Trends in the Use of Feeding Tubes in North Carolina Hospitals

1989 to 2000

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OBJECTIVE: **National data describing the placement of feeding tubes demonstrated a rapid increase in use in the early and mid-1990s. In the past several years, substantial concerns have arisen regarding the appropriateness of the procedure in many chronically ill patients. The purpose of this study is to determine whether the use of feeding tubes has continued to increase through the 1990s despite these widely publicized concerns.**

DESIGN: **Repeated measure cross-sectional study of the North Carolina Discharge Database.**

SETTING: **Analyses of all nonfederal hospital inpatient admissions in North Carolina.**

MEASUREMENTS AND MAIN RESULTS: **We examined the absolute numbers and rates of feeding tube placements from 1989 to 2000. The rate of feeding tube placement increased from 59/100,000 persons in 1989 to 94/100,000 persons in 2000, an overall 60% increase with slowing in the rate of increase in the late 1990s. However, when outpatient procedures were included, the increase in tube feeding continued throughout the 11-year period of observation. The increase was due to an increase in utilization within all hospitals over the time period. Utilization did not differ between profit and not for profit hospitals. The relative growth rate of inpatient feeding tube placement did not differ by age group but the absolute increase was greatest in those age 75 years and over.**

CONCLUSIONS: **Our study demonstrates that the use of feeding tubes has continued to increase through the 1990s. This increase occurred despite ongoing controversy in the medical literature about feeding tube placement in chronically ill patients.**

KEY WORDS: **tube feeding; gastrostomy; utilization; trends.**
J GEN INTERN MED 2004;19:1034–1038.

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Feeding tubes are often placed to provide nutrition to patients who are otherwise unable to maintain adequate caloric intake. Their use has evolved through time. Initially, nasogastric feeding tubes were used, but these have largely been replaced by surgical or percutaneous feeding tubes for long-term feeding that allow feeding directly into the stomach through the abdominal wall. Surgical placement has declined over time with the advent of endoscopic placement in the 1980s. Because endoscopic placement does not require general anesthesia, the relative ease of this procedure encouraged more frequent use, reflected in the doubling of the number of feeding tubes in patients over the age of 65 years from 61,000 in 1988 to 121,000 in 1995.[1]

Although feeding tubes are frequently placed with the intent to prolong life,[2,3] mortality after placement is high. Among Medicare beneficiaries in 1991, 24% of feeding tube recipients died within 1 month of placement and 63% died within 1 year.[1] Similar, mortality rates have been found in other studies.[4–7]

Significant mortality after feeding tube placement may be indicative of the severity of the underlying disease states in those who receive feeding tubes.[8] Some evidence demonstrates that survival after feeding tube placement differs depending upon the underlying diagnoses.[1,5,8–11] In general, patients with underlying malignancy[1,10,11] and dementia[3,5,9,12] appear to do worse than other patients receiving feeding tubes. Age has also been shown to be an important predictor for survival in some studies.[1,4,7,13] Patients with stroke as an underlying cause for feeding tube placement may have better outcomes than those with other diagnoses.[5,9]

Over the last decade, placement of feeding tubes in patients who likely have poor prognoses has become controversial.[1,2,3,14–16] Concerns have been raised about the "technological imperative," where feeding tubes are placed because they are available[17] but offer little benefit. Some fear that the goals of care at the end of life, such as maximizing comfort and quality of life, may not be adequately addressed in these patients.[18] For others, providing nutrition for patients who cannot eat may provide unrecognized benefits to the patient and comfort for the family.[16]

Because many of these concerns have been raised through discourse in medical journals in the last several years, we wondered whether the placement of feeding tubes has continued to increase since the mid-1990s. We designed a study to answer this question by determining the trends in feeding tube placement from 1989 to 2000 using the North Carolina Hospital Discharge Database. To examine whether there have been changes in placement over time in specific subsets of patients, we also examined

feeding tube admissions by age, comorbidity, discharge status, and diagnoses commonly associated with feeding tube placement.

METHODS

Study Design

For this study we analyzed the North Carolina Hospital Discharge Database for each year from 1989 to 1994 and from 1996 to 2000. Data for 1995 was not collected due to lack of state funds. This database is resident at the Cecil G. Sheps Center for Health Services Research at the University of North Carolina, and is funded by the North Carolina Division of Facility Services. Data from outpatient procedures were added beginning in 1997, although these data lack the level of clinical detail in the inpatient dataset. The University of North Carolina Office of Protection of Human Subjects exempted our study from formal review.

Data Sources and Definitions

The North Carolina Hospital Discharge Database includes all admissions to nonpsychiatric, nonfederal hospitals in North Carolina. Information contained in this database includes basic demographic, diagnostic, and care information common to discharge databases. Principal diagnosis and multiple secondary diagnoses are recorded. The number of secondary diagnostic fields varies from year to year as regulations addressing discharge data change. For purposes of consistency across the study period, we restricted the number of secondary diagnostic fields to 6 in all years.

For this analysis, we included all admissions for adults over the age of 18. We included admissions that documented initial, not repeat, placement of a feeding tube by International Classification of Diseases, Ninth Revision (ICD-9) procedure codes for feeding tube placement: 43.2 (surgical, permanent), 43.1 (surgical, temporary), 43.19 (laparoscopic), 43.11 (percutaneous). Therefore, these data include both surgical and endoscopically placed feeding tubes, but not nasogastric feeding tubes.

Data Analyses

We initially describe the rates of feeding tube placement at the population level. Until 1997, these data included only inpatient feeding tube placements. After 1997, outpatient data became available. For these data, we performed a time trend analysis using a linear regression model with the years weighted by population and included heteroskedastic-consistent standard errors. A spline regression was also performed, with a single knot placed at 1995. We performed similar analyses using only inpatient data to describe rates of feeding tube placement on the individual hospital level per year and for comparative analyses by age. We stratified feeding tube rates by age: less than 65 years of age, 65 to 74 years of age, and over age 75. We did not have enough detail in the outpatient files to include outpatient feeding tubes in these analyses.

We also examined feeding tube placement admissions by underlying diagnoses, comorbidity, and discharge status over the time period of interest. We calculated the proportion of the total diagnoses for 3 medical conditions that are most often associated with the use of feeding tubes: malignancy (ICD 140-208), stroke (ICD 430-438, 342, 344), and neurodegenerative disorders (ICD 331-341, 357, 358). We calculated the Elixhauser comorbidity measure[19] for the admissions with and without feeding tube placement through the time period.

RESULTS

Overall, the absolute number of inpatient feeding tube placements increased from 3,756 out of 635,521 admissions in North Carolina in 1989 to 7,521 out of 796,002 admissions in 2000. The rate of new inpatient feeding tubes increased from 59 per 100,000 persons in North Carolina in 1989 to 94 per 100,000 persons in 2000. This is a 60% increase over the 11-year period. This increase was greater from 1989 to 1994 than in subsequent years, an apparent leveling off of the increase (Fig. 1). However, when we examined the outpatient procedure files, we found that increasing numbers of outpatient feeding tube procedures took place in the late 1990s. In 1997, 1,141 outpatient feeding tubes were placed in North Carolina and this number increased to 2,145 in 2000. When the inpatient and outpatient feeding tubes are summed, feeding tube rates continue to increase throughout the 1990s (analysis for time trend $P < .001$); the average growth rate per year for inpatient and outpatient feeding tube placement was 3.8 per 100,000. In 1989, 90% of North Carolina hospitals (110 out of 123) already performed the feeding tube placement, demonstrating that the increase in the number of feeding tubes was due to increased use within hospitals, not to initial use in substantial numbers of facilities. Although the average rates of placement differed by hospital ($P < .001$), we found no differences between profit and not for profit hospitals.

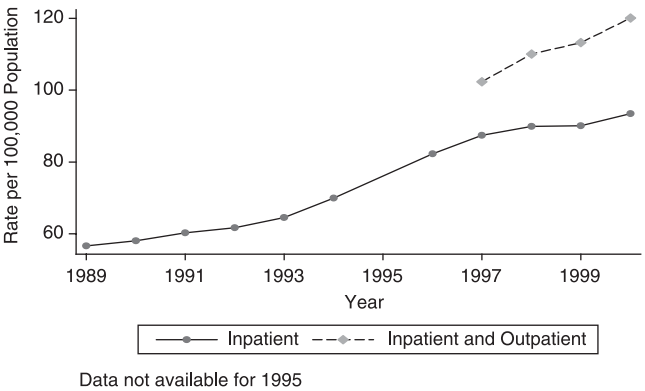

FIGURE 1. Rate of feeding tubes per 100,000 population.

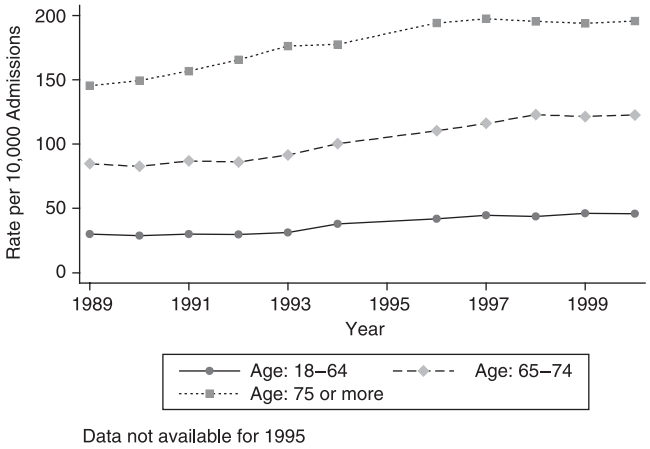

FIGURE 2. Rate of feeding tubes per 10,000 admissions.

Rates of Inpatient Feeding Tube Placements by Age and Diagnoses

The absolute rates of feeding tube placement per admission were, as expected, lowest for the youngest age group (Fig. 2). The average growth rate increased with age: 1.4 per 10,000 admissions in those less than age 65, 13.9 per 10,000 admissions for those ages 65 to 74, and 30.7 per 10,000 admissions for those over age 75 ($P < .001$), but the relative growth rates did not differ by age.

The three diagnoses of interest (neurodegenerative disorders, cancer, stroke) comprised between 30% and 50% of all diagnoses among admissions with new feeding tubes in any given year. For the 3 age strata, the trends over the 11-year time period demonstrate an increase in the proportion of admissions with feeding tube placement among stroke diagnoses. This increase was most dramatic for the youngest age group (Fig. 3) and less pronounced for the 2 older age groups (data not shown). Cancer diagnoses among the 3 groups remained relatively stable. Neurodegenerative disorders comprised a small proportion of all patients (less

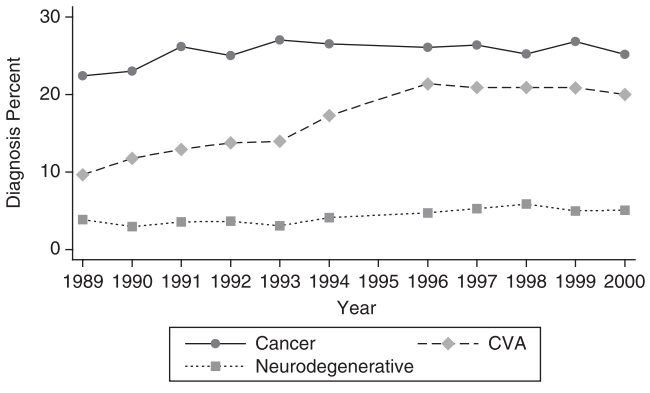

FIGURE 3. Diagnoses ages 18 to 64 years with feeding tubes. Percent of patients with feeding tubes with diagnosis.

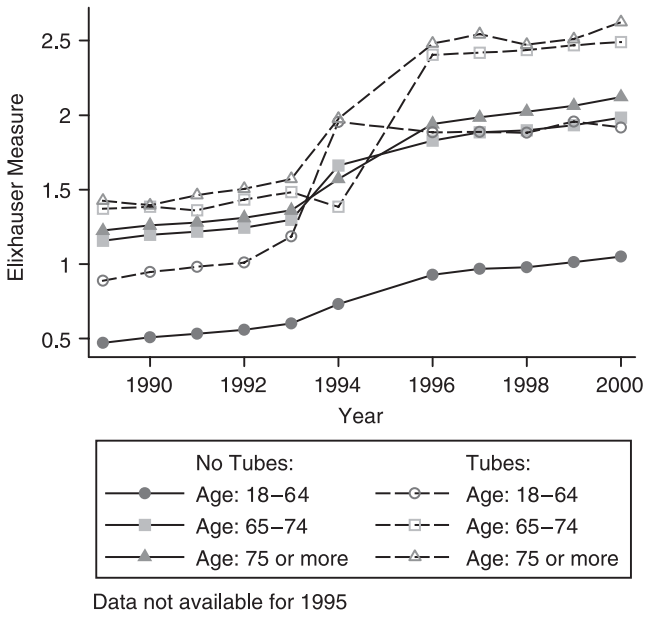

FIGURE 4. Elixhauser comorbidity measure by age and tube placement status.

than 15%) for all 3 age groups, and increased minimally over time.

Comorbidity Measures and Discharge Status

Comorbidity, measured using the Elixhauser method,[19] increased for all hospital admissions (those with feeding tube and without) from 1989 to 2000 (Fig. 4). The comorbidity measure was greater in those patients who received feeding tubes than in those patients who did not have feeding tubes placed for each age group. In-hospital mortality after feeding tube placement was relatively constant over the period, although we did find that for patients over age 75 who received a feeding tube, the probability of in-hospital death declined from 18% in 1989 to 13% in 2000. The proportion discharged to a nursing home increased for the over-75 age group from 34% in 1989 to 55% in 2000.

DISCUSSION

We found that the placement of feeding tubes in North Carolina hospitals increased steadily over the 11-year period from 1989 to 2000. Rates of use increased in all adult age groups. Our findings also demonstrate that the rate of inpatient feeding tube placement has slowed in North Carolina since 1996. The number of outpatient procedures has increased substantially during this same time, suggesting that outpatient procedures are replacing inpatient procedures for some patients.

Although the rates for feeding tube placement continued to increase over the 11-year period, the relative rate of increase did not differ among the 3 age groups. The absolute number of feeding tube placements was much

greater in those age 75 and older than in those who were younger. Older age has been found to be associated with higher mortality after feeding tube placement,[1,4,7] but we did not find a trend toward a preference for placement in younger patients.

There were some differences in utilization over time by diagnoses. The proportion of tube-fed patients with stroke has increased over time while the proportion with cancer has remained relatively stable. Physicians could be targeting patients with lower mortality rates after feeding tube placement and, perhaps, the best chance of functional improvement. Somewhat disturbing is the increase in the use of feeding tubes in patients with neurodegenerative disorders. Demented patients who are unable to eat are least likely to benefit from tube feeding [3,12] We should note, however, that neurodegenerative diseases was a small proportion of the total patients receiving feeding tubes in this study.

Our examination of comorbidity measures found that tube-fed patients in general had a higher burden of chronic illness than non-tube-fed patients, and this measure increased over time. This finding coupled with the observation that more tube-fed patients over the age of 75 were being discharged to a nursing home over time suggests that the use of feeding tubes may be expanding to patients who likely have poorer prognoses.

Our study has limitations. The use of a secondary dataset limits the clinical detail available. Additionally, the data did not allow for closer analysis of outpatient procedures. Outpatients may have different characteristics than hospitalized patients, potentially affecting some of our findings. For example, those getting outpatient procedures may not have been as ill as the inpatients. On the other hand, it is plausible that outpatient feeding tube placements were primarily initiated by nursing homes, and that these patients' illness severities were comparable to those who were in the hospital. Our research is restricted to North Carolina, which raises concerns regarding generalizability to other states or populations. Because the rate of rise in feeding tube placement in North Carolina parallels the rise noted in analysis of national Medicare data in the early 1990s,[1] our North Carolina data may reflect national trends for feeding tube placement reasonably well.

Diffusion theory hypothesizes that adoption and discontinuance of new technology occurs in stages: development, diffusion, domination, and disillusionment.[20] Adoption occurs when there is a perceived relative advantage over alternatives.[21] Not surprisingly, endoscopic feeding tubes were rapidly adopted in the early part of the 1990s as the technology became more available and thereby offered an alternative to hand feeding, surgical placement of feeding tubes, or decisions to forego feeding. Despite the increase in use, evidence supporting the benefits of feeding tube placement in terms of improving functional status and prolonging life have not materialized over time for many chronically ill patients. Consequently, some have questioned their use in these patients,[2,8,12,17] what diffusion theorists would call "disenchantment discontinuance."[21] Although these concerns have been raised, our data demonstrate no evidence of discontinuance, but a progressive increase in utilization has continued from 1989 to 2000.

A decrease in feeding tube placement may still occur given more time. The rate of discontinuance for other medical technologies has varied widely[20,22] but has not always been attributable to medical evidence. Continued utilization or discontinuance may have more to do with physicians' personal experience, social norms, and the availability of alternative approaches than evidence of benefit or harm.[20] It is also important to note that adoption of technology depends on *perceived* benefit relative to the alternatives.[21] For many family members (and perhaps physicians), placing a feeding tube is preferred over standing by while a patient fails to eat.[16] Whether these patients have improvement in functional status or have their life prolonged may not be the measure of benefit being considered in the decision-making process. Family members or physicians may perceive nutritional support as a social good, providing perceived comfort, nurture, or care irrespective of its effect on function or survival.

Our study demonstrates that the use of feeding tubes has continued to increase through the 1990s. This increase occurred despite ongoing controversy in the medical literature about feeding tube placement in chronically ill patients. Whether utilization will level off or decline in the future in response to this controversy remains to be seen. Experience with other medical technologies suggests that continued utilization may depend more on perceived benefits than on evidence in the medical literature, especially in situations with limited alternatives.

This research was supported by NINR grant NR05018 and the Duke Endowment.

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