or conventional care alone.

Results—Twice as many rural people with arthritis had one or more visits with a doctor of chiropractic compared to non-rural arthritis people. More rural chiropractic users with arthritis reported their perceived health status as excellent, very good, or good compared to non-rural chiropractic users with arthritis and to rural arthritis people who reported no chiropractic visits. Healthcare expenditures for other physician services were higher among rural chiropractic users with arthritis than non-rural users with arthritis.

© 2012 National University of Health Sciences. Published by Mosby, Inc. All rights reserved.

Ekele I. Enyinnaya DC, MS, ee2fv@virginia.edu, Center for the Study of Complementary and Alternative Therapies, School of Nursing, University of Virginia, PO Box 800782, Charlottesville, VA 22908, Phone number: 434-924-0113, Fax number: 434-243-9938.

CONFLICTS OF INTEREST

The authors reported no conflicts of interest.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Conclusions—Differences in chiropractic utilization were observed between rural and non-rural individuals with arthritis. More studies are needed to investigate these differences and the impact on healthcare utilization and expenditures and outcomes of individuals with arthritis.

Keywords

Chiropractic; Arthritis; Rural Population; Outcomes

INTRODUCTION

Arthritis is considered the leading cause of disability among adults in the U.S. today and contributes substantially to the rising cost of healthcare.¹ According to recent results from the 2007–2009 National Health Interview Survey, just over 20% of adults have been physician-diagnosed with arthritis and this estimate is projected to reach 25% of adults, or 67 million, by 2030.² Affected most is the growing aging population that currently represents about 13% of the total U.S. population, with this figure expected to increase over the next two decades to 19%, or 72 million persons.³ In rural (non-metropolitan) areas, the elderly, approximately 15% of the rural population or 7.5 million persons, are especially affected, with evidence suggesting that these individuals experience higher rates of arthritis and comorbid conditions, poorer health status, greater poverty, and less access to medical care.^{4–6} Osteoarthritis (OA) is the most frequently diagnosed form of arthritis among the elderly and contributes substantially to their associated disability.² As the prevalence of arthritis in the aging rural population continues to place an additional burden on the public in terms of cost, interventions with demonstrated efficacy and cost effectiveness will help address the unique challenges this growing group will face.

Total attributable costs for arthritis in 2003 were \$128 billion USD, with direct costs estimated at \$81 billion and indirect costs at \$47 billion.⁵ In each state, costs attributable to arthritis and related conditions ranged from less than 1% to nearly 3% of each state's GDP.⁵ These costs are increased when comorbidities typically seen in the elderly population are taken into account, including heart disease, chronic respiratory conditions, diabetes, and stroke, with a 22% increase in medical expenditures having occurred between 1997–2005.⁶ Additionally, arthritis accounted for 3% of all hospitalizations and 5% of all ambulatory care visits in 2004 related to a primary diagnosis of arthritis. Costs related to pharmaceutical use for arthritis were estimated at more than \$75 billion in 2003 compared to \$33 billion in 1997.⁷

Many proposals for decreasing costs, providing access to care, and improving health-related quality of life for those with arthritis have been set forth, including recent recommendations from the Centers for Disease Control and Prevention for evidence-based programs of self-management education, physical activity, and health communications.⁸ Evidence for the benefits of complementary and alternative medicine (CAM) for chronic musculoskeletal conditions, including arthritis, has been steadily emerging.⁹ Chiropractic care, considered a form of CAM, is the third largest branch of healthcare in the U.S. and uses a drug- and surgery- free approach to care for patients with a wide range of injuries and disorders of the musculoskeletal system.¹⁰ Of particular interest are the potential cost savings, satisfaction with care, and improvement in health that have been previously demonstrated among users of chiropractic for other chronic musculoskeletal conditions,^{10, 11, 30} and which may be replicated for arthritis patients.⁸ Recent clinical studies on chiropractic care for patients with osteoarthritis have demonstrated positive outcomes such as reductions in pain levels and improved function.^{31, 32} Although the results of these studies are promising, limitations, such as small sample size exist and larger clinical studies on chiropractic care for arthritis patients are needed.

Approximately 6–12% of the population currently uses chiropractic care, primarily for musculoskeletal complaints¹³ with rural residents reporting a higher rate of usage than urban residents.¹⁴ Data from MEPSnet, a component of the Medical Expenditure Panel Survey (MEPS), shows that there were 12,867,991 individuals in 2008 that had one or more chiropractic visits among community residing individuals in this country. The average age of these individuals with one or more chiropractic visits was 46.47(S.D. 1.14) compared to 36.80 (0.31) without a chiropractic visit.²⁴ In addition, nearly 15% of Medicare beneficiaries used any chiropractic visits over the 1993–2007 time period with an average of 5% of visits occurring on an annual basis.²⁵

The purpose of this article is to document chiropractic use specifically by rural and non-rural arthritis patients and to describe any differences in other healthcare utilization and expenditures, and describe any differences in health status by those using chiropractic care plus conventional care or conventional care alone. The availability of chiropractic services by residence will also be determined. It is anticipated that as more evidence emerges on the benefits of selected CAM interventions, the burden of arthritis may lessen for those with this widespread chronic condition by offering the best integrated care while minimizing cost.

METHODS

The Medical Expenditure Panel Survey (MEPS) is a nationally representative survey of the U.S. civilian non-institutionalized population which is co-sponsored by the Agency for Healthcare Research and Quality and the National Center for Health Statistics. It contains data on estimates of healthcare use and expenditures, health insurance coverage, payment source, and health status, as well as access to care and social and demographic characteristics. All data for a sampled household are reported by a single household respondent. The panel design of the survey includes 5 rounds of interviews over 2 full calendar years.

A nationally representative longitudinal cohort from Panel 12 ($n = 12,440$) of the MEPS spanning 2007–2008 was selected for this study to represent healthcare utilization and expenditures and perceived health status throughout this period. The population was stratified by arthritis diagnoses and rural status. Individuals self-reporting physician-diagnosed arthritis ($n = 2,005$) were compared to those who did not self-report physician-diagnosed arthritis ($n = 6,399$) in the past 12 months, and individuals residing in a metro statistical area, or non-rural area, were compared to those residing in a non-metro statistical area, or rural area. These groups were compared further based on their use of chiropractic services plus conventional care or conventional care alone.

Weighted proportions with standard errors on person-level estimates for demographics, socioeconomic status, health status, and utilizations for all groups were obtained from the MEPS Panel 12 household component file using Stata 12 software (StataCorp., College Station, TX). Weighted healthcare expenditure estimates for all groups using a Taylor-series approach to estimate standard errors and statistical analysis also were performed.²⁹ Chi-square tests, corrected for complex sampling design,¹⁵ were used to compare differences among residence and self-report, physician-diagnosed arthritis to demographics, health status and healthcare utilization. A significance level of $P < 0.05$ was used to assess statistical significance. P-values and the Rao-Scott F-statistic are reported for comparisons determined to be statistically significant.

To better determine the availability of doctors of chiropractic in metropolitan versus non-metropolitan areas in all counties within the U. S. and its territories, data from the Area Resources File were analyzed for 2001. The Area Resources File is a database that contains

information for every county in the U.S. including health facilities, health status, health professions and training programs, resource measures, economic activity, and socioeconomic and environmental characteristics.²⁶

This study used a public data set, the MEPS, which UVA Institutional Review Board for Health Sciences has included on a list of approved public datasets that do not constitute human subject research, and thus the UVA Institutional Review Board did not require review. Data obtained from Area Resources Files are county level data and do not contain data on human subjects.^{33,34}

RESULTS

Demographics and social background

Demographic data for the study sample are reported in Tables 1 and 2. A greater percentage of individuals with arthritis resided in a rural area compared to individuals without arthritis ($F = 4.23$, $P < 0.001$), with OA being the most common type of arthritis reported and more females than males self-reporting arthritis. (Tables 1, 2) Arthritis was over five times more common in the combined 45–64 and 65–85 age groups than in those ages 18–44, for both rural and non-rural individuals, and was generally more prevalent among Whites than Blacks ($F = 3.64$, $P = 0.005$) and for non-Hispanics than Hispanics in both rural and non-rural arthritis persons ($F = 7.21$, $P < 0.001$). For both rural and non-rural arthritis persons, the majority of individuals were married, although a higher percentage of rural arthritis persons reported being poor, near poor, or low income, compared to non-rural arthritis persons ($F = 2.06$, $P = 0.010$) and had achieved substantially less higher education than non-rural arthritis persons ($F = 3.44$, $P = 0.003$). (Table 1)

Demographics and social background by chiropractic use

For rural arthritis persons with one or more chiropractic visits, a greater percentage of individuals were male, and all were White non-Hispanics. For both rural and non-rural arthritis persons, nearly all were between 45–85 years of age. The majority of both rural and non-rural arthritis persons in this group were married, with a greater percentage of rural and non-rural individuals reporting middle to high incomes. However, of those reporting poor and near poor incomes, a larger percentage of rural arthritis persons were represented than non-rural arthritis persons (Table 1).

For arthritis persons with no chiropractic visits, more females than males were represented for both rural and non-rural individuals, and the racial and ethnic makeup was predominantly White, with a much smaller representation of Blacks and Hispanics. The largest age groups represented for both rural and non-rural arthritis persons who reported no chiropractic visits included the combined 45–85 age group, followed by the 25–44 age group. A much smaller percentage of rural individuals attained higher education degrees than non-rural individuals. The majority of both rural and non-rural individuals reporting no chiropractic visits were married, with a larger percentage of rural and non-rural individuals reporting middle to high incomes, although more rural individuals than non-rural individuals were represented among those reporting poor, near poor, and low incomes (Table 1).

Health status

Compared to non-rural arthritis, a greater percentage of rural people with arthritis perceived their physical and mental health status to be fair or poor, and fewer considered themselves to be in an excellent, very good, or good health state compared to non-rural arthritis persons (Table 3). Rural people with arthritis also required more help with instrumental activities of daily living (IADL), such as housekeeping and shopping, than non-rural arthritis persons

and experienced a higher percentage of joint pain within the past 12 months compared to non-rural arthritis persons (Table 3).

Compared to rural and non-rural individuals without arthritis, a greater percentage of rural arthritis persons considered themselves in fair to poor physical and mental health. Rural arthritis persons also reported a larger percentage of joint pain and required more help with ADLs and IADLs compared to rural and non-rural individuals without arthritis (Tables 3, 4).

Health status and chiropractic use

For rural people with arthritis with one or more visits to a chiropractor, a higher percentage reported their perceived physical health and mental health as excellent or very good, compared to non-rural arthritis also reporting one or more visits to a chiropractor, and compared to rural and non-rural individuals with arthritis who reported no visits to a chiropractor (Table 3).

A higher percentage of joint pain was reported by rural people with arthritis compared to non-rural arthritis persons for both individuals with one or more recorded chiropractic visits and for those with no recorded chiropractic visits. (Table 3) A smaller percentage of rural people with arthritis with one or more visits to a chiropractor reported needing help with IADLs compared to non-rural arthritis persons also with one or more visits to a chiropractor and to rural arthritis persons with no recorded visits to a chiropractor (Table 3).

Healthcare utilization and chiropractic use

For individuals with rural arthritis, nearly twice as many had at least one or more visits with a chiropractor compared to non-rural arthritis persons ($F = 3.83$, $P = 0.012$; Figure 1). For arthritis persons with one or more visits to a chiropractor, a higher percentage of office-based physician visits and filled prescriptions were recorded for rural individuals compared to non-rural individual. (Figure 2)

Chiropractic services availability

In the 3,223 counties, there is an average of 20.7 (S.D. 84.5) chiropractors with a wide range of 0–2,884 chiropractors in the different counties in 2001. There was an average of 1.7 chiropractors per 10,000 census for the nation. As seen in Figure 3, the rate of chiropractors to population decreases slightly in the metropolitan areas represented by categories 1–3 as the population size decreases. In the non-metropolitan counties, adjacent to metropolitan areas, there is also a decrease as the population decreases (categories 4,6,8) and the decrease is larger in the non-metropolitan counties that are non-adjacent to metropolitan areas (5,7,9) as the population decreases. The most rural areas have the lowest rate of availability of chiropractors.²⁷

Healthcare expenditures

Average chiropractic expenditures were higher for rural arthritis persons than for non-rural arthritis persons and for both rural and non-rural individuals with no self-reported arthritis. (Figure 4) For rural arthritis persons with one or more visits to a chiropractor, fewer expenditures were recorded for physical and occupational therapy services and for prescription drugs compared to non-rural arthritis persons also reporting one or more visits to a chiropractor. (Figure 5) A greater amount of expenditures were recorded for office-based physician services for rural arthritis persons compared to non-rural arthritis persons who reported one or more visits with a chiropractor. (Figure 5)

DISCUSSION

In this study, differences were noted between individuals with arthritis and those without arthritis and between those who resided in a rural location compared to their non-rural counterparts. Although some of these differences, especially those related to demographics, have already been documented in the literature, the relationship of these differences with respect to CAM usage and healthcare costs and outcomes requires further investigation. The focus of the current study on chiropractic use, other healthcare expenditures, and health outcomes by rural arthritis persons contributes to a growing trend toward discovering the role of CAM in healthcare management within rural areas.

Compared to individuals without arthritis, a larger percentage of individuals with arthritis resided in rural areas. Prior studies have detailed possible explanations for this trend, including primarily a larger migration of older individuals to rural locations during retirement, aging of rural residents whose primary occupations were physical or manual labor, and increased prevalence in rural areas of other independent risk factors for arthritis, including obesity.^{4, 16} Arthritis is primarily a disorder of the elderly and the findings within this study are consistent with this evidence. The implications of these trends have prompted investigations into appropriate allocation of healthcare resources to tackle the challenges associated with care for older individuals diagnosed with arthritis at present and in the future.

Nationally, arthritis is currently over-represented among women (26%) compared to men (18%). This trend is expected to worsen by 2030 with a prediction of nearly two-thirds of arthritis patients being women.² An interesting finding in this study is that although there were more rural women than men reporting arthritis, the majority of rural chiropractic users were men. Currently, most studies report a higher CAM usage for women compared to men.¹⁷ Further investigation into current and future trends of CAM utilization patterns for men will provide insight within this area and warrant additional studies.

According to this study, and consistent with national estimates, arthritis was more prevalent among Whites than any other racial group. Although the literature reveals that despite having a lower prevalence rate compared to Whites, Blacks experience a higher percentage of activity and work limitations (45%) compared to Whites (36%) and report more severe pain (38%) compared to Whites (23%).¹⁶ In this study, utilization of chiropractic services overall was very low among minorities and absent for rural minorities with arthritis. Additional studies assessing the impact of arthritis on rural minorities and a potential role for CAM are needed, including investigation of the role CAM therapies have in alleviating rural racial healthcare disparities with regard to arthritis.

In general, rural individuals tend to be poorer and have fewer years of education than non-rural individuals¹⁸ both of which were evidenced in this study. Previous studies also suggest an association between income levels and CAM use, with users more likely to have higher incomes.^{19, 20} In this study, rural and non-rural arthritis persons with at least one visit to a chiropractor were predominantly those in middle to high income levels. This finding highlights the divide between income and utilization of chiropractic services and warrants further investigation into issues of access and coverage for these services in rural areas, especially for those with lower incomes.

People with arthritis typically report a worse health status than those without arthritis, including more unhealthy days and activity-limited days, major depression, and other psychological illnesses.² In this study, more arthritis patients reported that their health was fair to poor compared to non-arthritis persons, with a larger percentage reporting better health status, and among those with arthritis, more rural individuals reported their health as

worse than non-rural individuals. Although rural arthritis persons reported worse health outcomes overall than non-rural arthritis persons, rural arthritis persons who reported visits to a chiropractor reported better health outcomes compared to non-rural arthritis persons also having seen a chiropractor and to rural and non-rural arthritis persons who reported no visits to a chiropractor. It was not assessed in this study whether the changes in health outcomes were related to chiropractic use itself or to socioeconomic and demographic factors, such as income, education, and geographic location, which can also impact health status and have been suggested in other studies.^{21, 22}

Rural individuals with arthritis in this study had twice as many visits to a chiropractor as their non-rural counterparts, consistent with prior studies that have shown a preference for CAM therapies by rural individuals,²³ and notwithstanding reduced availability of chiropractic services in less populated, non-metropolitan areas than in more highly populated metropolitan areas as seen in this study. Also, rural individuals with arthritis who reported one or more visits to a chiropractor also reported higher utilization of other physician services and prescriptions than their non-rural counterparts. This suggests that a greater number of rural individuals with arthritis in this study who used CAM did so in conjunction with conventional care and not independent of it.

Chiropractic expenditures for rural and non-rural individuals with arthritis were higher than for the non-arthritis group, representing increased utilization. This could represent a growing interest in CAM use for treatment and management of symptoms related to arthritis, particularly for individuals residing in rural areas, where utilization was found to be higher than in a non-rural area. Also, greater expenditures for office-based physician visits were reported for rural chiropractic users with arthritis compared to non-rural chiropractic users. One possible explanation could be the higher incomes reported for rural chiropractic users with arthritis, reflecting increased access to care. Further investigations into other factors responsible for increased healthcare utilization and expenditures among rural arthritis persons may provide a greater understanding of the potential role for CAM in rural communities.

Although inpatient healthcare expenditures were not assessed in this study, in 2008, using data from HCUP-net it was determined that there were 911,472 discharges from general hospital inpatient care for patients with a principal diagnosis of osteoarthritis generating aggregate charges of \$40,379,862,681. Over 93% of these admissions were for adults between the ages of 45–84.²⁸ If chiropractic utilization was increased in community care perhaps this increase could also reduce the use of expensive hospitalizations and contribute to reducing the burden of arthritis.

Limitations

There are several limitations in using MEPS data. One limitation is that findings of this study may be related to sampling variation. Some subgroups and regional analysis is not available with MEPS. And the limitations that are associated with surveys, such as response bias, should be considered when interpreting these findings. A major strength of this study is the use of a nationally representative sample from the MEPS data, which provided the capability to accurately represent healthcare utilization and expenditures and the demographics of our study sample. However, a limitation of the study is the small sample sizes obtained for the arthritis subgroups based on use of chiropractic for the particular MEPS panel under investigation, as statistical analysis of groups of fewer than 100 participants within MEPS are considered unreliable for estimation purposes.

CONCLUSION

Differences regarding healthcare utilization, expenditures, and outcomes were noted between rural and non-rural individuals with arthritis. In general, individuals having arthritis and residing in a rural location were associated with higher levels of poverty, fewer years of education, and poorer health compared to individuals with arthritis living in a non-rural location. However, rural arthritis persons reporting one or more visits to a chiropractor had higher incomes and reported better health than rural and non-rural arthritis persons who reported no visits to a chiropractor. Rural individuals with arthritis reported higher utilization of chiropractic compared to non-rural individuals with arthritis. Rural chiropractic users reported greater utilization and expenditures for other physician services compared to rural individuals reporting no visits with a chiropractor and to non-rural individuals reporting one or more visits with a chiropractor. Because this was a descriptive study, more research is needed to investigate other healthcare utilization and costs, outcomes related to chiropractic use, and the impact on rural individuals with arthritis.

Acknowledgments

Funding sources

Grant number 5-T32-AT000052 from the National Center for Complementary and Alternative Medicine at the National Institutes of Health and award number P20NR009009-05S1 from the National Institute of Nursing Research

FUNDING SOURCES

This publication was made possible by grant number 5-T32-AT000052 from the National Center for Complementary and Alternative Medicine (NCCAM) at the National Institutes of Health (NIH) and by award number P20NR009009-05S1 from the National Institute of Nursing Research (NINR). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NCCAM, NINR or the NIH.

References

- Centers for Disease Control and Prevention (CDC). Prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation: United States, 2007–2009. *MMWR Morb Mortal Wkly Rep.* 2010; 59(39):1261–5. [PubMed: 20930703]
- Centers for Disease Control and Prevention (CDC). [Accessed 11/21/2011.] Arthritis: meeting the challenge. <http://www.cdc.gov/chronicdisease/resources/publications/AAG/arthritis.htm>
- Administration on Aging (AOA). [Accessed 11/21/2011.] A profile of older Americans: 2010. http://www.aoa.gov/aoaroot/aging_statistics/Profile/2010/3.aspx
- Jordan JM, Linder GF, Renner JB, Fryer JG. The impact of arthritis in rural populations. *Arthritis Care Res.* 1995; 8(4):242–50. [PubMed: 8605262]
- Centers for Disease Control and Prevention (CDC). [Accessed 11/21/2011.] Arthritis cost statistics: national and state cost estimates. http://www.cdc.gov/arthritis/data_statistics/cost.htm
- Centers for Disease Control and Prevention (CDC). [Accessed 11/21/2011.] Arthritis: comorbidities. http://www.cdc.gov/arthritis/data_statistics/comorbidities.htm
- Yelin E, Murphy L, Cisternas MG, Foreman AJ, Pasta DJ, Helmick CG. Medical care expenditures and earnings losses among persons with arthritis and other rheumatic conditions in 2003, and comparisons with 1997. *Arthritis Rheum.* 2007; 56(5):1397–407. [PubMed: 17469096]
- Centers for Disease Control and Prevention (CDC). [Accessed 11/21/2011.] Arthritis: intervention programs. <http://www.cdc.gov/arthritis/interventions.htm>
- Vitetta L, Cicuttini F, Sali A. Alternative therapies for musculoskeletal conditions. *Best Pract Res Clin Rheumatol.* 2008; 22(3):499–522. [PubMed: 18519102]
- American Chiropractic Association. [Accessed 11/21/2011.] About chiropractic. http://www.acatoday.org/level1_css.cfm?T1ID=42

11. Fiechtner JJ, Brodeur RR. Manual and manipulation techniques for rheumatic disease. *Med Clin North Am.* 2002; 86(1):91–103. [PubMed: 11795093]
12. Gottlieb MS. Conservative management of spinal osteoarthritis with glucosamine sulfate and chiropractic treatment. *J Manipulative Physiol Ther.* 1997; 20(6):400–14. [PubMed: 9272473]
13. Lawrence DJ, Meeker WC. Chiropractic and CAM utilization: a descriptive review. *Chiropr Osteopat.* 2007; 15:2. [PubMed: 17241465]
14. Lind BK, Diehr PK, Grembowski DE, Lafferty WE. Chiropractic use by urban and rural residents with insurance coverage. *The Journal of Rural Health.* 2009; 25(3):253–8. [PubMed: 19566610]
15. Rao JNK, Scott AJ. On chi-squared tests for multiway contingency tables with cell proportions estimated from survey data. *Ann Statist.* 1984; 12(1):46–60.
16. Centers for Disease Control and Prevention (CDC). [Accessed 11/21/2011.] Arthritis: racial/ethnic differences. http://www.cdc.gov/arthritis/data_statistics/race.htm
17. Barnes PM, Powell-Griner E, McFann K, Nahin RL. Complementary and alternative medicine use among adults: United States, 2002. *Adv Data.* 2004; (343):1–19. [PubMed: 15188733]
18. United States Department of Agriculture (USDA) Economic Research Service (ERS). Rural poverty at a glance. Washington D.C: United States Department of Agriculture (USDA); 2004. p. 100 Available from: <http://www.ers.usda.gov/publications/rdr100/rdr100.pdf>
19. Tindle HA, Davis RB, Phillips RS, Eisenberg DM. Trends in use of complementary and alternative medicine by US adults: 1997–2002. *Altern Ther Health Med.* 2005; 11(1):42–9. [PubMed: 15712765]
20. Bishop FL, Lewith GT. Who uses CAM? A narrative review of demographic characteristics and health factors associated with CAM use. *Evid Based Complement Alternat Med.* 2010; 7(1):11–28. [PubMed: 18955327]
21. Braveman PA, Cubbin C, Egerter S, Williams DR, Pamuk E. Socioeconomic disparities in health in the United States: what the patterns tell us. *Am J Public Health.* 2010; 100(S1):S186–96. [PubMed: 20147693]
22. Lubetkin EI, Jia H, Franks P, Gold MR. Relationship among sociodemographic factors, clinical conditions, and health-related quality of life: examining the EQ-5D in the U.S. general population. *Qual Life Res.* 2005; 14(10):2187–96. [PubMed: 16328899]
23. Arcury TA, Preisser JS, Gesler WM, Sherman JE. Complementary and alternative medicine use among rural residents in western North Carolina. *Complement Health Pract Rev.* 2004; 9(2):93–102.
24. MEPSnet. [Accessed 12/21/2011.] Medical Expenditure Panel Survey query tool. http://www.meps.ahrq.gov/mepsweb/data_stats/meps_query.jsp
25. Weigel P, Hockenberry JM, Bentler SE, Obrizan M, Kaskie B, Jones MP, Ohsfeldt RL, Rosenthal GE, Wallace RB, Wolinsky FD. A longitudinal study of chiropractic use among older adults in the United States. *Chiropr & Osteo.* 2010; 18(34):1–14.
26. Area Resource File (ARF). US Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions; Rockville, MD: 2009–2010.
27. USDA, Economic Research Service. [Accessed 12/16/11.] Measuring Rurality: Rural-Urban Continuum Codes. <http://www.ers.usda.gov/briefing/rurality/ruralurbcon/>
28. HCUPnet. Healthcare Cost and Utilization Project (HCUP). Agency for Healthcare Research and Quality; Rockville, MD: 2006–2009. <http://hcupnet.ahrq.gov>
29. Medical Expenditure Panel Survey (MEPS) [Internet]. Computing standard errors for MEPS estimates. Agency for Healthcare Research and Quality; Rockville, MD: Available from: <http://www.meps.ahrq.gov/mepsweb/surveycomp/standarderrors.jsp>
30. Brantingham JW, Cassa TK, Bonnefin D, Jensen M, Globe G, Hicks M, Korporaal C. Manipulative therapy for shoulder pain and disorders: expansion of a systematic review. *J Manipulative Physiol Ther.* 2011 Jun; 34(5):314–46. Review. 10.1016/j.jmpt.2011.04.002 [PubMed: 21640255]
31. Yu H, Hou S, Wu W, He X. Upper cervical manipulation combined with mobilization for the treatment of atlantoaxial osteoarthritis: a report of 10 cases. *J Manipulative Physiol Ther.* 2011 Feb; 34(2):131–7. [PubMed: 21334546]

32. Thorman P, Dixner A, Sundberg T. Effects of chiropractic care on pain and function in patients with hip osteoarthritis waiting for arthroplasty: a clinical pilot trial. *J Manipulative Physiol ther.* 2010 Jul-Aug;33(6):438–44. [PubMed: 20732581]
33. University of Virginia Institutional Review Board for Health Sciences. Archival Data [Internet]. University of Virginia, Health Sciences IRB; Available from: <http://www.virginia.edu/vpr/irb/hsr/specialissues.html>
34. University of Virginia Institutional Review Board for Health Sciences. Public Data Sets [Internet]. University of Virginia, Health Sciences IRB; Available from: <http://www.virginia.edu/vpr/irb/hsr/specialissues.html>

\$watermark-text

\$watermark-text

\$watermark-text

Figure 1. Presence of self-reported arthritis, for those who use chiropractic services, by rural or non-rural residence in 2007–2008.

*Data listed are the equivalent of the averaged value over 2 years.

Figure 2.

Types of healthcare utilization among chiropractic users with self-reported arthritis, by rural or non-rural residence in 2007–2008.

*Data listed are the equivalent of the averaged value over 2 years.

Figure 3.
Availability of chiropractors by USDA classification of rural-urban areas.

Figure 4. Mean* annual population-weighted chiropractic expenditures for individuals with a self-report of arthritis by rural or non-rural residence in 2007–2008.
*Data listed are the equivalent of the averaged value over 2 years.

Figure 5.
Mean* annual population-weighted other healthcare expenditures among chiropractic users with self-report arthritis, by rural or non-rural residence in 2007–2008.
*Data listed are the equivalent of the averaged value over 2 years.

Table 1

MEPS sample size (unweighted), and weighted proportions with standard errors for residence and demographics of individuals with self-report arthritis in 2007–2008.

Arthritis	Sample Population			Chiropractic Users			Chiropractic Non- users		
	Rural	Non- rural	1589 % <i>(SEM)</i>	Rural	Non- rural	45 % <i>(SEM)</i>	Rural	Non- rural	1462 % <i>(SEM)</i>
<i>n</i>	375 % <i>(SEM)</i>	1589 % <i>(SEM)</i>	24 % <i>(SEM)</i>	324 % <i>(SEM)</i>	45 % <i>(SEM)</i>	324 % <i>(SEM)</i>	1462 % <i>(SEM)</i>	324 % <i>(SEM)</i>	1462 % <i>(SEM)</i>
Arthritis type	RA	15.0(2.4)	15.8(1.1)	18.2(5.4)	17.1(6.3)	14.8(2.7)	16.0(1.1)		
	OA	38.9(3.3)	35.3(1.5)	43.1(11.5)	46.4(7.7)	38.8(3.3)	34.9(1.5)		
Gender	Unspecified	46.1(2.9)	48.9(1.8)	38.7(9.9)	36.5(7.4)	46.5(3.4)	49.1(1.7)		
	Male	42.2(2.1)	38.5(1.2)	58.6(10.3)	21.5(5.5)	40.5(2.3)	39.3(1.2)		
Age	Female	57.8(2.1)	61.5(1.2)	41.4(10.3)	78.5(5.5)	59.5(2.3)	60.7(1.2)		
	18–24	1.4(.54)	.60(.21)	-	-	1.6(.64)	.61(.23)		
	25–44	15.1(2.5)	11.2(.89)	-	6.0(3.6)	15.6(2.3)	10.9(.89)		
	45–64	43.6(4.2)	45.3(1.5)	38.0(12.1)	54.9(8.7)	42.9(4.0)	45.1(1.6)		
Race	65–85	39.9(4.3)	42.9(1.6)	62.0(12.1)	39.1(8.5)	39.8(4.1)	43.4(1.7)		
	White	90.3(2.1)	82.9(1.5)	100.0	93.0(3.2)	89.7(2.2)	82.1(1.5)		
	Black	6.3(1.5)	12.0(1.2)	-	1.7(1.7)	7.5(1.7)	12.7(1.3)		
	Asian	.66(.66)	2.7(.62)	-	2.0(1.5)	-	2.9(.64)		
Ethnicity	Other	2.7(1.2)	2.3(.40)	-	3.3(2.3)	2.8(1.4)	2.4(.42)		
	Hispanic	2.4(.54)	7.6(.81)	-	-	2.5(.71)	7.8(.87)		
Marital status*	Non- Hispanic	97.6(2.4)	92.4(2.1)	100.0	99.9(3.1)	97.5(2.5)	92.2(2.2)		
	Married	62.8(3.0)	55.4(1.6)	74.2(8.1)	76.3(7.1)	62.2(3.1)	54.5(1.8)		
Poverty level*	Other	37.2(3.5)	44.6(5.7)	25.1(5.9)	23.7(7.4)	37.8(3.6)	45.5(1.9)		
	Poor	16.3(2.4)	11.4(1.1)	7.0(4.4)	5.8(4.2)	17.8(2.7)	11.6(1.0)		
	Near poor	5.3(1.2)	5.2(.63)	7.1(3.6)	1.7(2.5)	6.1(1.6)	6.0(.76)		
	Low income	18.3(2.3)	13.2(1.1)	5.6(4.2)	7.6(4.1)	20.4(3.2)	14.3(1.1)		
Education	Mid- income	34.2(2.7)	32.9(1.6)	42.0(8.5)	32.2(7.5)	30.6(3.3)	31.4(1.5)		
	High income	25.9(3.5)	37.3(1.6)	38.3(8.8)	52.7(8.1)	25.2(3.7)	36.6(1.7)		
	GED/High school	58.9(3.7)	49.4(1.7)	66.5(11.8)	36.1(8.9)	59.7(4.0)	49.1(1.8)		
	College	11.6(2.2)	25.2(1.6)	4.2(3.8)	47.2(9.1)	11.0(2.4)	24.5(1.6)		
	Other	29.1(2.6)	24.9(1.3)	29.3(12.7)	16.7(6.3)	29.3(2.9)	26.4(1.4)		

* Data listed are the equivalent of the averaged value over 2 years for data reported annually.

Table 2

MEPS sample size (unweighted), and weighted proportions with standard errors for residence and demographics of individuals with a self-report of no arthritis in 2007–2008.

Non- arthritis	Sample Populatio		ChiropracticUsers		Chiropracti c Non-users	
	Rural	Non- rural	Rural	Non- rural	Rural	Non- rural
<i>n</i>	852 % <i>(SEM)</i>	5450 % <i>(SEM)</i>	11 % <i>(SEM)</i>	106 % <i>(SEM)</i>	796 % <i>(SEM)</i>	5136 % <i>(SEM)</i>
Gender						
Male	50.6(1.7)	51.2(.65)	24.3(9.1)	47.6(4.3)	51.2(2.1)	51.6(.68)
Female	49.4(1.7)	48.9(.65)	75.7(9.1)	52.4(4.3)	48.8(2.1)	48.4(.68)
Age						
18–24	14.6(1.3)	14.0(.63)	11.7(10.8)	7.9(3.7)	14.5(1.5)	14.2(.61)
25–44	39.4(2.7)	46.8(1.1)	41.6(15.4)	41.3(6.6)	39.1(2.9)	46.8(1.1)
45–64	33.7(2.0)	31.0(.84)	46.8(15.2)	44.0(6.4)	33.9(2.1)	30.9(.87)
65–85	12.2(1.7)	8.1(.52)	-	6.8(2.5)	12.4(1.7)	8.2(.54)
Race						
White	89.2(1.8)	79.1(1.3)	100	89.2(3.7)	88.2(1.9)	78.4(1.3)
Black	7.6(1.6)	12.5(1.0)	-	1.9(1.3)	8.2(1.7)	13.1(1.1)
Asian	.88(.39)	5.9(.58)	-	7.0(3.2)	.96(.44)	6.0(.61)
Other	2.4(1.2)	2.5(.32)	-	1.5(1.1)	2.6(1.3)	2.5(.32)
Ethnicity						
Hispanic	7.2(2.4)	17.6(1.3)	-	4.5(1.9)	7.6(2.7)	18.4(1.3)
Non- Hispanic	92.8(3.3)	82.4(1.8)	100.0	95.5(5.2)	92.4(3.7)	81.6(1.9)
Marital status*						
Married	59.7(2.5)	54.4(1.1)	59.4(13.4)	60.8(5.9)	58.8(2.4)	53.9(1.1)
Other	40.3(2.5)	45.6(1.1)	40.6(6.9)	39.2(6.7)	41.2(2.6)	46.1(1.1)
Poverty level*						
Poor	14.1(1.7)	9.2(.63)	3.0(4.2)	2.8(1.5)	14.0(1.6)	10.1(.66)
Near poor	5.1(1.0)	3.5(.34)	2.9(4.0)	25(.35)	5.6(1.0)	3.5(.33)
Low income	17.8(2.2)	12.5(.59)	19.4(10.8)	10.1(2.7)	15.1(1.9)	12.5(.67)
Mid- income	34.5(2.1)	33.0(.87)	42.4(13.5)	27.9(5.4)	34.0(2.2)	31.5(.91)
High income	28.5(2.9)	41.8(1.3)	32.4(12.7)	59.0(5.6)	31.2(3.1)	42.5(1.3)
Education						
GED/High school	59.2(3.1)	46.5(.95)	51.6(16.6)	38.0(5.6)	58.8(3.3)	46.8(.98)
College	12.9(1.6)	29.7(.94)	11.1(11.2)	43.9(6.7)	13.0(1.7)	29.1(.95)
Other	27.7(2.7)	23.2(.89)	37.3(16.7)	18.1(4.9)	28.2(2.9)	24.1(.92)

* Data listed are the equivalent of the averaged value over 2 years for data reported annually.

Table 3

MEPS sample size (unweighted), and weighted proportions with standard errors for health status of individuals with self-report arthritis in 2007–2008.

Arthritis	<i>n</i>	Sample Population		Chiropractic Users		Chiropractic Non-users	
		Rural 375 % <i>(SEM)</i>	Non-rural 1589 % <i>(SEM)</i>	Rural 24 % <i>(SEM)</i>	Non-Rural 45 % <i>(SEM)</i>	Rural 324 % <i>(SEM)</i>	Non-rural 1462 % <i>(SEM)</i>
Perceived health *	Excellent	10.7(1.9)	12.8(1.1)	20.0(10.5)	14.9(5.4)	10.1(2.0)	12.7(1.1)
	Very good	27.7(2.7)	27.9(1.3)	33.6(10.7)	32.2(6.6)	26.9(2.9)	27.8(1.4)
	Good	30.9(2.7)	33.6(1.4)	30.3(9.6)	33.1(6.9)	30.3(2.8)	33.4(1.5)
	Fair	20.2(2.7)	18.8(1.1)	12.0(6.5)	12.3(4.9)	22.2(3.0)	19.2(1.1)
	Poor	10.2(1.9)	6.7(1.1)	4.1(3.7)	7.5(4.0)	10.2(2.0)	6.7(1.4)
Perceived mental health *	Excellent	21.8(2.8)	29.3(1.8)	29.7(11.2)	35.2(7.3)	21.1(3.0)	29.3(1.6)
	Very good	31.1(3.2)	28.6(1.5)	38.1(10.9)	32.9(7.6)	29.6(3.3)	28.4(1.5)
	Good	32.0(3.2)	29.7(1.4)	24.1(7.3)	20.7(5.9)	32.9(3.8)	29.7(1.9)
	Fair	11.7(2.3)	9.7(1.4)	7.3(4.3)	7.8(4.5)	12.5(2.6)	10.0(1.8)
	Poor	3.2(1.1)	2.4(1.2)	1.7(1.7)	3.4(2.6)	3.7(1.3)	2.3(1.5)
Joint pain *	Yes	75.4(2.9)	70.9(1.4)	81.6(8.4)	75.8(6.5)	75.5(3.5)	70.9(1.5)
	No	24.2(3.0)	28.7(1.4)	18.4(8.4)	24.2(6.5)	23.9(3.6)	28.7(1.5)
ADL help *	Yes	3.0(0.90)	3.4(1.0)	3.8(3.7)	4.6(2.9)	3.1(1.0)	3.5(1.5)
	No	96.7(93)	96.4(52)	96.2(3.7)	95.4(2.9)	96.5(1.1)	96.3(1.5)
IADL help *	Yes	8.3(1.9)	8.0(1.78)	5.4(4.4)	9.0(4.9)	8.7(1.9)	8.2(1.82)
	No	91.4(1.9)	91.9(1.78)	94.6(4.4)	91.0(4.9)	91.0(1.9)	91.6(1.83)

* Data listed are the equivalent of the averaged value over 3 or 5 rounds for data listed per round.

Table 4

MEPS sample size (unweighted), and weighted proportions with standard errors for health status of individuals with a self-report of no arthritis in 2007–2008.

Non- Arthritis	Sample Population		Chiropractic Users		Chiropractic Non-users	
	Rural	Non- rural	Rural	Non- Rural	Rural	Non- rural
<i>n</i>	852 % <i>(SEM)</i>	5450 % <i>(SEM)</i>	11 % <i>(SEM)</i>	106 % <i>(SEM)</i>	796 % <i>(SEM)</i>	5136 % <i>(SEM)</i>
Perceived health *	Excellent	31.1(.90)	12.6(10.4)	27.3(5.4)	30.0(2.4)	31.4(.92)
	Very good	35.0(2.2)	44.1(15.9)	40.1(5.5)	34.5(2.3)	35.4(.89)
	Good	25.5(2.2)	25.2(.78)	30.6(13.0)	25.7(4.2)	25.1(.81)
	Fair	8.1(1.3)	6.8(.44)	11.6(11.0)	5.4(2.2)	8.2(1.4)
	Poor	1.4(.41)	1.1(.16)	1.1(2.5)	.92(.82)	1.5(.48)
Perceived mental health *	Excellent	39.8(2.5)	42.5(1.0)	25.9(13.4)	34.5(5.7)	39.9(2.6)
	Very good	31.1(2.3)	31.6(.92)	46.0(14.5)	39.6(5.6)	30.5(2.4)
	Good	23.3(2.4)	21.0(.73)	25.1(10.7)	20.6(4.3)	23.7(2.6)
	Fair	4.8(1.1)	3.9(.31)	3.0(4.6)	4.0(2.1)	4.9(1.1)
	Poor	.83(.32)	.76(.34)	-	1.2(1.1)	.86(.35)
Joint pain *	Yes	23.0(2.1)	19.6(.83)	39.4(15.9)	34.0(5.1)	22.3(2.0)
	No	75.7(2.1)	79.1(.84)	60.6(15.9)	65.2(5.0)	76.6(2.1)
ADL help *	Yes	.62(.32)	.75(.11)	-	-	.63(.34)
	No	98.9(.55)	98.8(.16)	100.0	100.0	98.9(.55)
IADL help *	Yes	1.5(.48)	1.7(.18)	2.3(4.8)	1.8(1.4)	1.6(.51)
	No	98.3(.51)	98.1(.20)	97.7(4.8)	98.2(1.4)	98.2(.55)
						98.1(.21)

* Data listed are the equivalent of the averaged value over 3 or 5 rounds for data listed per round.