Rural–Urban Differences in End-of-life Care: The Use of Feeding Tubes

Charles E. Gessert, M.D., M.P.H., and David R. Calkins, M.D., M.P.P.

ABSTRACT: *Efforts to improve end-of-life care have increased during the past decade. The goals of these efforts include increasing patient autonomy and reducing or more selectively using intensive medical interventions near the end of life. In this light, examination of community-to-community variations in end-of-life practices may serve to clarify the values and goals of different populations, as well as the roles of patients, families and professionals in bringing about specific patterns of medical care. This study examined the use of feeding tubes among Kansas nursing home residents between Jan. 1, 1994, and June 30, 1998 (n=78,895), using the Minimum Data Set. Residents with very severe, persistent and irreversible cognitive impairment (n=4,847) were included in the study population. The location of nursing homes in urban, midsize and rural counties was an independent variable. Feeding tubes were used in 19.3 percent of the urban nursing home residents, 8.0 percent of the residents in midsize counties and 6.4 percent of the rural residents. The rate of feeding tube use was significantly higher in urban counties for most subpopulations, including men, women, whites, nonwhites, and those eligible and ineligible for Medicaid. The observed rural–urban differences in feeding tube use near the end of life may be associated with differences in access to surgical or nursing services, differences in the relationships between providers and consumers of care in different communities or differences in rural and urban cultures. Qualitative research may be useful in clarifying the roles of each of these factors.*

Over the past decade, interest in improving end-of-life care has increased significantly. The federal Patient Self Determination Act of 1990 clarified patients' rights to control end-of-life care and formalized requirements for informing patients of their rights. The Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments (SUPPORT) (SUPPORT Principal Investigators, 1995) confirmed substantial shortcomings in the care of seriously ill hospitalized patients near the end of life. Several national initiatives to improve care near the end of life are continuing, including the Robert Wood Johnson Foundation's Last Acts Campaign (Gibson, 1998) and the American Medical Association's Education for Physicians on End-of-Life Care (Emanuel, et al., 1999), which the Robert Wood Johnson Foundation supports.

Studies of regional variation in medical practice have made invaluable contributions to our understanding of the factors that influence many aspects of medi-

cal decision making. Marked variations in rates of many services, from surgery for benign prostatic hyperplasia to ICU care during terminal hospitalization, have been documented (Cooper, 1999). In many instances, the documentation of variation in practices—for example, in coronary artery bypass grafts—has stimulated further study of the indications for and outcomes of the procedures. The study of regional variation in end-of-life care is just beginning. The 1999 *Dartmouth Atlas of Health Care in the United States* examined place of death and the use of Medicare services during the last six months of life and documented marked regional variation for many services (Cooper, 1999). However, despite increased interest in end-of-life care in recent years and evidence of regional variation in end-of-life practices, little has been published on community-to-community differences in the use of specific medical interventions, such as resuscitation, feeding tubes and hospitalization for pneumonia in patients with dementia, near the end of life.

This study examines the use of feeding tubes in a population of nursing home residents with severe and irreversible dementia, with particular attention to rural–urban variation in feeding tube use. The authors chose to examine the use of feeding tubes because the benefits of such tubes have not been demonstrated in patients with advanced dementia, and their use is not supported by evidence of improved outcomes (Finucane, et al., 1999; Gillick, 2000). In the absence of compelling clinical indications for feeding tubes, patterns of feeding tube use might be expected to indicate current regional variation in end-of-life care.

Methods

Study Population. This was a descriptive, cross-sectional and population-based study. The study cohort was drawn from the population of individuals who had lived in Kansas nursing homes between Jan. 1, 1994, and June 30, 1998. The cohort comprised residents with very severe, persistent and irreversible cognitive impairment. Such impairment was defined as (a) two or more consecutive Minimum Data Set (MDS) reports with Cognitive Performance Scale (CPS) scores of 6 separated by at least 60 days, and (b) no subsequent MDS report with a CPS score of 4 or less. (MDS and CPS are described in more detail below.) Thus, residents were included in the study on the basis of their cognitive status near the end of their nursing home stay, without regard to the duration of their cognitive impairment or institutionalization. Residents under age 65 were eliminated from the study population, because many such individuals would not be near the end of life. Similarly, the relatively few nursing home residents who were comatose at the time of the next-to-last MDS report in their record were also eliminated from the study population, because coma may be reversible in some cases and therefore may lead to a discrete rationale for feeding tube use.

Residents who had one or more MDS reports in the last 120 days of the study period were identified as having "open" MDS records. Those residents were compared with the rest of the study population (i.e., those with "closed" records) to identify differences between residents more likely to be living at the close of the study period (open records) and those more likely to have died (closed records).

Data Sources and Definitions. The (MDS) was the principal source of data for this study. The MDS is a federally mandated data set collected on all residents of Medicare- and Medicaid-certified nursing homes (Hawes, et al., 1995). Data for the MDS reports are collected by nursing homes from medical records and from direct observations by nurses and other staff familiar with each resident. Completed MDS reports are turned in to the states and are used to assess nursing homes in regard to quality of care and certification. Only routine (or "initial") admission, readmission, quarterly and annual MDS reports were used in this study. Residents' Social Security numbers were used to track changes in their MDS reports over time.

The study used the Cognitive Performance Scale (CPS) (Morris, et al., 1994) to assess the degree of residents' cognitive impairment. The CPS uses an algorithm based on data from the MDS, incorporating such items as decision making and short-term memory, to provide a score from 0 ("intact") to 6 ("very severe cognitive impairment"). The CPS has been validated against other measures of cognitive impairment (Hartmaier, et al., 1994; Hartmaier, et al., 1995). The CPS distinguishes between residents with "severe cognitive impairment" (a score of 5) and those with "very severe cognitive impairment" (a score of 6) on the basis of whether the resident is "totally dependent" for eating. Very severe cognitive impairment is

For further information, contact: Charles E. Gessert, M.D., M.P.H., Senior Research Scientist, Division of Education and Research, St. Mary's/Duluth Clinic, 400 E. 3rd St., Duluth, MN 55805-1983; e-mail cgessert@smdc.org.

Table 1. Study Population.

	Patients, *n*	Percentage Tube Fed
Total sample, Kansas nursing homes, Jan. 1, 1994, to June 30, 1998	78,895	
Severe, chronic and irreversible cognitive impairment	5,406	14.0
Age unknown or <65	345	42.6
Coma present or unknown	64	53.2
Missing demographic data (age, sex, race, location)	150	11.3
Study population	4,847	11.6

defined on the basis of the severity of neurologic impairment, regardless of underlying cause.

Several steps were taken to prepare the data in the MDS reports for analysis. When MDS reports indicated that nursing home residents were tube-fed and had not eaten in the previous seven days, such residents were coded as totally dependent for eating, for the purposes of CPS calculation. Some MDS reports on comatose residents included data in fields that were supposed to have been left blank; only those data fields that were completed in accordance with MDS instructions were used. These steps were taken to ensure that CPS scores would be calculated correctly in accordance with the CPS algorithm.

The next-to-last report of each resident was examined as the report of interest. This report was selected (1) to examine a similar report late in the nursing home course of each resident; (2) to use a uniform point in each resident's course for examining age, activities-of-daily-living status, co-morbidity status and location of nursing home; and (3) to reduce the inclusion of data that reflected last-minute end-of-life care decisions.

For each resident, clinical and demographic independent variables were assessed using data in the MDS report of interest. Residents were regarded as activities of daily living–dependent (ADL-dependent) if they were totally dependent for care for all seven ADL. The presence or absence of a feeding tube, which includes all enteral and parenteral tubes used to provide nutrients in MDS reports, was determined by positive responses on any two of three MDS items: feeding tube, proportion of calories received through IV or feeding tube in the last seven days, and average fluid intake per day by IV or feeding tube in the last seven days. The geographic location of nursing homes was determined using the MDS facility code, linked to a county code. The 105 Kansas counties were defined as urban, midsize or rural on the basis of the U.S. Department of Agriculture's *Rural-Urban Continuum Codes for Metro and Nonmetro Counties* (Butler and Beale, 1994). The urban counties (nine) were in metropolitan statistical areas. The midsize counties (21) were those with an urban population of 20,000 or more and those that had an urban population of at least 2,500 and adjoined a metropolitan area. The rural counties (75) were those with smaller populations.

Analysis

Bivariate analysis and logistic regression using statistical analysis system (SAS) procedures were used to analyze the data. The association between each of the independent variables[1] and the use of feeding tubes in urban, midsize and rural counties was examined using chi-square tests. Starting with the variables that had been shown to have an association with feeding tubes in bivariate analysis, a logistic regression was performed using a stepwise selection method to determine which factors were significant in the model. Variables were entered into the model if they were significant at the $\alpha=0.05$ level and subsequently were removed if they were not significant at that level. Both main effects and two-way interactions between independent variables were considered, including interactions between age and sex, age and urban or rural location, age and race, age and stroke, sex and stroke, race and urban or rural location, and race and stroke. The adequacy of the final model was assessed using the Hosmer and Lemeshow goodness-of-fit test (Hosmer and Lemeshow, 1989), which examines the concordance between the predicted probabilities and observed responses.

Table 2. Demographic and Clinical Characteristics of Study Population (N=4,847).

	Urban (n=1,770)	Midsize County (n=1,315)	Rural (n=1,762)	*P* Value
Age (percent 86 or older)	52.2	58.8	60.8	<0.001
Gender (percent female)	78.7	78.7	79.4	ns
Race (percent nonwhite)	11.8	3.4	2.0	<0.001
Living will (percent)	25.0	28.5	26.1	ns
Resuscitation (percent DNR)	80.1	68.3	61.0	<0.001
Medicaid-eligible (percent)	59.6	57.5	52.7	<0.001
Alzheimer's disease	35.0	34.3	32.0	ns
Other dementia	57.2	53.8	56.1	ns
Any dementia	81.2	79.0	78.3	ns
Stroke	25.8	23.7	23.7	ns
Cancer	6.3	6.8	7.4	ns
Chewing problem	60.6	68.3	75.0	<0.001
Swallowing problem	47.6	40.8	40.0	<0.001
100 percent ADL dependent	27.6	25.0	24.9	ns

Note: DNR=do not resuscitate, ADL=activities of daily living, ns=not significant.

Results

The derivation of the study population is summarized in Table 1. A total of 78,895 individuals lived in Kansas nursing homes during the period between Jan. 1, 1994, and June 30, 1998. Of those, 5,406 had very severe, chronic and irreversible cognitive impairment. Three hundred forty-five residents were excluded because they were under 65, and 64 more were excluded because of coma. An additional 150 nursing home residents were excluded because the MDS report of interest did not include key demographic data. The remaining 4,847 residents constituted the study population. Five hundred sixty-two (11.6 percent) of the residents in the study population had feeding tubes.

The demographic and clinical characteristics of the study population are summarized in Table 2. Of the study population, 36.5 percent was from the nine urban counties, 27.1 percent was from the 21 midsize counties and 36.4 percent was from the 75 rural counties. The urban residents were more likely to be younger, nonwhite and Medicaid-eligible than those in midsize and rural counties, but the clinical characteristics of the three cohorts were similar.

Characteristics associated with feeding tube use in bivariate analysis are shown in Table 3. Overall, feeding tubes were used in 19.3 percent of the urban nursing home residents, 8.0 percent of the residents in midsize counties and 6.4 percent of the rural residents. The rate of feeding tube use was significantly higher in urban counties for most subpopulations, including men, women, whites, nonwhites, and those eligible and ineligible for Medicaid. Similarly, feeding tube use was found to be greater among urban nursing home residents when clinical subpopulations, such as residents with Alzheimer's disease or stroke, were examined separately. The sole exception was residents with cancer, where the differences in feeding tube use by county of residence were not significant.

In logistic regression, geographic location of nursing home, nonwhite race and underlying clinical condition (stroke, as opposed to Alzheimer's disease) were found to be strongly associated with feeding tube use, as summarized in Table 4. In addition, male sex, ADL dependency and absence of a living will were associated with feeding tube use, albeit much less strongly. The concordance between the predicted probabilities and observed responses was 82.9 percent, indicating that the model did a satisfactory job of predicting tube-feeding status based on the included explanatory variables. The Hosmer and Lemeshow test produced a *P* value of 0.5136, indicating that the model provided a good fit.

Overall, the factor most strongly associated with feeding tube use was swallowing problems. That is of

Table 3. Feeding Tube Use in Study Population (N=4,847); Bivariate Analysis.

	Urban (N=1,770)	Midsize County (N=1,315)	Rural (N=1,762)	*P* Value
Overall rate (percent tubes)	19.3	8.0	6.4	<0.001
Age				
86 or older	14.2	5.3	5.1	<0.001
<86	24.9	11.8	8.4	<0.001
Sex				
Female	18.0	6.7	5.5	<0.001
Male	24.4	12.9	9.9	<0.001
Race				
White	16.5	7.7	6.2	<0.001
Nonwhite	40.2	15.9	17.1	<0.001
Living will				
Present	16.3	5.6	5.5	<0.001
Absent	20.4	8.9	6.8	<0.001
Resuscitation status				
DNR	17.6	8.6	6.3	<0.001
No DNR	26.1	6.7	6.5	<0.001
Medicaid				
Eligible	20.2	8.1	6.7	<0.001
Ineligible	18.0	7.9	6.1	<0.001
Alzheimer's disease	9.4	3.8	2.8	<0.001
Other dementia	17.0	5.8	5.6	<0.001
Any dementia	15.0	5.3	4.6	<0.001
No dementia	38.0	18.1	13.1	<0.001
Stroke	36.8	18.9	12.2	<0.001
No stroke	13.4	4.6	4.6	<0.001
Cancer	18.2	12.4	13.1	ns
Chewing problem	11.5	4.9	4.0	<0.001
Swallowing problem	34.1	15.3	12.2	<0.001
100 percent ADL dependent	22.0	8.8	6.8	<0.001

Note: DNR=do not resuscitate, ADL=activities of daily living, ns=not significant.

interest because swallowing problems were more common among urban residents than among those in the midsize and rural cohorts. However, even among the 2,769 subjects who did not have a swallowing problem, tubes were more frequently used in urban (5.9 percent) than in midsize (3.0 percent) or rural (2.6 percent) settings ($P<0.001$). Similarly, among the 1,555 subjects who did not have chewing problems, feeding tubes were more widely used in urban (31.4 percent) than in midsize (14.6 percent) or rural (13.6 percent) settings ($P<0.001$). No significant differences were found between those residents (30 percent of the study population) who had ongoing "open" MDS records at the end of the study period and the rest of the study population.

Discussion

Previously published studies of small area variation in medical practice suggest that variation is most likely to occur when the service in question does not provide an obvious advantage over other courses of ac-

Table 4. Factors Associated with Feeding Tube Use (N=4,827): Main Effects Logistic Regression.

Factor	Odds Ratio (95 percent CI)	*P* Value
Swallowing problem	5.421 (4.295–6.842)	
Urban county of nursing home[1]	3.210 (2.501–4.120)	<0.0001
Nonwhite race	2.634 (1.913–3.627)	<0.0001
Stroke	2.499 (2.032–3.072)	<0.0001
Absence of dementia	2.499 (2.012–3.106)	<0.0001
Male sex	1.331 (1.057–1.677)	=0.0151
Dependency for all ADL	1.305 (1.014–1.681)	=0.0389
Absence of a living will	1.291 (1.013–1.645)	=0.0389
Age <86 years	1.210 (1.134–1.291)	<0.0001
Midsize county of nursing home[1]	1.288 (0.958–1.732)	ns
Not Medicaid eligible	1.010 (0.820–1.243)	ns

Note: CI=confidence interval, ADL=activities of daily living, ns=not significant.
[1] Rural counties used as reference.

tion (such as nonintervention) and is one of several accepted medical practices for the condition. The use of feeding tubes in cognitively impaired nursing home residents clearly meets both of those criteria. A recent review concluded with the following:

> . . . We found no data to suggest that tube feeding improves any of these clinically important outcomes [prevent aspiration pneumonia, prolong survival, reduce the risk of pressure sores or infections, improve function, or provide palliation] and some data to suggest that it does not. . . . We believe that for severely demented patients the practice should be discouraged on clinical grounds (Finucane, et al., 1999).

This study found substantially greater use of feeding tubes in urban nursing homes than in midsize and rural counties. However, the cross-sectional, descriptive data used in this study do not permit the authors to address questions regarding the sources or causes of these observed differences. The following discussion addresses several factors that may have contributed to these findings.

Access to Services. Much of the variation in the rate at which specific health services are used has been found to be associated with variation in the availability (density) of resources and service providers (Cooper, 1999). Small-area variation in the numbers and types of providers may affect feeding tube use in several specific ways. Tube feeding for cognitively impaired nursing home residents is usually provided via gastrostomy tubes, most commonly the percutaneous endoscopic gastrostomy or PEG tube. In Kansas, of the 240 gastroenterologists and general surgeons with an identified county of practice, there were 11.3 per 100,000 population in the nine urban counties, compared with 8.1 per 100,000 in midsize counties and 7.6 per 100,000 in rural counties (Gary Caruthers, Kansas State Medical Society [personal communication, 1999]). Thus, access to surgical specialists—and operating facilities—with the capacity to place PEG tubes may have contributed to our findings. Similarly, differences in access to swallowing studies and other diagnostic procedures may have influenced the number of feeding tubes that were placed.

Another aspect of access to care may have affected feeding tube practices in our study population: nursing home staffing. The director of the Long Term Care Home Program of the Kansas Department of Health and the Environment (KDHE) noted that in some Kansas nursing homes, particularly in rural areas where it is difficult to recruit highly trained nursing staff, feeding tubes may be perceived as "high tech" and as placing additional demands on already stretched nursing staffs (Patricia A. Maben, KDHE [personal communication, 1998]). In such an environment the placement of feeding tubes might be discouraged and patients with feeding tubes might be denied admission or transferred to another facility.

How much would these access issues affect feeding tube practices? In practice, neither the placement nor the maintenance of PEG tubes—the most common type of surgically placed feeding tube—depends on highly specialized services. PEG tubes may be placed by gastroenterologists, general surgeons or family physicians who have developed skills in the procedure, and the procedure may be done in a hospital, an outpatient surgical center or any facility equipped for general surgery. Endoscopic procedures have been found to be a prominent part of rural general surgical practice, constituting 25 percent of cases, compared with 9 percent of cases of urban general surgeons (Ritchie, et al., 1999). Clinical series of PEG tube placements report low intraoperative and postoperative complication rates (Loser, et al., 1998; Petersen and Kruse, 1997; Raha, 1994). Hence, access to PEG tube placement is not restricted to urban centers. Further-

more, because PEG tube placement is rarely done at the patient's bed (although it is possible under some circumstances), essentially all nursing home residents who are undergoing the procedure are transported from their nursing home to a hospital or surgery center and then returned to the nursing home after the procedure. The functional difference in access to PEG tubes for rural and urban nursing home residents may be small.

Similarly, in practice, the maintenance of a feeding tube does not require highly specialized nursing skills. In fact, PEG tubes are used extensively in home care and other low-tech environments. The placement of a feeding tube may actually decrease demand on nursing, in view of the staff time that is required to provide oral feeding to severely cognitively impaired residents.

Thus, although access to services—both medical and nursing—may be important in feeding tube practices, those factors may not be powerful enough to account for the threefold difference between rural and urban rates that this study observed. The authors believe that several additional factors may contribute to differences in end-of-life care between rural and urban settings, especially differences in relationships between providers of care and patients or families, and differences in attitudes toward medical intervention in the dying process.

Relationships Between Providers and Patients/Families. Advance care planning requires good communication and the development of confidence between providers of care and patients or family decision-makers. As stated by Emanuel, et al. (1999), "During this process patients explore, discuss, articulate, and document their preferences." When patients or families and providers are familiar with each other and have developed an atmosphere of trust, they are in a position to clarify the goals of care and to weigh the burdens and benefits of medical interventions near the end of life. The "technological brinksmanship" (Callahan, 1993) that leads to the overuse of medical interventions is less likely to be dominant in decision making.

Are there significant differences between patient-provider relationships in rural and urban settings? In most rural communities, especially those as small as the rural counties in our study, there are relatively few providers of care—few physicians, few hospitals, few nursing homes. Patients and families are likely to be familiar with local providers, either as patients themselves or through relatives or neighbors who are patients. Rural providers are more likely to have primary care practices, to care for multiple members of the same family (Radecki, 1990), to visit patients in their homes (Ingram, et al., 1999; Keenan, et al., 1992) and to provide continuity of care (Blazer, et al., 1995; Farrell, et al., 1996) than their urban counterparts. In view of the limited number of providers in many rural communities, there also may be greater continuity of physician care before and after nursing home admission in rural settings. Lastly, in rural communities, networks of informal care, provided by family and friends, are more common and more extensive than in urban communities (Stoller and Lee, 1994), and that may affect the relationships between patients or families and their care providers.

All of these factors suggest that the nature of the relationship between provider and patient or family may be substantively different in rural and urban settings. These differences may be important in feeding tube use because of the nature of the decision to use or forgo a medical intervention often perceived as life-prolonging. At issue in such decisions is the proper role—and limits—of medicine. When patients or families and providers do not know each other well, it may be more difficult to agree to withhold a specific medical intervention. Such a decision requires overt or at least tacit agreement on concepts such as quality of life and futility. Because society does not, as yet, share a general cultural understanding of those issues, agreement must be based on the communication—trust—that develops in the specific patient/family-provider relationship.

Attitudes Toward Medical Interventions Near the End of Life. Are there substantive differences between residents of rural and urban communities in regard to preferences for end-of-life care? Despite increased interest in end-of-life care, rural–urban differences in patient and family preferences have not been addressed in the medical literature. Such differences may be significant, since attitudes toward death—and the need to use medical interventions to forestall or "prevent" death—have been found to vary from culture to culture (Payer, 1996). Rural and urban "cultures," albeit in the same society, are probably no exception.

Life experiences—community experiences—have a significant effect on values and preferences for care in the older adult (Rowles, 1998). The differences between the lifetime experiences of rural and urban elders may affect preferences for specific types of medical interventions such as feeding tubes. Rural residents may have had more intimate exposure to life cycles in nature—in crops, gardens, farm animals,

wildlife—than urban residents. In addition, rural living often provides closer contacts with extended family and neighbors than urban living (Stoller and Lee, 1994), and in some instances that may provide rural residents more firsthand exposure to the natural *human* life cycle as well. Whether these differences in life experiences could translate into greater acceptance of death in rural communities is unknown but worthy of further study.

Another aspect of rural life that may influence end-of-life preferences might be termed the "agrarian mentality." Rural residents (those who work the land) have occupied a distinctive niche in societies throughout history (Hanson, 1996). The "agrarian idea" that such rural populations champion in a culture may be characterized in several ways: conservative, practical, skeptical about innovation and resistant to change (Hanson, 1996). An agrarian voice in a culture serves as a brake on the introduction of new ideas, especially ideas that run counter to common experience, conventional wisdom and common sense. The agrarian mentality, in combination with the common experience of the cycle of life in rural settings, may well serve to limit the preferences for feeding tubes in severely impaired residents near the end of life.

Study Limitations. This was a retrospective, descriptive study. The authors used quantitative data that had been collected for administrative purposes. That data revealed a strong association between feeding tube use and urban location of nursing home, but such an association did not establish a cause-and-effect relationship. Additional data are needed on the reasoning behind feeding tube decisions, the duration of residence in urban or rural settings and other factors. Some of the gaps in understanding may be addressed through qualitative research, using interviews and focus groups to examine the decision-making processes of patients, families and health care providers.

This study used data from one state (Kansas), and its findings should be interpreted in light of the special characteristics of that setting. For example, Kansas is a largely rural state with many frontier counties and a very small nonwhite population. Rural conditions and population characteristics in other settings may differ markedly from those found in Kansas. In addition, Kansas law is silent on end-of-life care and patient feeding. Those in areas with more explicit or restrictive laws on end-of-life care should interpret the findings here with caution.

Conclusions

Improving care at the end of life is one of the great challenges facing society. The shortcomings of current practices have been documented, and commented upon, extensively. Despite this widespread interest, relatively little attention has been devoted to examination of variations in current practices from community to community. Such variations may provide rich insights for general improvements in end-of-life care for all. In particular, it is important to identify and study "best practices" (i.e., communities or settings in which current practices are close to societal ideals). The study findings suggest that it may be valuable to examine end-of-life practices in rural communities as part of the ongoing quest for such "best practices."

The study findings demonstrate that alternatives to feeding tubes are accepted medical practice in severely demented patients, in that 88.4 percent of the study population did *not* have feeding tubes. The authors' inclusion criterion required that all subjects be totally dependent for eating; all subjects required personal support for eating. Feeding tubes were actually used in fewer than 1 in 8 subjects, the alternative of assisted oral feeding being widely accepted in such subjects.

The marked differences in feeding tube use between rural and urban settings in Kansas invites further investigation. This study's methods did not permit examination of questions regarding why differences in feeding tube use occur. The authors believe that qualitative research methods might be particularly applicable in future investigations of rural–urban differences in end-of-life decision making, so that the reasoning behind decisions may be understood using the ideas, values and language of those who are involved in the process.

Notes

1. Demographic, socioeconomic and clinical variables were examined: age, sex, race, county of nursing home, living-will status, resuscitation status, Medicaid status, neurological conditions (Alzheimer's disease, other dementia, stroke, Parkinson's disease, any dementia), cardiovascular disease (arteriosclerotic heart disease, cardiac dysrhythmia, congestive heart failure, peripheral vascular disease, other cardiovascular disease), other clinical conditions (chronic obstructive pulmonary disease, arthritis, cancer, diabetes mellitus), activity of daily living status and presence or absence of chewing or swallowing difficulties.

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