Urban-Rural Differences in Amitriptyline Use Among Nursing Facility Residents

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Objective: To characterize patterns of amitriptyline use across the urban-rural continuum.

Design: Retrospective analysis of antidepressant drug codes and demographic and clinical data from the Minimum Data Set (MDS), 1994 to 1997.

Setting: Kansas nursing facilities.

Participants: Facility residents aged 65 and older.

Measures: A four-strata system was used to classify nursing facility location by county, from urban to frontier. We examined admission use and after-admission use of amitriptyline across strata for each year separately. Unadjusted and adjusted odds ratios were determined for each stratum, using the urban stratum as the point of reference.

Results: Admission use of amitriptyline occurred in 2.3 to 4% of all admissions, and although such use was highest in the most rural stratum, no clear urban-rural gradient was found. In contrast, amitriptyline use 30 days or more after admission demonstrated modest urban-rural gradients in unadjusted and adjusted analyses. In 1997, when adjusted for demographic factors, odds ratios for amitriptyline use were 2.10 (1.54–2.87), 1.68 (1.33–2.13), and 1.49 (1.17–1.90) for the Frontier, Rural, and Densely Settled Rural categories as compared with the Urban reference group.

Conclusions: After admission to Kansas nursing facilities, rural practice patterns for amitriptyline use are less favorable than those in urban areas, and an urban-rural gradient is identified. Further work is needed to identify explanatory patient, facility, and prescriber factors. **(J Am Med Dir Assoc 2002; 3: 5–11)**

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Experts have deemed selected medications generally inappropriate for use in nursing facility residents because of poor tolerance in this population. One such medication is amitriptyline, a tricyclic antidepressant (TCA) with strong anticholinergic actions that can cause confusion, orthostasis, dry mouth, and other adverse effects.[1] Reports regarding inappropriate prescribing for older adults indicate that amitriptyline is consistently one of the most frequently prescribed inappropriate drugs in nursing facility, homebound, and ambulatory older populations.[2–8]

We previously reported that amitriptyline was the most commonly prescribed new TCA in Kansas nursing facilities, despite declining new TCA use overall.[9] It is unknown to what extent declining incidental use has altered the overall prevalence of amitriptyline use in nursing facilities, because it is possible that the drug is often continued in those individuals who are already receiving it. Also unknown is whether prescribing patterns for amitriptyline have varied across the urban-rural continuum. A potential for delayed implementation of new practice recommendations exists in rural areas, but most reports of urban-rural practice differences involve access to special technical or consultative services that are less available in rural areas. In contrast, relatively little is known about urban-rural differences in prescribing patterns for oral medications that are readily available regardless of location.

We retrospectively studied patterns of amitriptyline use across the urban-rural continuum in Kansas nursing facility residents from 1994 to 1997. Kansas provides an excellent setting for this investigation because its rural areas, although sparsely populated overall, contain proportionally large numbers of people of very advanced age.[10] We gathered antidepressant drug use data as well as relevant demographic and clinical factors from the Minimum Data Set (MDS), examining incidental and prevalent amitriptyline use among all

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facility residents across a four-strata urban-rural classification system.

METHODS

This project was approved by the Institutional Review Board of the University of Kansas Medical Center, and all analyses were made using masked administrative data.

Identification of Amitriptyline Use

The MDS contains demographic and clinical information from federally mandated periodic assessments of all nursing facility residents. Assessments are made at admission, for changes in clinical status, and at least quarterly in an ongoing fashion. The MDS+ and MDS 2.0 versions were used to capture data from 1994 through 1997.

Kansas MDS data include information about prescribed drugs in the form of National Drug Codes (NDC) because Kansas is one of five states participating in a demonstration project. We devised a series of decision rules to overcome inconsistencies in facilities' NDC code entries, arriving at a final list of unique digit strings representing all dosage forms of antidepressant drugs. Amitriptyline was then evaluated separately because of its regulatory significance as a potentially problematic agent in nursing facilities and the frequency of its use reported in the literature.[2–8]

Urban-Rural Classification

Various classification systems are available to categorize geographic locations.[11–14] We reviewed classification schemes published by the Kansas Department of Health and Environment[15] and selected a four-level system that incorporated factors relevant to health care delivery. Each Kansas county was classified into one of four groups: 1) Metropolitan Service Area (MSA), which is called *Urban* for the purposes of this article; 2) Densely Settled Rural, with more than 25 people per square mile; 3) Rural, with 6 to 25 people per square mile; and 4) Frontier, with fewer than 6 people per square mile. Table 1 shows the demographic pattern for each stratum.

Analysis of Admission and After-Admission Use among All Residents

The first episode of amitriptyline use for each individual in each year was identified and categorized as occurring at the time of admission or after the individual had resided within the facility for at least 30 days. We had no information about prescription drug use before admission to the facility. The percentage of all residents who had been prescribed amitriptyline at admission and ≥30 days after admission were obtained for each urban-rural stratum by year. A binomial generalized estimating equation (GEE) model treating the resident as the unit of analysis was used to examine the trends in the number of amitriptyline prescriptions across strata, accounting for potential clustering within facilities. For each year, unadjusted and adjusted analyses were performed separately for prescribing at admission and ≥30 days after admission. Odds ratios were calculated for each nonurban stratum using the Urban stratum as the reference category. Adjusted models included age and gender. Formal statistical tests were not performed to examine trends across years, because some residents were represented in more than 1 year.

RESULTS

Urban-Rural Status and Demographic Profile

The 105 counties in Kansas were distributed as follows: MSA (Urban), 9 counties; Densely Settled Rural, 21; Rural, 44; and Frontier, 31. Strata 1, 2, 3, and 4 contained 37, 29, 26, and 7%, respectively, of the total number of people in facilities during the time of study. Women comprised 73% of the total sample population, and the mean age of the total sample population was 85 years. The endorsement of MDS-coded diagnoses of dementia and depression varied somewhat by strata, as shown in Table 1.

Decreasing Amitriptyline Use Among All Residents

Amitriptyline Use at Admission

There were 310, 320, 273, and 265 events of amitriptyline use at facility admission in 1994, 1995, 1996, and 1997, respectively. The total number of people with admission assessments for each year are shown in Figure 1, which demonstrates that the percentage of residents receiving amitriptyline at facility admission was highest in the Frontier stratum. Unadjusted and adjusted odds ratios are shown in Table 2, which indicates no clear urban-rural gradient for amitriptyline use at time of admission. Older residents and those with dementia were modestly less likely to receive amitriptyline, and men were less likely than women to receive it. Depression diagnoses were associated with the use of amitriptyline, but this association appeared to weaken as time passed.

Table 1. *Demographic Characteristics by Urban-Rural Stratum*

Demographic Characteristic	Urban	Densely Settled Rural	Rural	Frontier
Mean age (±SD)	84.6 (±8.0)	85.1 (±7.7)	85.9 (±7.6)	86.2 (±7.7)
Sex (% women)	74.3	73.0	73.0	73.4
Medicaid (%)	37.0	37.1	36.5	35.5
Depression* (%)	25.7	17.8	20.0	21.7
Dementia† (%)	45.3	38.9	38.5	40.6

*Percentage of all facility residents with a Minimum Data Set endorsement of a diagnosis of depression or dementia.
†At the assessment in which amitriptyline use is identified.

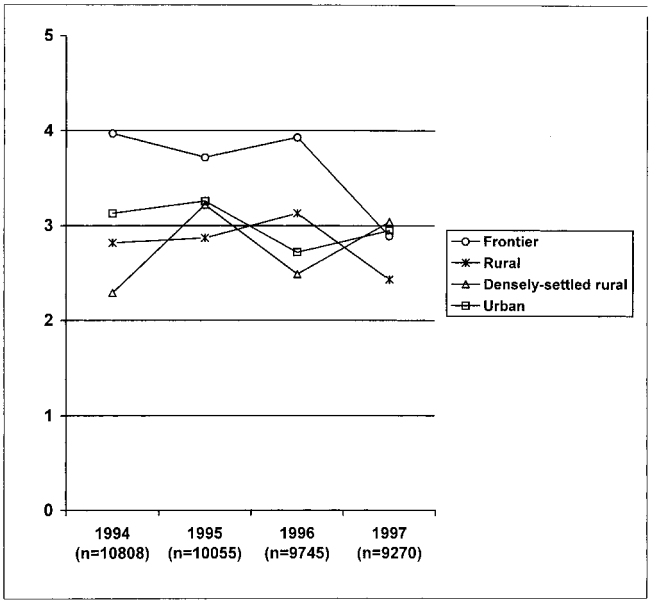

Fig. 1. *Graph illustrating the percentage of individuals using amitriptyline at facility admission.*

New Amitriptyline Use After Admission

Amitriptyline use at least 30 days after admission was even more common, as shown in Figure 2. There were 242, 421, 524, and 517 events of after-admission amitriptyline use in 1994, 1995, 1996, and 1997, respectively, counting ≥1 episode of use only once per year for each resident. Odds ratios for adjusted and unadjusted models are shown in Table 3. In 1994, a gradient is seen for the odds ratios, but they lack statistical significance. From 1995 to 1997, clearer urban-rural patterns are seen, from highest use in Frontier areas to lowest use in Urban areas. A gradient of gradually decreasing differences, as compared with the Urban stratum, is seen across the Frontier, Rural, and Densely Settled Rural areas. For example, in 1997, unadjusted odds ratios for amitriptyline use were 1.93 (1.41–2.63), 1.62 (1.29–2.03), and 1.37 (1.08–1.74) in the Frontier, Rural, and Densely Settled Rural areas, respectively, as compared with the Urban reference group. After adjustment for age and gender, these odds ratios were *2.10* (1.54–2.87), 1.68 (1.33–2.13), and 1.49 (1.17–1.90) for the Frontier, Rural, and Densely Settled Rural areas, respectively, as compared with the Urban stratum. Associations with age, gender, dementia, and depression for after-admission use were similar to those noted above for use at admission. Adjustment for these factors did not attenuate the urban-rural effects, as shown in Table 3.

DISCUSSION

Amitriptyline Use at and After Admission

The prevalence of amitriptyline use among Kansas nursing facility residents in the mid-1990s is consistent with other reports of amitriptyline use among 3% or more of older adults included in analyses of potentially inappropriate prescribing.[2–4] A modest decline in use was seen from 1994 to 1997, suggesting a change in practice associated with dissemination of prescribing criteria that discouraged amitriptyline use. In this study, amitriptyline was used less among the oldest patients and among those with a dementia diagnosis, both of which are reassuring findings, given the drug's poorer tolerability in these patients. The after-admission figures for any use during a year, however, counted once per person, suggest some cause for concern, particularly in most rural areas, where as many as 5 to 6% of all residents received amitriptyline within a year.

Recommendations for treatment of geriatric depression discourage the use of amitriptyline because better-tolerated medication choices are available.[16–19] Amitriptyline's sedative effect has been exploited as a hypnotic, but other treatment options are available for the same purpose. Although amitrip-

Table 2. *Odds Ratios for Amitriptyline Use at Admission*

Geographic Strata	1994 Odds Ratio (95% CI)	1995 Odds Ratio (95% CI)	1996 Odds Ratio (95% CI)	1997 Odds Ratio (95% CI)
Unadjusted				
Frontier	1.26 (0.76–2.08)	1.15 (0.72–1.83)	1.46 (0.92–2.34)	1.01 (0.59–1.72)
Rural	0.89 (0.64–1.25)	0.88 (0.65–1.18)	1.16 (0.83–1.60)	0.87 (0.60–1.25)
Densely Settled Rural	0.73 (0.53–0.99)	0.98 (0.75–1.29)	0.92 (0.66–1.27)	1.07 (0.78–1.46)
Urban (reference group)	—	—	—	—
Adjusted				
Frontier	1.37 (0.83–2.27)	1.27 (0.81–2.00)	1.54 (0.93–2.53)	1.07 (0.63–1.82)
Rural	0.96 (0.69–1.33)	0.93 (0.68–1.27)	1.23 (0.89–1.70)	0.94 (0.65–1.35)
Densely Settled Rural	0.82 (0.59–1.12)	1.04 (0.79–1.38)	1.05 (0.75–1.49)	1.15 (0.83–1.59)
Urban (reference group)	—	—	—	—
Age*	0.97 (0.96–0.98)	0.97 (0.96–0.98)	0.97 (0.95–0.98)	0.98 (0.96–0.99)
Sex¶	0.65 (0.50–0.84)	0.63 (0.49–0.82)	0.81 (0.63–1.04)	0.70 (0.52–0.95)
Depression	4.22 (5.29–5.54)	3.44 (2.67–4.43)	3.12 (2.43–4.01)	2.82 (2.12–3.74)
Dementia	0.53 (0.40–0.70)	0.44 (0.32–1.66)	0.75 (0.56–1.01)	0.67 (0.49–0.90)

* Odds ratio is relative to a resident who is 1 year younger.
¶ Odds ratio is for a male resident relative to a female resident.
CI, confidence interval.

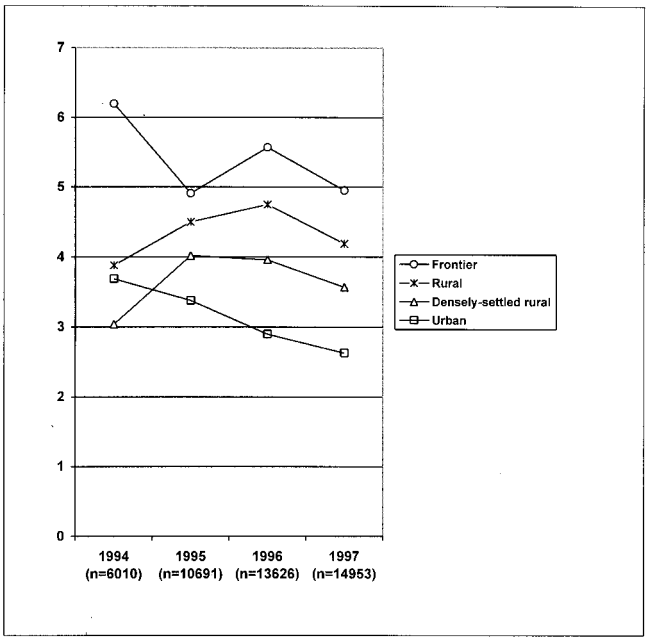

Fig. 2. *Graph illustrating the percentage of residents with amitriptyline use after admission.*

tyline is considered to have a high potential for severe outcome, it may be considered appropriate for treatment of neuropathic pain if other alternatives are not effective or are inappropriate.[20] Although individual clinical situations may occasionally warrant the use of nonrecommended medications, these situations would be expected to be relatively uncommon and would not be anticipated to occur preferentially in rural areas.

Different patterns were seen for admission and after-admission use. Admission use may primarily reflect community prescribing patterns via initial admission orders, whereas use after admission reflects facility care processes and prescribing patterns of attending providers. Gradients of highest amitriptyline use in more rural areas to lowest use in urban areas were seen, despite an overall modest decline in all strata from 1994 to 1997. Although the odds ratios for these gradients are of modest size and although their statistical significance is due in part to the large overall sample size, this pattern nonetheless was seen across all years of analysis. Such after-admission use probably reflects ongoing drug continuation in people who were already receiving amitriptyline, with these results suggesting potential missed opportunities for drug discontinuation, particularly in more rural areas.

Rural-Urban Practice Differences

A 1966 report on medical innovation described diffusion of a new medication from "early adopters" to "late adopters" and described important influences of practice location and physicians' social and professional networks.[21] Our findings are consistent with the theory that new practice patterns are adopted by rural physicians somewhat later than those of urban physicians. The findings of the 1966 study may be less applicable to current practice, however, which is affected by practice guidelines and consensus statements, formularies, increased regulatory oversight, and electronic communication resources that may reduce differential dissemination of new information across the urban-rural continuum.

Associations with practice location have been reported for various types of health care, including immunizations and other preventive efforts, provision of common surgical procedures, and a variety of technical procedures, special diagnostics, and consultative care services for which distance represents an obvious barrier to reaching services in more urban areas.[22–26] In contrast, relatively little is known about urban-rural patterns of prescribing of oral medications, with the exception of antibiotics for viral upper respiratory tract infections, with regard to which some urban-rural results are contradictory.[27,28] We are unaware of any previous reports examining patterns of readily available medications across a

Table 3. *Odds Ratios for Amitriptyline Use After Admission*

Geographic Strata	1994 Odds Ratio (95% CI)	1995 Odds Ratio (95% CI)	1996 Odds Ratio (95% CI)	1997 Odds Ratio (95% CI)
Unadjusted				
Frontier	1.69 (0.96–3.00)	1.48 (0.94–2.34)	1.95 (1.39–2.74)	1.93 (1.41–2.63)
Rural	1.03 (0.73–1.45)	1.33 (0.99–1.80)	1.64 (1.25–2.14)	1.62 (1.29–2.03)
Densely Settled Rural	0.80 (0.54–1.17)	1.20 (0.92–1.57)	1.36 (1.07–1.72)	1.37 (1.08–1.74)
Urban (reference group)	—	—	—	—
Adjusted				
Frontier	1.77 (0.98–3.18)	1.66 (1.04–2.64)	2.13 (1.51–2.98)	2.10 (1.54–2.87)
Rural	1.10 (0.78–1.57)	1.47 (1.08–1.99)	1.78 (1.34–2.36)	1.68 (1.33–2.13)
Densely Settled Rural	0.86 (0.59–1.27)	1.30 (0.99–1.72)	1.49 (1.17–1.90)	1.49 (1.17–1.90)
Urban (reference group)	—	—	—	—
Age*	0.99 (0.97–1.00)	0.97 (0.96–0.99)	0.97 (0.96–0.98)	0.98 (0.97–0.99)
Gender¶	0.78 (0.57–1.07)	0.73 (0.58–0.93)	0.69 (0.56–0.84)	0.77 (0.62–0.96)
Depression	3.31 (2.49–4.39)	2.73 (2.21–3.39)	2.67 (2.23–3.19)	2.79 (2.33–3.33)
Dementia	0.58 (0.43–0.79)	0.55 (0.44–0.70)	0.56 (0.46–0.69)	0.55 (0.45–0.66)

*Odds ratio is given relative to a resident who is one year younger.
¶Odds ratio is given for a male resident relative to a female resident.
CI, confidence interval.

multilevel urban-rural gradient; rather, urban-rural status typically has been dichotomized and characterized as an adjustment variable in studies that examined other primary questions.

In contrast to the transportation difficulties and long distances faced by rural community dwellers in reaching physician's offices or pharmacies, nursing facilities represent a unique setting in which to explore urban-rural prescribing patterns in relative isolation from these distance-related confounding factors, because most oral medications are readily available for residents regardless of the facility's location. The prescribing environment in nursing facilities is particularly complex, however, because it involves interactions between prescribers, consultant pharmacists, and facility personnel.[29] The relative contributions of these participants to overall prescribing outcomes have not been elucidated, but reported differences in the rural health care work force may be relevant. Rural areas have fewer physicians and other health professionals per capita,[11] and rural providers thus have larger workloads.[30,31]

Potentially Inappropriate Prescribing

Data from California nursing homes indicated that 40% of all residents had been prescribed at least one inappropriate drug, with amitriptyline being common among these.[32] A few studies examined provider characteristics that modify prescribing patterns in long-term care. Beers et al.[33] found that unfavorable prescribing profiles were more likely with older physician age, small nursing home practice, and infrequent psychiatric consultation. The educational backgrounds and other characteristics of rural physicians, such as age, differ somewhat in the aggregate from those of urban physicians.[11] A study of British general practitioners reported that older physicians were more likely to prescribe older, unmodified, poorly tolerated TCAs to depressed elderly patients, citing reasons including "knowledge of drug" and "experience in use."[34] Although not specific to long-term care, a 1997 study of a drug claims database showed physicians without specialty certification to be more likely to prescribe potentially inappropriate medications to older adults.[35] A study of Missouri Medicaid patients in nursing facilities found that more than half were cared for by physicians without board certification.[31]

Implications

Our data suggest the need for improved quality assurance processes to target amitriptyline use for potential discontinuation, with substitution of more favorable agents for nursing home residents when necessary. Recent updates to the drug therapy review guidelines for state surveyors from the Health Care Financing Administration incorporate the use of the Beers criteria in evaluating potential drug side effects, including those of amitriptyline.[20] The impact of these new guidelines across the urban-rural continuum remains to be seen.

It is unclear what constitute the most cost-effective methods to sustain improved medication use patterns in this complex and unique prescribing setting.[29] One randomized trial of a geriatric psychopharmacology education program for physicians, nurses, and aides was effective in reducing psychotropic drug prescriptions in nursing facilities.[36] A computer-based online drug use review process incorporating telephone contact between pharmacists and physicians led to improved prescribing patterns for ambulatory older adults.[37] Computerized drug review has been suggested for nursing home populations as well.[32]

Study Limitations

This study has several limitations. First, the MDS was developed as an administrative tool, and the accuracy of facility-entered NDC drug data for research purposes has not been demonstrated directly. Other investigators, however, found consistency between results based on MDS drug codes and other data sources,[38,39] and MDS data has been used to study inappropriate drug use.[40] A second limitation is that individual indications and doses for amitriptyline could not be determined with confidence; the administration of low-dose amitriptyline for the treatment of symptoms other than depression could not be separated from higher-dose uses. Expert opinion discourages amitriptyline use for older nursing home residents without regard to dose, however, and other investigators to date have not specified dose or indications when assigning inappropriateness to amitriptyline prescribing.[1,35,41–44] Third, after-admission use was counted once per individual per year for any identified amitriptyline use on an assessment at least 30 days after admission. This measure of use during each year may overestimate the number of residents receiving amitriptyline at any given time; nonetheless, it provides a gross marker of the number of residents each year who were exposed, at least for a time, to this generally inappropriate drug. Fourth, information about prescriber demographic and educational characteristics was not available for this study, so potentially explanatory prescriber factors were not examined. Because there are fewer providers in rural areas than in urban areas, it is possible that most of the observations in these strata are attributable to a small number of prescribers who account for most of the observed effects. Finally, detailed patient-level clinical variables and relevant facility characteristics were not analyzed.

These data from 1994 to 1997 were collected before changes in the survey process that allow for increased scrutiny of potentially inappropriate medication use. Analysis of more recent data sources is needed to determine whether this regulatory change has been associated with further declines in use of amitriptyline and other common potentially inappropriate medications.

CONCLUSION

Despite the publication of expert opinion advising against its use, amitriptyline remained commonly used in Kansas nursing facility populations in the mid-1990s. Room for improvement was found particularly with regard to use after admission in rural locales. Such use may reflect ongoing use in people who were already receiving the drug, suggesting the need for enhanced opportunities to consider amitriptyline discontinuation or the substitution of other therapies when appropriate. Our results may have implica-

tions for medical directors, consultant pharmacists, attending physicians, nurse practitioner prescribers, and nursing staff involved in quality management programs related to medication use.

Additional research is needed to determine whether other potentially inappropriate medications display similar urban-rural gradients, to learn to what extent various confounding factors explain such gradients, and to improve understanding of prescribing processes in nursing facilities in general. Programs should be tailored to the needs of rural facilities and providers and creative delivery methods, such as interactive distance televideo- or Internet-based education offerings, should be explored with the goal of optimizing medication use patterns in nursing facility residents across the urban-rural continuum.

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REFERENCES

1. Beers MH, Ouslander JG, Rollingher I, et al. Explicit criteria for determining inappropriate medication use in nursing home residents. UCLA Division of Geriatric Medicine. Arch Intern Med 1991;151:1825–1832.
2. Williams B, Betley C. Inappropriate use of nonpsychotropic medications in nursing homes. J Am Geriatr Soc 1995;43:513–519.
3. Willcox SM, Himmelstein DU, Woolhandler S. Inappropriate drug prescribing for the community-dwelling elderly. JAMA 1994;272: 292–296.
4. Piecoro LT, Browning SR, Prince TS, et al. A database analysis of potentially inappropriate drug use in an elderly Medicaid population. Pharmacotherapy 2000;20:221–228.
5. Aparasu RR, Fliginger SE. Inappropriate medication prescribing for the elderly by office-based physicians. Ann Pharmacother 1997;31: 823–829.
6. Golden AG, Preston RA, Barnett SD, et al. Inappropriate medication prescribing in homebound older adults. J Am Geriatr Soc 1999;47:948–953.
7. Aparasu RR, Mort JR. Inappropriate prescribing for the elderly: Beers criteria-based review. Ann Pharmacother 2000;34:338–346.
8. Mort JR, Aparasu RR. Prescribing potentially inappropriate psychotropic medications to the ambulatory elderly. Arch Intern Med 2000;160:2825–2831.
9. Rigler SK, Webb M, Redford L, et al. Antidepressant use in nursing facilities: Changing patterns. Int J Geriatr Psychopharm 2000;2:122–126.
10. Krout JA. An overview of older populations and community-based services. In: Krout JA, ed. *Providing Community-Based Services to the Rural Elderly* (Sage Focus Editions, No 165). Thousand Oaks, CA: Sage Publications, 1994;3–18.
11. Coward RT, McLaughlin DM, Duncan RP, Bull CN. An overview of health and aging in rural America. In: Galliher JM, ed. *Health Services for Rural Elderly*. New York: Springer Publishing Co., 1994;1–32.
12. The National Resource, and Policy Center on Rural Long-Term Care. Classifying rural/urban zip codes: The density centile approach (Grant No. 90-AM-0697). Kansas City: University of Kansas Medical Center, 2–9, 1996.
13. Goldsmith HF, Puskin DS, Stiles DJ. Improving the operational definition of "rural areas" for federal programs: Federal Office of Rural Health Policy; Health Resources and Services Administration. Washington, DC: U.S. Department of Health and Human Resources, 1993.
14. Ricketts TC, Johnson-Webb KD, Taylor P. Definitions of rural: A handbook for health policy makers and researchers. Chapel Hill: University of North Carolina at Chapel Hill, Cecil G. Sheps Center for Health Services Research, 1998.
15. Kansas Department of Health, and Environment Office of Local, and Rural Health Systems. Defining Rural Kansas. Topeka, KS, 1–9, 1997.
16. Lebowitz BD, Pearson JL, Schneider LS, et al. Diagnosis and treatment of depression in late life: Consensus statement update. JAMA 1997;278: 1186–1190.
17. Agency for Health Care Policy and Research. Depression in primary care: Vol.1. Detection and diagnosis. Vol. 2. Treatment of major depression. Rockville, MD: AHCPR, 1994.
18. Lawhorne LW, Belgey ML, Breslau L, et al. Pharmacotherapy Companion to the Depression Clinical Practice Guideline. Columbia, MD: American Medical Directors Association 23, 1998.
19. Rothschild AJ. The diagnosis and treatment of late-life depression. J Clin Psychiatry 1996;57(Suppl 5):5–11.
20. Kaldy J. Will the explicit criteria & drug therapy surveyor guidelines make a difference? A conversation with Mark Beers, MD, and Jonathan Musher, MD, CMD. Caring for the Ages: A Monthly Newsletter for Long-Term Care Practitioners. Vol. 1. Columbia, MD: American Medical Directors Association, 2000;1–31.
21. Coleman JS, Katz E, Nenzel H. Medical Innovation: A Diffusion Study. New York: Bobbs-Merrill, 138, 1966.
22. Roche RA, Simpson DM, Suarez L. Texas physician immunization practices. Med Care 2000;38:686–692.
23. Hueston WJ, Meade RL, Mainous AG III. Childhood immunization practices of primary care physicians. Arch Fam Med 1992;1:225–228.
24. Harris R, Leininger L. Preventive care in rural primary care practice. Cancer 1993;72(3 Suppl):1113–1118.
25. Britt H, Miles DA, Bridges-Webb C, et al. A comparison of country and metropolitan general practice. Med J Aust 1993;159(Suppl):S9–S64.
26. Ridout R, Hawker GA. Use of bone densitometry by Ontario family physicians. Osteoporos Int 2000;11:393–399.
27. Mainous AG III, Hueston WJ, Clark JR. Antibiotics and upper respiratory infection: Do some folks think there is a cure for the common cold? J Fam Pract 1996;42:357–361.
28. Mainous AG III, Zoorob RJ, Hueston WJ. Current management of acute bronchitis in ambulatory care: The use of antibiotics and bronchodilators. Arch Fam Med 1996;5:79–83.
29. Avorn J, Gurwitz JH. Drug use in the nursing home. Ann Intern Med 1995;123:195–204.
30. Federal Office of Rural Health Policy. Facts About Rural Physicians: Vol. 2000. Federal Office of Rural Health Policy. Rockville, MD: Health Resources and Services Administration, U.S. Department of Health and Human Services.
31. Lawhorne LW, Walker G, Zweig SC, Snyder J. Who cares for Missouri's Medicaid nursing home residents? Characteristics of attending physicians. J Am Geriatr Soc 1993;41:454–458.
32. Beers MH, Fingold SF, Ouslander JG. A computerized system for identifying and informing physicians about problematic drug use in nursing homes. J Med Syst 1992;16:237–245.
33. Beers MH, Fingold SF, Ouslander JG, et al. Characteristics and quality of prescribing by doctors practicing in nursing homes. J Am Geriatr Soc 1993;41:802–807.
34. Butler R, Collins E, Katona C, Orrell M. How do general practitioners select antidepressants for depressed elderly people? Int J Geriatr Psychiatry 2000;15:610–613.
35. Anderson GM, Beers MH, Kerluke K. Auditing prescription practice using explicit criteria and computerized drug benefit claims data. J Eval Clin Pract 1997;3:283–294.
36. Avorn J, Soumerai SB, Everitt DE, et al. A randomized trial of a program to reduce the use of psychoactive drugs in nursing homes. N Engl J Med 1992;327:168–173.
37. Monane M, Matthias DM, Nagle BA, Kelly MA. Improving prescribing patterns for the elderly through an online drug utilization review intervention: A system linking the physician, pharmacist, and computer. JAMA 1998;280:1249–1252.
38. Gambassi G, Landi F, Peng L, et al. Validity of diagnostic and drug data in standardized nursing home resident assessments: Potential for geriatric pharmacoepidemiology. SAGE Study Group. Systematic Assessment of Geriatric drug use via Epidemiology. Med Care 1998;36:167–179.

39. Bernabei R, Gambassi G, Lapane K, et al. Characteristics of the SAGE database: A new resource for research on outcomes in long-term care. SAGE (Systematic Assessment of Geriatric drug use via Epidemiology) Study Group. J Gerontol A Biol Sci Med Sci 1999;54:M25–M33.
40. Hume AL, Lapane KL, Middleton S, et al. The SAGE database: Medication use in elderly nursing facility residents. Consultant Pharmacist 1998;13:1356–1364.
41. Goldberg RJ. Adverse effects of selective serotonin reuptake inhibitors. Arch Fam Med 1999;8:196–197.
42. Beers MH. Explicit criteria for determining potentially inappropriate medication use by the elderly: An update. Arch Intern Med 1997;157: 1531–1536.
43. Stuck AE, Beers MH, Steiner A, et al. Inappropriate medication use in community-residing older persons. Arch Intern Med 1994;154:2195–2200.
44. Beers MH, Ouslander JG, Fingold SF, et al. Inappropriate medication prescribing in skilled-nursing facilities. Ann Intern Med 1992;117:684–689.