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Original Communications

Older Adults Receiving Home Enteral Nutrition: Enteral Regimen, Provider Involvement, and Health Care Outcomes

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ABSTRACT. *Background:* Home enteral nutrition (HEN) is most frequently prescribed for older adults. Medicare reimbursement policy limits in-home nursing visits, and in-home professional nutrition services are restricted to those patients with diabetes or predialysis kidney disease. Most older adults receiving HEN rely on informal (family) caregivers to provide HEN care. The purpose of this study was to apply care process theory to identify and investigate variables related to health care outcomes of HEN in a sample of older adults dependent on informal caregivers. We assessed relationships among patient characteristics, the HEN regimen prescription and adherence, formal provider involvement, and health care outcomes. *Methods:* In-home interviews were conducted with a multiethnic (14 white, 8 Hispanic, 7 African American, 1 Asian) sample of 30 older adults (mean = 68.4 years) during their first 3 months of HEN (mean = 1.83 months). *Results:* Daily enteral intake averaged 1596 ± 553 kcal. Gastrointestinal complications, occurring in up to 63.3% of patients, interrupted daily infusions. Further, one-third reported tube clogging or leaking, and one-third had tube displacement. Water intake was half of calculated need and associated with decreased urination ($p = .001$). Average weight change was -4.35 pounds ($p = .001$), and 17 patients had body mass indexes (BMIs) <18.5. Women had more complications ($p = .004$), lower enteral intake ($p = .009$), and lower BMIs ($p = .02$). Only 6 patients saw dietitians in follow-up care. Complications and type of feeding tube were associated with unscheduled health care visits and readmissions ($p < .05$). *Conclusion:* The efficacy of HEN in older adults (ie, reversal of malnutrition and improvements in health, functionality and quality of life) requires more frequent monitoring, reassessment, and intervention from a highly skilled multidisciplinary team that includes dietitians. (*Journal of Parenteral and Enteral Nutrition* **28:**92–98, 2004)

Older adults comprise the majority of home enteral nutrition (HEN) patients. The main indications for HEN are diseases that often occur in later years (eg, neoplasms of the head, neck, and upper gastrointestinal tract; neuromuscular swallowing disorders; and a variety of bowel disorders, including malabsorption syndromes and anorexia associated with illnesses).[1] Medicare payments for HEN are estimated at over $600 million annually.[1] In Florida, for example, Medicare paid more than $9 million for HEN during fiscal year 1998.[2]

However, Medicare reimbursement policy restricts home and community-based professional nutrition services to those patients with diabetes or predialysis kidney disease. Further, in-home nursing services are typically limited to 3 visits after hospital discharge.[3] This gap in care delivery is felt by HEN patients who report dissatisfaction with continuity and quality of care, specifically from inadequate interactions with professionals knowledgeable of nutrition and infusion-related issues.[4,5] The lack of adequate formal home health services also means that >75% of older adults rely on informal caregivers (ie, unpaid family/relatives, friends, or neighbors) to manage their HEN.[6]

The current state of postacute health care delivery raises concerns as to whether the goal of providing HEN to older adults (ie, to improve health, functionality, and quality of life by reversing malnutrition in a safe and cost-effective manner) is being met.[7,8] Conceptual models of the care delivery process offer insight into the variety of factors that may influence HEN outcomes. In Smith's model,[9] developed with home parenteral nutrition patients, quality of care is linked to patient physical condition, technology-related side effects, and quality of life. The model of Pearlin et al[10] suggests that the background and context of care delivery (eg, caregiver and care recipient characteristics, knowledge, responsibilities) and factors that mediate the care process (eg, coping and adaptation skills, support networks, resources) influence outcomes.

In this dual-phase integrated study, we used care process theory to identify and investigate several factors that may be associated with the efficacy of HEN in

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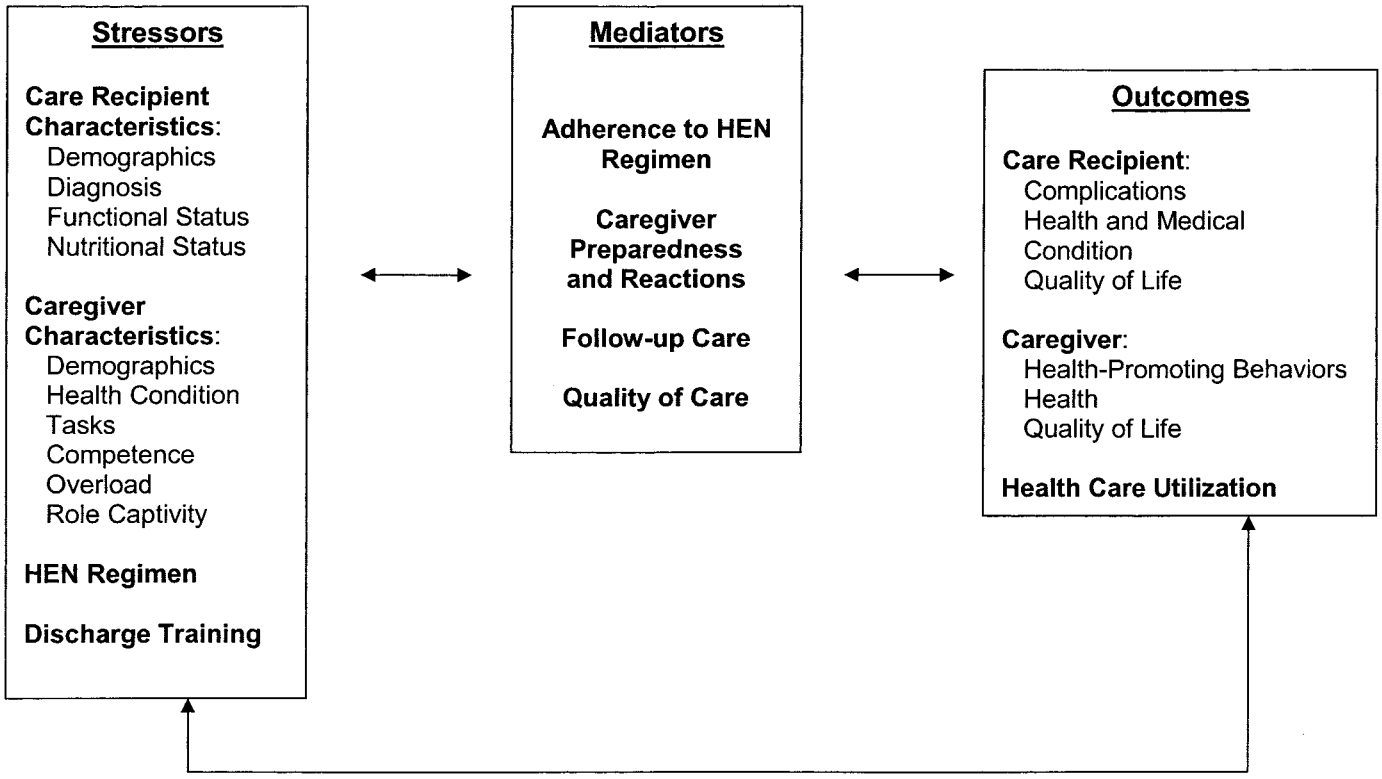

FIG. 1. Conceptual model applying care process theory in a sample of older adults on home enteral nutrition (HEN).

a sample of older adults dependent on family caregivers for daily HEN care (Fig. 1). The full methods and findings from the first phase have been reported previously.[11] To summarize, in-home structured interviews were conducted with 30 family caregivers (24 women, 6 men) who were primarily responsible for managing an older adult's daily HEN for an average of 1.8 ± 0.7 months after hospital discharge. Caregivers were 52.3 ± 14.9 years old (range, 21 to 76 years). They performed an average of 20 functional, care management, technical, and nutrition-related tasks daily for an average of 62 caregiving hours weekly. Half received training for these tasks in the hospital before patient discharge. Nine were trained in the patient's home, 4 in the outpatient clinic, and 2 never received any training. Overall, their reported need for training exceeded the number of tasks for which they reported receiving training. They were generally unprepared for caregiving, lacked competence and confidence, and felt anxious, sad, tense, overwhelmed, and frustrated.

In the second phase of this study, reported here, we conducted in-home structured interviews with the patients to further investigate factors identified in Smith's model of caregiving[9] that may be related to outcomes of HEN in older adults. Thus, the relationships we assessed for the background and context of care delivery were patient characteristics and the enteral regimen, for mediators of care we assessed adherence to the enteral regimen and health care provider involvement/follow-up care, and for patient-related health care outcomes we assessed physical and technical complications, patient condition, quality of life, and health care use.

MATERIALS AND METHODS

Patients

Institutional review board approval was obtained from 2 university-affiliated medical institutions in Miami, Florida. Over a 6-month period, monthly billing lists were gathered to identify patients aged 60 and over with current procedural terminology codes for radiologic or surgical enteral tube placement. Those with a discharge plan for HEN documented in their medical record (n = 90) were visited in their hospital rooms to describe the study and obtain home contact information. Thirty-four patients were excluded because of subsequent mortality (n = 17), change from enteral to parenteral support (n = 7), discharge to long-term care (n = 6), or removal of the enteral tube at discharge (n = 4). None of the 56 patients were being followed up by the hospitals' nutrition support services.

The 56 patients were contacted by telephone at home within 2 weeks after discharge to verify that no formal (paid) caregivers provided HEN care and that the informal caregiver who managed daily HEN was over age 21 and resided within 45 driving minutes of the patient's home. Of the 56 patients telephoned, 45 agreed to bring their caregiver to their first outpatient visit, scheduled between 2 to 4 weeks after discharge.

Data Collection Procedures

At the outpatient visit, the 45 patients and their caregivers provided written consent and in-home interviews were scheduled to occur 4 to 12 weeks after discharge. Patients' medical records were reviewed for

age, diagnosis, medical and surgical history, and discharge instructions, including enteral regimen (formula, water, and infusion prescription). Enteral regimen was based on physician or dietitian prescription, and nutrient adequacy was assumed. The 45 patients were measured for weight and height on the clinic stadiometer, and tube type was confirmed.

Thirty patients were ultimately enrolled as 7 caregivers withdrew consent, 4 patients died between outpatient visit and in-home interview, 2 patients were readmitted, and 2 chose not to continue enteral support. In-home interviews (mean of 55 ± 15 minutes) were conducted at 1 to 3 months after discharge using a multicomponent structured survey instrument. The survey instrument consisted of validated scales and several original items, including a HEN Complications Inventory, according to the HEN literature and the first author's previous nutrition support experience. The survey instrument was refined after review for content validity by a panel of experts and piloted with a multiethnic sample of 6 older adults receiving HEN. Survey questions were read to patients while they were shown 3"×5" cards with printed response choices. Spanish-speaking patients received translation from a trained Hispanic graduate assistant. Caregivers were present during interviews; they confirmed responses but did not serve as proxies.

The first portion of the interview focused on demographic information, medication use, nutrition history (enteral infusion, food and water intake, and meal participation), and health care provider involvement after discharge. Patients' functional status was assessed using the physical, psychological, social, and quality of interaction subscales of Jette's Functional Status Questionnaire (FSQ).[12] These 21 items were scored within each scale to produce a summary score that was transformed to a percentile value ranging from 0 to 100, with higher scores indicating better functional ability. Reported α reliability coefficients for these subscales range from 0.64 to 0.82,[12] and were 0.68 to 0.91 in this sample.

Next, patients were weighed (Health-o-meter scale, Sunbeam Products, Inc, Boca Raton, FL) while dressed in light clothing without shoes to calculate weight change (from discharge) and body mass index (BMI). Patients were asked for the total number of cans of enteral formula that had been infused over the previous 72-hour period. Infused volume was compared with enteral prescription to assess adherence. Patients were also asked for the total volume of water they received (*via* feeding tube flushes and by mouth) over the previous 72-hour period, which was added to the water content of the infused formula. Hydration status was assessed by comparing total water intake to need, calculated as 30 mL/kg/bw/day,[13] and asking whether the frequency of daily urination was "less," "same," or "more" than usual.

Physical and technical complications of HEN were measured using the HEN Complications Inventory. Patients were asked about the presence/absence and frequency of diarrhea (≥3 liquid stools daily for 72 hours), constipation (no stool for 72 hours), nausea, vomiting, abdominal distension/bloating, stomach pain/cramps, gas, tube blockage/clogging, tube leak, tube malposition, infusion pump malfunction, and aspiration. They were also asked, "Have you stopped your feeding during the past 3 days?" and if "yes," the reason was recorded. The tube site was inspected for "redness" and "oozing," and patients were asked if the skin around the site was "itchy" or "sore."

Hathaway's General Quality of Life tool[14] was used to measure global quality of life (QOL) on a single-item 5-point Likert scale. Patients were asked to rate their QOL since HEN from "poor" (1 point) to "excellent" (5 points). Hathaway's QOL has concurrent and construct validity with multidimensional measures of QOL and significantly correlates with Ferrans and Powers[15] QOL Index used in home parenteral nutrition.[16]

Finally, health care use was measured by asking, "How many times (since your discharge) have you or your caregiver telephoned a health care provider for problems related to the tube feeding?" and "How many times (since your discharge) have you been to a hospital, physician's office, clinic, or emergency room for a problem related to the feeding tube that was not part of your scheduled follow-up care?" Health care use included number of readmissions and was confirmed by patients' medical records and communication with their providers.

Statistical Analysis

Descriptive statistics were used to summarize data. χ^2 Analysis was conducted to examine relationships between categorical variables. *t*-Tests were used to assess differences between continuous variables. Spearman's Rho nonparametric ranked correlations were calculated to assess bivariate associations between quantitative variables. Results were considered significant at $p < .05$. Data analysis was performed using SPSS (version 10.0, SPSS, Inc, Chicago, Ill, 1999).

RESULTS

Thirty patients (20 men, 10 women) who had received HEN for an average of 1.8 ± 0.7 months after discharge were interviewed. Their mean age was 68.4 ± 7.2 years (range, 60 to 80 years). Fourteen were white, 8 Hispanic, 7 African American, and 1 was Asian. Eighteen were married, 9 divorced, and 3 widowed. Twenty-three had feeding gastrostomies placed during surgery for head and neck cancer. The other 7 had jejunostomies: 4 for swallowing disorders, 2 for bowel malabsorption, and 1 for head trauma. Twenty received bolus feedings from 1 to 4 times daily, and 10 infused continuously at night.

Functional Status

Table I presents results from the FSQ. Functional status scores were moderately high for activities of daily living (ADLs) (75.0 percentile) and psychological function (70.7 percentile). Quality of interaction score was moderate (57.0 percentile) with patients unable to act affectionately or get along well with others. More impaired was social function (29.5 percentile), because

TABLE I
Assessment of functional status using the Jette FSQ in older adults receiving home enteral nutrition* (n = 30)

FSQ item	Mean ± SD
Basic ADL score†	2.26 ± 0.89
Moves in/out of chair/bed	3.33 ± 0.92
Dresses and bathes self	3.30 ± 1.06
Walks indoors, around home	3.14 ± 0.94
Intermediate ADL (IADL) score†	0.99 ± 0.87
Walks several blocks	2.50 ± 1.22
Climbs a flight of stairs	2.17 ± 1.18
Drives a car or uses public transportation	2.06 ± 1.29
Does light housework	2.03 ± 1.30
Does errands, goes shopping	2.03 ± 1.22
Participates in vigorous activities	1.13 ± 0.57
Psychological function score‡	2.83 ± 0.48
Feels happy§	4.76 ± 1.30
Feels calm and peaceful§	3.76 ± 1.72
Feels nervous	3.45 ± 1.99
Feels down in the dumps, can't cheer up	3.34 ± 1.59
Social function score†	0.88 ± 0.72
Visits with relatives or friends	2.76 ± 1.13
Participates in community activities	1.69 ± 1.12
Takes care of other people/family	1.21 ± 0.59
Quality of interaction score‡	2.85 ± 0.58
Makes unreasonable demands	4.77 ± 1.28
Acts irritable toward others	4.20 ± 1.30
Isolates self from others	4.07 ± 1.72
Acts affectionate toward others§	3.27 ± 1.55
Gets along well with others§	2.97 ± 1.47

*Jette Functional Status Questionnaire 1986; each scale summary score transformed to percentile: 0%–100%, higher scores indicate better functional ability.
†Scale: 0 = don't do; 1 = don't do because of health; 2 = much difficulty; 3 = some difficulty; 4 = no difficulty.
‡Scale: 1 = all the time; 2 = most of the time; 3 = a good bit of the time; 4 = some of the time; 5 = a little of the time; 6 = none of the time.
§Reverse scored: 1 = none of the time, 6 = all the time.
ADL, activities of daily living.

of an inability to participate in community or family activities. Intermediate ADL (IADL) score was very low (16.5 percentile) with patients most often choosing "Don't do because of health."

HEN Complications

The number of patients reporting physical or technical complications is presented in Table II. The most common physical complaint was related to patients' skin at the tube site. Ten reported soreness or pain, and 7 reported itchiness. Upon inspection, 13 patients had oozing and 12 had redness. Gastrointestinal side effects were also common as 19 patients reported diarrhea, 16 reported stomach pain/cramps, 16 reported gas, 15 reported bloating/distension, 15 reported constipation, and 12 reported nausea. Eleven patients reported that gastrointestinal side effects interrupted their enteral infusion daily.

Technical complications were less frequent than physical, but one-third of the patients reported tube clogging or leaking, and 4 of the 13 using an infusion pump reported pump malfunction. Almost one-third reported tube displacement, the usual cause for unscheduled health care visits and readmissions (Table II). There were no significant differences in types of complications reported either between patients receiving bolus *vs* continuous feeding or between those with gastric *vs* jejunal tubes.

Nutrition

Eighteen enteral regimens were written by physicians and 12 by dietitians. They were not significantly different in total volume, kilocalories (per kg/bw), or water prescribed. As shown in Table III, the mean daily enteral formula prescription was 1596 ± 553 kcal. Patients reported infusing an average of 92% ± 24% of the prescribed formula, which provided an average of 25 ± 11 kcal/kg body weight per day. Eighteen patients reported consuming "soft foods"; the rest had no oral food intake. Daily total water intake averaged 931 ± 576 mL per day. Water intake provided a mean of 15.9 ± 11.1 mL/kg body weight, or about half of estimated need (53% ± 37%).

TABLE II
*Reported physical, technical, and infusion-related complications of home enteral nutrition (HEN) since discharge**

Type of complication	Number of patients reporting problem (*n* = 30)
Physical complications	
Decreased urination	22
Diarrhea	19
Stomach pain/cramps	16
Gas	16
Stomach bloating/distension	15
Constipation	15
Nausea	12
Vomiting	4
Skin problems at tube site	21
Oozing	13
Redness	12
Soreness/pain	10
Itchiness	7
Technical complications	
Tube clogging	10
Tube leaking	10
Pump malfunction (*n* = 13)‡	4
Tube displacement	8
Aspiration pneumonia	2
Daily feeding interruption	11
Reason for interruption	
Reflux	3
Nausea/vomiting	2
Bloating/fullness	2
Leaking	1
Tube clogging	1
Aspiration	1
Unrelated pain	1
Unscheduled visits†	
None	8
1 Visit	12
2 Visits	7
≥3 Visits	3
Reason for visit/readmission	
Tube fell out and replaced	7
Tube clogged	5
Infection	3
Dehydration	3
Tube leaking	2
Aspiration	1
Hyperglycemia	1

*Mean duration of HEN = 1.8 ± 0.7 months.
†Unscheduled medical visits/readmissions after discharge.
‡Only 13/30 used an infusion pump.

TABLE III
Nutrition-related factors in older adults receiving home enteral nutrition (n = 30)

Nutrition-related factor	Mean ± SD	Range
Body mass index*	20.04 ± 5.12	13.17–34.18
Weight change,† lbs	−4.35 ± 8.40	−25.0–13.0
Daily enteral Rx, kcal	1596 ± 553	251–2882
Actual enteral intake (as % Rx)	92 ± 24	0–138
Water Rx *via* Tube, mL	573 ± 500	0–2000
Total daily water intake, mL	931 ± 576	120–2500
Water intake as % fluid need‡	53 ± 37	7–201

*At time of interview.
†From hospital discharge to interview; mean of 1.8 ± 0.7 months.
‡Fluid need calculated as 30 mL/kg body weight; mean intake = 15.9 ± 11.1 mLs/kg body weight.

Tables IV and V show differences in enteral formula and water intakes between patients reporting *vs* those not reporting complications. No significant differences were observed for enteral formula or water intakes by diagnosis, type of tube, or infusion regimen. Patients who consumed food had a significantly lower enteral formula prescription (1356.9 ± 514.3 *vs* 1955.8 ± 402.3 kcal/day; $p = .002$). They also had significantly lower enteral formula intakes, as did patients who reported stomach pain or nausea (Table IV). Patients who reported tube clogging had significantly higher enteral formula intakes (1785.3 ± 563.4 *vs* 1295.3 ± 515.5 kcal/day; $p = .02$). The 22 patients who reported decreased urination had significantly lower total water intakes (790 ± 462.4 *vs* 1636 ± 611.9 mL/day; $p = .001$). Water intakes were also significantly lower for patients who reported stomach pain, distention, or vomiting (Table V).

Only 5 patients, all men, gained weight. For these 5, enteral formula prescription tended to be higher (2038 ± 583 *vs* 1447 ± 568 kcal; $p = .05$). Overall, mean interview weight was significantly lower than discharge weight, $p = .001$, with weight change averaging -4.4 ± 8.4 pounds (range, -25 to +13 pounds). Weight change was not significantly related to water intake. Weight change was significantly lower for patients who reported consuming food than for those who did not (-7.2 ± 8.7 *vs* 0.3 ± 5.5 pounds; $p = .008$). BMI at interview averaged 20 ± 5.1, with 17 patients under 18.5. The mean BMI for female patients was especially low at 17.1 ± 3.9.

QOL

Mean QOL score was 2.0 ± 0.8, with 22 patients rating QOL as "poor" or "fair." QOL score was significantly higher for cancer patients than other patients (2.2 ± 0.8 *vs* 1.4 ± 0.5; $p = .03$). Notably, cancer patients were significantly younger (67 ± 6.8 *vs* 73 ± 6.5 years; $p = .03$) and had significantly higher ADL and IADL scores (2.5 ± 0.6 *vs* 1.4 ± 1.1; $p = .001$ and 1.2 ± 0.8 *vs* 0.1 ± 0.2; $p = .002$, respectively). Overall, higher QOL score was associated with higher IADL and social function scores ($r = .56$, $p = .001$ and $r = .39$, $p = .03$, respectively). QOL score was significantly lower for patients who reported distention/bloating compared with those who did not (2.3 ± 0.9 *vs* 1.7 ± 0.6; $p = .02$).

Health Care Use

Only 6 patients had dietitians involved in their follow-up care. One was referred by a physician and 5 by inpatient dietitians before discharge. These 6 patients had significantly lower mean BMIs (16.1 ± 1.9 *vs* 21.0 ± 5.2; $p = .001$) and an increased likelihood for daily infusion interruption (83.3% *vs* 25%; $p = .02$).

Twenty-two patients reported from 1 to 6 unscheduled visits to a physician's office, outpatient clinic, or emergency room (Table II). Unscheduled visits occurred significantly more often for those who (with their caregiver) telephoned health care professionals more frequently, $r = .67$; $p < .001$. All unscheduled visits led to readmissions, most commonly for tube displacement, tube clogging, infection, and dehydration. Patients with jejunal tubes had significantly more unscheduled visits/readmissions (2.4 ± 1.8 *vs* 0.9 ± 0.8; $p = .003$).

DISCUSSION

Meeting the goal of HEN is challenging in the current health care environment of early discharge, inadequate time for patient and family education, decreased availability of nutrition support services, lack of professional nutrition services in home and community settings, and dependence on informal caregivers.

In the present study, despite compliance with the enteral prescription, the older adults on HEN had multiple negative outcomes, as did their family caregivers.[11,17] The majority of patients experienced compli-

TABLE IV
Comparison of average daily enteral formula intake for patients who reported having/not having HEN-related complication

Variable	Enteral formula intake, kcal/day*		*p* Value
	Yes	No	
Decreased urination	1502.68 ± 508.30 ($n = 22$)	1238.17 ± 867.92 ($n = 8$)	NS
Stomach pain	1212.32 ± 632.94 ($n = 16$)	1740.05 ± 330.15 ($n = 14$)	0.008
Distension/bloating	1363.09 ± 543.38 ($n = 15$)	1554.09 ± 603.45 ($n = 15$)	NS
Nausea	1151.50 ± 666.96 ($n = 12$)	1663.33 ± 400.46 ($n = 18$)	0.01
Vomiting	1391.02 ± 595.34 ($n = 4$)	1468.99 ± 580.38 ($n = 26$)	NS
Tube clogging	1785.27 ± 563.38 ($n = 10$)	1295.26 ± 515.46 ($n = 20$)	0.02
Consumes food	1241.49 ± 607.20 ($n = 18$)	1784.25 ± 318.62 ($n = 12$)	0.002

*Means ± SD. NS, nonsignificant.

TABLE V
Comparison of average daily total water intake for patients who reported having/not having HEN-related complication

Variable	Total water intake, mL/day*		*p* Value
	Yes	No	
Decreased urination	790.00 ± 462.43 (n = 22)	1636.00 ± 611.95 (n = 8)	0.001
Stomach pain	725.63 ± 413.55 (n = 16)	1165.71 ± 656.37 (n = 14)	0.03
Distension/bloating	702.00 ± 423.88 (n = 15)	1160.00 ± 628.13 (n = 15)	0.03
Nausea	847.50 ± 682.23 (n = 12)	986.67 ± 506.02 (n = 18)	NS
Vomiting	400.00 ± 260.38 (n = 4)	1012.69 ± 569.47 (n = 26)	0.04
Tube clogging	762.00 ± 471.89 (n = 10)	1015.50 ± 614.72 (n = 20)	NS
Consumes food	958.33 ± 591.44 (n = 18)	890.00 ± 574.61 (n = 12)	NS

*Means ± SD. NS, nonsignificant.

cations, particularly skin problems at the tube site and gastrointestinal side effects. Many had tube-related technical complications. Both gastrointestinal and technical complications interrupted daily infusions. Most patients lost weight, and their low BMIs suggest that their protein-energy undernutrition was continuing.[8,18] The patients who were consuming food had the lowest enteral intake and greatest weight loss. It is likely that their lower enteral prescription assumed an unrealistic oral intake. In actuality, oral intake was negligible and consisted of small portions of soup and gelatin. It is also possible that oral intake caused gastrointestinal distress and interfered with enteral support. Overall, female patients reported more complications and had the lowest enteral intakes and BMIs. This is consistent with Stiller's findings that home care technologies are more successful when women are caregivers not care recipients.[19]

Most disconcerting was these patients' low water intakes. Total water intake was especially low for those patients reporting a high incidence of gastrointestinal side effects, which was most likely increasing their fluid need. Phillips et al[20] demonstrated that older adults respond to dehydration with reduced thirst and water intake compared with younger adults. Other evidence suggests that frail older adults who do not voluntarily replete their fluid deficit when water restricted are at increased mortality risk.[21] de Castro[22] found that older adults maintain their fluid balance by coingesting fluids with solids. In this sample of older adults dependent on HEN, the potential for dehydration raises particular concern regarding the adequacy of the fluid component of the enteral prescription.

Only 6 of these patients received follow-up care that included a dietitian. Presumably, it was the low weight status of these patients that triggered a dietitian referral. In general, follow-up care was not comprehensive; in addition to the lack of dietitian involvement, nutrition support services were not used. As shown by Hull et al,[23] the consequences of protein-energy undernutrition for patient morbidity, mortality, and health care use justify the costs of these teams. Further, this practice contrasts with the recent recommendations of the Institute of Medicine that enteral (and parenteral) nutrition therapy be provided by a multidisciplinary team and that dietitians be direct providers of nutrition therapy.[8]

In this study there was also evidence of impaired functionality. Most of these patients had little engagement in IADLs or social activities and had poor quality of interactions. Faden and German[24] report that QOL of older adults is related to functionality and health condition. Not surprisingly, most of these older adults rated their QOL less than good. Contrary to Smith's[16] findings in home parenteral nutrition patients where longevity of nutrition infusion was salient to impaired QOL, in this sample HEN usage seemed to be immediately interfering with QOL.

In addition to poor QOL, the magnitude of the multiple problems observed is evident in the frequency of health care use in these first 3 months after discharge. Health care use was 7 times greater than the yearly readmission rate expected for older adults receiving HEN.[1,25] This has implications for both health care labor (ie, inefficient use of providers' time) and health care costs (ie, unscheduled visits, especially emergency room visits, and resultant admissions). Most importantly, many of the reasons for health care use (eg, physical complications, feeding interruption, tube clogging, dehydration, and infection) may be preventable.

The limitations of this study derive primarily from the small sample size and the cross-sectional design. No data exist on the actual numbers of older adults discharged receiving HEN from the 2 participating institutions, nor in Florida, nor nationwide. A well-designed inclusion criterion was strictly followed to identify all potential patients within the 6-month data collection period. Thus, these 30 patients represent more than half (54%) of those discharged home and allowed for 80% power in testing for correlations of .5 or greater at a .05 significance level.[26] The small sample may have led to underestimation of the adverse outcomes identified, as the main reasons for dropout were death, readmission, and intolerance of enteral support. Future studies should include larger, more representative samples and examine changes in salient variables over time. The conceptual model (Fig. 1) used for identifying variables and relationships among variables could be a framework for future studies. Because the 2001 Medicare regulations reimburse home and community-based nutrition care in only 2 disease states (diabetes and renal disease), further research is needed to document the value of medical nutrition therapy for other diseases and conditions affecting older adults. Such research could also lead to the development of specific recommendations and evidence-based protocols, for example, for meeting the fluid needs of older adults receiving HEN.

A cross-sectional design was used to study the HEN experience of older adults who depended on informal caregivers in the immediate postdischarge period, the time that Smith et al[27] described as the most challenging for families using similar home care technologies. That patients sought to prolong interviews with nutrition-related questions and requests for future visits underscores the taxing nature of this initial phase of HEN. Other limitations, including possible differences by grouping variables such as comorbidities, the role of adaptation, and instrument validation, have been discussed elsewhere.[11,17] Finally, the role of medications in the outcomes observed was not investigated, because of the variety of medications and administration routes prescribed.

Despite some limitations, the observations of this study highlight problems relevant to clinical practice, policy, and research. As many of the adverse outcomes experienced by older adults on HEN may be preventable, these observations emphasize the need for evidence-based protocols and interventions to prevent adverse outcomes. Efficacy of HEN appears to need more in-depth and frequent intervention by a multidisciplinary team of formal health care providers and more intensive training of informal caregivers.

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