PERCEIVED EFFECTIVENESS OF NUTRITION SUPPORT IN PATIENTS WITH SEPSIS AND MULTIPLE ORGAN DYSFUNCTION SYNDROME

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CHAPTER I

INTRODUCTION

Health care professionals need to find a way to deliver the best services to their patients. In critically ill patients, effective nutrition support is essential to provide needed nutrients and to improve recovery. Studies on nutrition support outcomes help dietitians and hospitals provide cost-effective nutrition care and benefit patients. Because the dietitian is responsible for providing nutrition support, the dietitian's background could influence outcomes of nutrition support in critically ill patients. Besides that, the type of facility where the dietitian works may also influence outcomes.

There are two methods of nutrition delivery in nutrition support: Total Parenteral Nutrition (TPN) and Total Enteral Nutrition (TEN). Each method functions differently and has advantages and disadvantages in the treatment of critical illnesses. Adverse effects such as protein-energy malnutrition and death can occur when patients are not given nutrition support at an appropriate time. According to the American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines, nutrition support is indicated in patients who are not expected to be able to eat for more than 10 to 14 days (Trujillo et al. 1998).

There are many factors affecting outcomes of nutrition support including routes of delivery of nutrition support, time of nutrition delivery, and types of nutrition support.

Some studies have compared the effect of TEN and TPN on desirable outcomes. Total enteral nutrition is superior to TPN in reducing infectious complications in trauma patients because TPN is associated with more catheter infections and sepsis (Barton and Cerra 1991). Current evidence suggests that enteral delivery of nutrition significantly reduces subsequent septic complications, presumably because of gut trophic factors and gastrointestinal (GI) barrier function (ASPEN 1993-B; Barton and Cerra 1991). Enteral feeding provides usable nutrients and has trophic effects on the intestine. Total parenteral nutrition use is associated with gut atrophy. Although enteral nutrition is the preferred route of nutrition support, critical illnesses are associated with GI disorders that may make it difficult to administer enteral nutrition (ASPEN 1993-B). Gastrointestinal intolerance has discouraged TEN use in stressed patients (Barton and Cerra 1991). The primary advantage of TPN is that its use does not depend on an intact or functional GI tract, while TEN requires an intact or functional small intestine.

Other researchers have found the importance of early nutrition support in critically ill patients. Critical illness causes changes in the body's function and energy requirement. Early nutrition support can help patients receive adequate energy and nutrients. One study showed that early TEN was associated with fewer septic complications than TPN in surgical patients (Moore et al. 1992). Another study reported that early enterally fed intensive care unit (ICU) patients showed decreased hospital stay, decreased rates of complication, and decreased mortality compared with those fed late (Schwartz 1996). Moreover, studies on specialized formula supplemented with certain nutrients have brought attention to TEN's effect on outcomes of nutrition support. Bower and coworkers (1995) studied the effect of a specialized TEN formula on hospital stay in

ICU patients. They found that septic patients receiving the experimental formula had significant reductions in length of stay and in infections when compared to the common use formula.

Few studies have been done on the influence of Registered Dietitian's (RD's) credentials and hospital services on outcomes of nutrition support in septic patients at risk of multiple organ dysfunction syndrome (MODS). Sepsis is the metabolic response to an infectious insult, and it can lead to Multiple Organ Dysfunction Syndrome. Patients with a hypermetabolic response to MODS need adequate nutrition support because this response leads to increased energy expenditure, enhanced protein breakdown, and loss of lean body mass (Bower et al. 1995). Nutrition support can help ill patients decrease septic complications, support immune function, and improve wound healing (Moore et al. 1992).

This study observed RDs' perceptions of outcomes of nutrition support in septic and MODS patients, their recommendations for appropriate feedings in septic patients, and their influence in nutrition support decisions. The purpose of the study was to examine the influence of the dietitians' characteristics and hospital services on perceived outcomes of nutrition support and RDs' knowledge of appropriate feedings in septic and MODS patients. Dietitians' characteristics included number of patients treated, years of experience, influence in nutrition support decisions, certification as a nutrition support dietitian, and member of nutrition support team. Hospital services included number of beds, and presence of a medical residency program and trauma center.

Abbreviations

ADA. American Dietetic Association.

ARDS. Adult Respiratory Distress Sundrome.

ASPEN. American Society for Parenteral and Enteral Nutrition.

CNSD. Certified Nutrition Support Dietitian.

DNA. Deoxyribonucleic Acid.

EN. Enteral Nutrition

GI. Gastrointestinal.

ICU. Intensive Care Unit.

IV. Intravenous.

BMI. Body Mass Index.

MD. Physician.

MODS. Multiple Organ Dysfunction Syndrome.

MOFS. Multiple Organ Failure Syndrome.

NBNSC. National Board of Nutrition Support Certification.

NPO. Nothing By Mouth.

NSD. Nutrition Support Dietitian.

NST. Nutrition Support Team.

PhD. Doctorate of Philosophy.

PN. Parenteral Nutrition.

RD. Registered Dietitian.

S-Ig A. Secretory Immunoglobulin A.

SBS. Short Bowel Syndrome.

SPSS. Statistical Package for the Social Sciences.

SIRS. Systemic Inflammatory Response Syndrome.

TEN. Total Enteral Nutrition.

TPN. Total Parenteral Nutrition.

CHAPTER II

REVIEW OF LITERATURE

Nutrition Support Outcomes

Outcomes research in nutrition support improves the quality and efficiency of patient care. Outcomes research helps hospitals establish standards of nutrition care, improve practitioner's practice, and determine the cost effectiveness of nutrition care (August 1995). Three factors leading to the outcomes movement include cost containment, a sense of competition, and differences in the use of medical procedures (August 1995; Epstein 1990). Because the growth of managed care and the initiation of other payment systems limit the increase in medical services, a negative effect on the quality of care can result. Outcome studies can help eliminate unnecessary costs and detect the system's problems (Epstein 1990). As the quality of patient care is influenced by the medical staff available and high costs of health care, a study of the cost-effectiveness of nutrition care could help hospitals provide better care (Simko and Conklin 1989). Not only price but also outcomes and quality can help consumers make health care decisions (Epstein 1990). Outcomes data can be used to determine differences in the use of medical services. Differences in the use of medical procedures result in inconsistent quality and costs to patients. Outcomes research can lead to the development

of standards or guidelines of medical care so professionals provide consistent high-quality care. Practice guidelines are developed based on research results and help modify health care professionals' practice by education (Epstein 1990). Health care practitioners can provide more effective treatment for their patients if they use the results of outcomes research studies (August 1995).

An outcome is defined as the measured result of a health care process, system, or episode of care (August 1995). Geigle and Jones (1990) defined outcomes measures as any measurement system used to identify results of treatment for patients. Outcomes research is defined as a determination of what works in medical care and what does not work (August 1995). The effectiveness of medical care is evaluated by desired or expected outcomes. Outcomes that can be used for measures of the effectiveness of medical care include morbidity, mortality, complication rate, length of hospitalization, weight changes, energy and nutrient intake, the patient's quality of life, functional status, ability to return to work, psychosocial parameters, hospital procedures, readmissions, patient satisfaction, charges, and costs (August 1995; Epstein 1990; Geigle and Jones 1990; Simko and Conklin 1989). The patient's quality of life during the final stages of dying, the patient's well-being, and the appropriate route of nutrition support determine the efficacy of providing aggressive nutrition support in terminally ill patients (American Dietetic Association 1992).

August (1995) and Simko and Conklin (1989) described three analyses to evaluate the effective use of nutrition care: risk-benefit, cost-benefit, and cost-effectiveness analyses. Risk-benefit analysis measures reduction in morbidity and mortality, and improvement in quality of life as a result of a treatment (August 1995).

The second analysis determines costs and benefits of the intervention using monetary value (August 1995; Simko and Conklin 1989). The analysis requires that all program benefits and costs be converted into dollars. The conversion of program costs and benefits into dollars helps health care providers make rational decisions. The third analysis requires measurement of the cost of achieving the desired outcomes (August 1995; Simko and Conklin 1989). Unlike the cost-benefit analysis, the cost-effectiveness analysis records the results of the program or intervention by objective outcome criteria. The goal is to see the desired change in patient health outcomes at less expensive costs.

The application of outcomes studies in health settings benefits hospitals and patient care (August 1995). Doctors and hospitals use outcomes to assure and improve professional performance, provide the best care for patients, and make informed decisions about health care. Patients are asked by hospitals and doctors to evaluate outcomes of care (Geigle and Jones 1990). One study on the level of resources required to provide nutrition support identified unnecessary use of TPN and improved quality of care (August et al. 1991). Another study on the impact of a team approach to nutrition care showed shorter duration of nutrition therapy and less personnel costs (Han-Markey et al. 1994). Another study on physician compliance with nutrition team recommendations reported great compliance by changes in the order form (Perez et al. 1993). The impact of outcomes studies is to improve quality of care and to reduce costs (August 1995).

One outcomes study on the effectiveness of enteral and parenteral nutrition for critically ill patients used a performance improvement process and identified the prescription practice patterns of physicians and patient outcomes (Schwartz 1996). Three

actions were taken to change practice and improve patient outcomes: an increase in the initial use of enteral nutrition instead of parenteral nutrition in the ICU patients, early initiation of nutrition care, and fulfillment of the estimated or measured protein and energy needs of patients. The results showed enhanced nutrition support practice and outcomes in intensive care patients after the performance improvement process was implemented. More patients met their nutrition needs, received appropriate nutrients, were discharged earlier, and were charged less; and fewer patients experienced substrate intolerance, had diarrhea, and stayed in the hospital longer than before the performance improvement was implemented.

Nutrition Support for Patients with Multiple Organ Dysfunction Syndrome

Nutrition Support

The provision of nutrition support is based on nutrition assessment, nutrient requirements, and the status of the gastrointestinal tract (GI). Nutrition assessment is conducted to identify the degree of malnutrition and stress, and to identify needs for nutrition support. Nutrient requirements in stressed patients are a function of the degree of malnutrition and metabolic stress. Estimates of nutrient requirements are calculated for energy intake. The route of nutrition support (TEN or TPN) is determined by the status of the gastrointestinal tract. Patients should receive enteral nutrition if they have a functional GI tract and parenteral nutrition if they have a non-functional GI tract (Lakshman and Blackburn 1986). Enteral feeding is food intake by mouth or nutrient intake by the GI

tract through a feeding tube (American Dietetic Association 1997; American Gastroenterological Association 1995; ASPEN 1990; ASPEN 1993-a; Skipper 1998). Parenteral nutrition provides nutrients through a large vein (such as the superior vena cava, the subclavian, or jugular vein) or a peripheral vein (in the hand or forearm) (American Dietetic Association 1997; ASPEN 1990; Sitzmann et al. 1989).

The provision of nutrition support to critically ill patients is challenging because severe trauma, burns, sepsis, and head injury are associated with dramatic changes in their bodies. Critically ill patients may have a hypermetabolic response to an injury. The response is associated with a hypermetabolic rate, loss of fat and muscle mass, immunosuppression, slow wound healing, proteolysis, insulin resistance with hyperglycemia, a depletion of lean body mass, and increased energy expenditure (ASPEN 1993-b; Bower et al. 1995; Heymsfield et al. 1979; Moore et al. 1989; Trujillo et al. 1998). The hypermetabolic response can lead to the systemic inflammatory response syndrome, sepsis, or multiple organ dysfunction syndrome. Critically ill patients may experience a prolonged hospital stay and high mortality rates (Bower et al. 1995).

Wilmore et al. (1988) reviewed the metabolic role of the gut during critical illness. During stress states, our body becomes hypermetabolic which increases oxygen consumption and elevates stress hormone concentrations. The hypermetabolic state alters the gut mucosal integrity and barrier function which promotes bacterial translocation. This response causes an increase in skeletal muscle breakdown and releases glutamine from muscle. The gut cells use glutamine as an energy source. Although glutamine levels increase, the gut repair requires a greater uptake of glutamine. If enteral feeding is not given, the mucosal cells may weaken and atrophy due to glutamine deficiency. The body

may continue to break down skeletal muscle and enters a prolonged hypercatabolic state (Moore et al. 1992; Wilmore et al. 1988). High protein breakdown adversely affects visceral mass, impairs host defenses, and promotes organ dysfunction.

Immediate nutrition support after injury may prevent this adverse effect in body function (Moore et al. 1989). The benefits of early nutrition support (24-48 hours after events) in postoperative patients are decreased septic morbidity, maintenance of immune function, and improved wound healing (Moore et al. 1992; Trujillo et al. 1998). Early nutrition support also prevents atrophy of gut mucosa and gut bacterial translocation (Trujillo et al. 1998).

The absence of enteral nutrition, prolonged periods of parenteral nutrition, and defunctionalized intestinal segments can cause mucosal atrophy (Skipper 1998). ICU patients will not maintain their gut mucosa and barrier function well if they receive TPN because use of TPN is associated with gut atrophy. Levine et al. (1974) reported that lack of oral intake resulted in the gut atrophy but oral intake maintained gut mass in rats. The results showed that rats receiving TPN had 22% less gut weight, 28% less mucosal weight, 35% less protein, 25% less DNA, and less mucosal height than the orally fed rats. Disaccharidase activity was lower in the TPN rats compared to the orally fed rats. The results showed that oral intake helped maintain gut mass and enzyme activity by stimulation of gut metabolic processes. The authors concluded that early oral intake is essential to prevent a decrease in mucosal weight in patients with impaired digestive and absorptive function after stress states.

Enteral nutrition is the preferable route of substrate delivery in postoperative patients. Use of the GI tract by TEN decreases hypermetabolism and bacterial

translocation that promote the progression of MODS (Lord et al. 1998; Silverman 1993). The gut can utilize substrates delivered by TEN better than TPN (Lord et al. 1998; Moore et al. 1992). TEN prevents gastrointestinal mucosal atrophy, decreases the injury stress response, maintains immunocompetence, and preserves normal gut flora better than TPN (Moore et al. 1992). TEN reduces septic complications because it preserves the GI barriers and host defenses (ASPEN 1993-b; Lord et al. 1998; Skipper 1998). Enteral feeding provides usable nutrients and has trophic effects on the mucosa which help maintain the mucosa and support gut barrier function (ASPEN 1993-a; Lord et al. 1998; Wilmore et al 1988).

The most common problems in nutrition care occur because patients cannot or do not receive enough nutrients or they cannot eat. Inadequate intake of protein and energy result in a deficiency state (Heymsfield et al. 1979). Trauma or surgical patients with hypermetabolism may develop acute protein malnutrition if appropriate nutrition is not given (Moore et al. 1992). Patients who are malnourished have an increased risk of organ dysfunction and death compared with adequately nourished patients (Trujillo et al. 1998). Protein-calorie malnutrition increases mortality and morbidity (ASPEN 1993-b; Trujillo et al. 1998). Stressed patients have nutrient needs greater than non-stressed patients because of metabolic changes (Lakshman and Blackburn 1986). Therefore, the goals of nutrition support for injured or stressed patients are to decrease starvation, prevent nutrient deficiency, provide sufficient energy, and reduce morbidity and duration of recovery (ASPEN 1993-b; Silverman 1993; Trujillo et al. 1998).

Multiple Organ Dysfunction Syndrome

Multiple organ failure is a term that is used to describe the process of progressive physiologic failure of several interdependent organ systems that occurs in critically ill patients. MODS is defined as a syndrome of altered organ function where homeostasis of organ function cannot be maintained without intervention (Members of The American College of Chest Physicians and Society of Critical Care Medicine 1992). MODS develops with the complete failure of more than one organ system and is the final complication of a critical illness (Beal and Cerrs 1994). The mortality of MODS is caused by complications of the disease, not by the disease itself (Beal and Cerrs 1994). A significant insult such as trauma, burns, infections, aspiration, multiple blood transfusions, pulmonary contusion, and pancreatitis lead to the continuum of changes in more than one organ system (Beal and Cerrs 1994).

A major threat to survival in critically ill patients is this process of progressive physiologic failure of several interdependent organ systems (Members of The American College of Chest Physicians and Society of Critical Care Medicine 1992). MODS is a leading cause of death for patients who experience major burns, trauma, and sepsis (Beal and Cerrs 1994; Bower et al. 1995). Patients admitted to the intensive care unit have a 15% chance of developing MODS. MODS was the major cause of death in ICU patients with death rates of 50% (Beal and Cerrs 1994; Nieuwenhuijzen et al. 1996).

Dunham et al. (1995) studied characteristics of multiple organ dysfunction in 3611 blunt trauma patients. The researchers found that failure in five organ metabolic systems (renal failure, adult respiratory distress syndrome (ARDS), hypoalbuminemia,

hyperglycemia, and recurrent acidosis) was significantly related to mortality rate. About 9% of patients in this study had MODS (the dysfunction of two or more of these five systems). Patients with MODS had a significantly higher mortality rate of 32.4% than patients without MODS (1.3%). In patients with MODS, 51.2% had both organ failure and metabolic dysfunction, and 47.9% had only metabolic dysfunction. Infection occurred in 63% of MODS patients and 9% of patients without MODS. In another study of 160 surgical and trauma and/or multiple organ failure patients by Henao et al. (1991), multisystem organ failure was defined as more than one of six organ failures: lung, liver, kidney, coagulation, GI tract, and heart. All organ failures but cardiac failure were associated with MODS. Patients with MODS had a mortality rate of 68%. The mortality rate increased with the number of system dysfunctions (Beal and Cerrs 1994; Dunham et al. 1995; Henao et al. 1991). Henao and coworker's (1991) study showed that mortality for one organ failure was 30%, two organ failures 57%, three organ failures 80%, and four or more organ failures 88%.

Providing adequate nutrients to patients with MODS can promote tissue repair, correct malnutrition, restore metabolic systems, and preserve organ structure and function (Lakshman and Blackburn 1986; Silverman 1993). Nutrition support improves patients' survival by helping them meet nutrition demands (Trujillo et al. 1998), but it does not improve survival in systemic inflammatory response syndrome and MODS; however, nutrition support in MODS patients can prevent mortality and morbidity caused by malnutrition (Beal and Cerrs 1994).

Development of MODS by Infection and Bacterial Translocation

Sepsis is defined as a clinical response to infection (Members of The American College of Chest Physicians and Society of Critical Care Medicine 1992; Trujillo et al. 1998). Infection is an inflammatory response to the presence or the invasion of microorganisms. Patients in ICU had a greater chance of developing nosacomial infections because of impaired host defenses, multiple invasive procedures, and the use of antibiotics (Nieuwenhuijzen et al. 1996). Systemic inflammatory response syndrome (SIRS) is a clinical response to an insult in the absence of infection (Beal and Cerrs 1994; Members of The American College of Chest Physicians and Society of Critical Care Medicine 1992). Most patients admitted to ICU have SIRS because a tissue injury induces this response. When the cause of SIRS is infection, SIRS is defined as sepsis (Beal and Cerrs 1994; Members of The American College of Chest Physicians and Society of Critical Care Medicine 1992). Noninfectious causes for SIRS may include pancreatitis, burns, and trauma. A frequent complication of SIRS is the development of organ system dysfunction (lung injury, shock, renal failure, and MODS); its major cause of death was central nervous system injury (Bower et al. 1995; Members of The American College of Chest Physicians and Society of Critical Care Medicine 1992).

The most severe form of sepsis is associated with the development of MODS and death (Trujillo et al. 1998). Such development of MODS is called Secondary MODS. Secondary MODS is a result of an abnormal body response to an insult such as SIRS and sepsis. Primary MODS is a direct result of an insult such as renal failure (Members of The American College of Chest Physicians and Society of Critical Care Medicine 1992).

The prevention of sepsis is more important than the treatment of underlying disease because sepsis and organ failure greatly affect any interventions (Trujillo et al. 1998).

Failure of the GI tract can take part in the development of MODS (Beal and Cerrs 1994). Nieuwenhuijzen et al. (1996) studied the causal relationship between gut failure and the development of MODS. Gut failure may result in infections and bacterial translocation. The high incidence of infection resulted in longer stay in the ICU and an increased mortality. The relative risk of death increased 3.5-fold in ICU patients who developed infections. Longer stays in the ICU increased the risk of developing infections.

In some patients infection was not directly related to the development of MODS; it just meant failing host defenses (Nieuwenhuijzen et al. 1996). One study showed that infection did not cause development of MODS because only 13% of trauma patients in early MODS and 48% in late MODS had infection (Dunham et al. 1995).

Bacterial translocation is the movement of bacteria from inside the gut, across the intestinal mucosal barrier to the mesenteric lymph nodes and distant organs through the systemic circulation when the gut barrier function fails due to an insult (Beal and Cerrs 1994; Nieuwenhuijzen et al. 1996). Three mechanisms promoting bacterial translocation are altered permeability of the intestinal mucosa, impaired host defense, and an increased number of bacteria within the intestine (Nieuwenhuijzen et al. 1996; Wilmore et al. 1988). Hemorrhagic shock, sepsis, injury, and cell toxins can cause increased permeability of mucosa. Infection is associated with bacterial translocation because it loosens junctions in the mucosa and allows bacteria to diffuse across the barrier into the blood stream. Patients with injury, multiorgan system failure, severe burns, and chemotherapy have higher rates of infection and bacterial translocation.

Immunosuppression and protein depletion can impair the immune function. Bacterial overgrowth and intestinal stasis can increase number of bacteria within the intestine (Wilmore et al. 1988).

Conditions promoting bacterial translocation included the use of total parental nutrition, elemental diets, protein malnutrition, and hemorrhagic shock (Nieuwenhuijzen et al. 1996). Alverdy et al. (1988) examined the effect of route of nutrient administration on bacterial translocation from the gut. Intestinal secretory immunoglobulin A (S-IgA) is one of mucosal defense mechanisms that protects against attachment of intestinal bacteria to mucosal cells. TPN reduced the secretion of S-IgA. This study in rats showed that TPN promoted bacterial translocation. An increase in the cecal bacterial count and a decrease in S-IgA level were associated with bacterial translocation. Although the TEN group had a higher cecal bacterial count, they were able to maintain normal S-IgA levels and decreased bacterial translocation from the gut. The authors concluded that intestinal bacterial translocation may be responsible for multiple organ failure syndrome and TPN may increase the risk of MODS.

Bacterial translocation may explain the development of MODS and sepsis in patients without an identified infection. Alterations in the flora of the GI tract and translocation of bacteria can alter the host immune response. The systemic inflammatory response could develop in response to bacterial translocation and lead to septic complications and MODS (Beal and Cerrs 1994; Nieuwenhuijzen et al. 1996).

Risk Factors for MODS

The number of risk factors is one of many methods to predict development of MODS. According to Dunham et al. (1995), 96.7% of patients with MODS had one or more risk factors. The risk of MODS increased with the number of risk factors. Seven risk factors significantly associated with MODS were pre-existing conditions, age greater than 50, injury severity score greater than 25, hypotension, acidemia, 24 hour blood loss greater than one liter, and major base deficit (Dunham et al. 1995; Klein et al. 1998). Pre-existing conditions included obesity; preadmission need for cardiac drugs or history of myocardial infarction or heart surgery; serum creatinine greater than 2 mg/L; history of cerebrovascular accident, hypertension, diabetes, cirrhosis, or preadmission medication for lung disease (Dunham et al. 1995).

One study used some of risk factors from Dunham and coworker's (1995) study to identify MODS patients: age greater than 50 years, injury severity score greater than or equal to 25, and blood loss greater than 1 L within 24 hours of injury in addition to length of hospital stay more than 14 days, and consumption of no oral feedings for more than 14 days. Eight of 31 trauma patients met the criteria and seven developed MODS within 15 days of admission. MODS developed when there was dysfunction in 2 or more of the following organ systems: respiratory, renal, hepatic, gastrointestinal, cardiac, hematologic, neurologic, or metabolic. The average number of organ dysfunctions per subject was 3.5 ± 2.2 (Klein and Wiles 1997).

Two studies used different risk factors to predict the development of MODS. Henao et al. (1991) studied the association of risk factors with multiorgan failure in 160

surgical and trauma patients. Age, time of evaluation before receiving treatment, massive volume administration, sepsis, and hypovolemic shock were risk factors significantly associated with MODS. There was an interaction among age, shock, and massive volume load in their risk for MODS. Shock, sepsis, and time of evaluation were independent risk factors for MODS. Beal and Cerrs (1994) indicated that risk factors of SIRS and MODS include inadequate and delayed resuscitation, infection, inflammation, baseline organ dysfunction, age greater than 65 years, alcohol abuse, bowel infarction, malnutrition, diabetes, steroids, cancer, and presence of hematoma.

Benefits of Nutrition Support

Nutritional Status

Nutrition support provides patients' nutrient needs and promotes adequate nutritional status. Sepsis is the major cause for mortality in patients with a fistula and may be affected by the patient's nutritional state. TPN may help these patients to overcome sepsis by reversing malnutrition (Sitzmann et al. 1989).

However all patients receiving nutrition support are not adequately nourished. Bruun et al. (1999) studied the nutritional status of 244 surgical patients receiving nutrition support in Norway. Thirty-nine percent of the patients were malnourished (BMI below 20 or weight loss above 5%). Thirty-four percent of the patients were at risk of malnutrition. Of 36 patients receiving nutrition support who were reevaluated, 31 lost weight. This may be due to inadequate amounts of nutrition or short duration of nutrition

support. Most patients received more than one type of nutrition support (partial parenteral nutrition, total parenteral nutrition, and tube feeding). Most of patients receiving nutrition support greater than 7 days did not eat. Many patients' nutrition needs were not met by nutrition support and this may have resulted in malnutrition and weight loss, probably affecting morbidity and hospital stay. In another study, four out of five critically ill patients fed enterally early did not meet their estimated protein and energy goals (Schwartz 1996). The reasons these patients did not meet nutrient goals of TEN included substrate intolerance, fluid restriction, a deteriorating condition that did not justify the provision of the nutrition care, and a trend to reduce the amount of energy provided to the critically ill.

Patients at nutritional risk had adverse outcomes of nutrition support. Buzby et al. (1980) predicted risk of morbidity and mortality by identifying measures of nutritional status in GI surgical patients receiving TPN during the postoperative period. The incidence of complications and death increased with increases in the prognostic nutrition index (based on albumin, transferrin, triceps skinfold, and delayed hypersensitivity). Thirty-nine percent of patients were classified as high risk; they had a 6-fold increase in complications, a 10-fold increase in major sepsis, and a 12-fold increase in mortality relative to patients identified as low risk. The researchers recommended both identification of patients at nutritional risk and administration of nutrition support before surgery to decrease complication rates.

Length of Stay

The average stay in the ICU is 21 days after MODS develops and treatment cost are extremely high (Beal and Cerrs 1994). Nutrition support promoted shorter hospital stays in critically ill patients (Schwartz 1996). Critically ill patients fed enterally early (before 48 hours after admission) showed improved outcomes compared with those fed late (more than 48 hours after admission) (Schwartz 1996). Outcome improvements included decreased length of stay in the ICU and hospital, incidence of sepsis, and number of deaths.

Bower et al. (1995) studied the effect of a specialized TEN formula (IMPACT) on the length of hospital stay in ICU patients by comparing it to a common used enteral formula. Patients receiving the experimental formula had significant reductions in length of stay and infections. Patients with sepsis receiving the experimental formula had significant reductions in length of stay, infections, but a increase in body weight.

Cost

TEN is administrated easily and safely, and at a reduced cost compared to TPN (A.S.P.E.N. 1993-a; Skipper 1998). One study showed that early enteral feeding and the maintenance of GI tract function contributed to the reduction in diarrhea and cost savings for enteral formula purchases in the critically ill patients (Schwartz 1996). TEN is less expensive than TPN (Lord et al. 1998; Moore et al. 1992). The use of TPN is expensive; the average cost of TPN in 1986 was $200 to $300 per day compared to $18 per day for

enteral feeding (American Gastroenterological Association 1995; Heymsfield et al. 1979; Sitzmann et al. 1989). In addition, the cost of maintenance of TPN is higher than TEN because TPN requires sterile technique and a trained team (Heymsfield et al. 1979). If TPN was only used in appropriate patients, its cost would decrease. The total avoidable charges for preventable and not indicated PN use (609 days on PN) were $183,309 over a 4-month period at one 600-bed hospital. These charges did not include costs of avoidable complications (Trujillo et al. 1999).

Mortality

Cerra et al. (1988) studied the influence of route of nutrition support on the reduction of MOFS (multiple organ failure syndrome) and mortality occurring in 66 patients who had persistent hypermetabolism 4 to 6 days after sepsis. Subjects randomly received either enteral nutrition (EN) or parenteral nutrition (PN). The results showed no beneficial effect of either TEN or TPN on the incidence of MOFS or mortality.

Another study showed a difference in mortality. Comparing critically ill patients initially fed enterally and parenterally, the greatest difference was found in the mortality rates: 3 patients (21%) in the enteral group and 6 (40%) patients in the parenteral group died (Schwartz 1996). Bower et al. (1995) studied the effect of a specialized TEN formula (IMPACT) on mortality rate in 326 ICU patients by comparing it to a common used enteral formula. There was no difference in death rates between the two groups; however, the mortality rate for both groups was significantly lower than expected.

Complications

There are complications of nutrition support. Complications of TEN include gastric residuals, delayed gastric emptying, abdominal distention, contamination of feedings, clogged tubes, aspiration, diarrhea, nausea, vomiting, infection, pharyngitis, and gastroesophageal reflux (Heymsfield et al. 1979; Lysen and Winkler 1993; Skipper 1998; Weddle et al. 1995). Diarrhea is the most common complication (American Gastroenterological Association 1995). Pulmonary aspiration is one of the most serious complications of TEN (ASPEN 1993-a). Complications of TPN include infection, mechanical complications, metabolic complications, and nutritional complications (ASPEN 1993-a; Skipper 1998).

The effect of the underlying disease can lead to increased patient complications (American Gastroenterological Association 1995). Patients with MODS are at risk of developing a secondary infection due to contamination of enteral or parenteral feedings (Silverman 1993). The more critically ill patients are more likely to have feeding-induced diarrhea because of many physiological factors involved such as infection, alterations in motility, malabsorption, and so on. Underlying disease pathophysiology such as head trauma must be considered in nutrition care because of the increased incidence of gastric emptying dysfunction. These patients can develop gastric distention and aspiration (American Gastroenterological Association 1995). However, one study showed that TEN intolerance was not associated with patient location (general care or intensive care) or severity of illness (Braunschweig et al. 1988).

Complications of overfeeding and underfeeding can be detrimental to the critically ill patient (Trujillo et al. 1998). Klein et al. (1998) defined overfeeding as provision of excessive amounts of energy, carbohydrate, protein, and fat. It can cause severe consequences and negatively affect function of organs such as the lungs, liver, and kidneys in the critically ill. Critically ill patients fed by TPN are vulnerable to overfeeding and intolerance during administration of a standard protocol or transitional feeding. Critically ill patients with one or more failing organs are more likely to experience complications of overfeeding because of an intolerance. Klein and Wiles (1997) reported that trauma patients at risk for multiple organ dysfunction syndrome did not receive appropriate feeding. All eight identified subjects developed systemic inflammatory response syndrome. The average number of days (within 15 days of hospitalization) that all subjects were overfed was 2.5 d, not fed 2 d, underfed 6.4 d, and adequately fed 4.1 d. Only one patient met estimated energy needs through tube feeding after initiation of nutrition support. Subjects fed by TPN had more organ dysfunctions (5.3 ± 1.7) compared to TEN and were underfed more than 50% of the time.

TEN is considered safer and more convenient than TPN because its complications are less severe and occur less often than those from TPN (ASPEN 1993-a; Heymsfield et al. 1979; Lord et al. 1998; Moore et al. 1992). TPN is easier to administer by rapid delivery and provides consistent nitrogen balance. GI intolerance in postoperative stressed patients has discouraged the use of TEN (Moore et al. 1992).

Some studies showed that use of TEN was associated with fewer complications. Moore et al. (1992) analyzed eight prospective randomized trials using the meta-analysis to compare the effect of early TEN versus TPN on the incidence of septic complications

in 192 high-risk surgical patients. When compared with TPN, the TEN group experienced more abdominal distention and diarrhea, but lower glucose levels and fewer septic complications. Septic complications were defined as abdominal abscess, pneumonia, bacteremia, catheter sepsis, and others. All trauma and blunt trauma patients had a significant reduction in septic complications when fed enterally as compared to other types of trauma and nontrauma patients. The authors concluded that the reduction in septic complications indicated better immunologic function. Another study by Cerra and coworkers (1988) found similar results. Septic patients in the EN group had more diarrhea and vomiting compared with the PN group (Cerra et al. 1988).

Use of TPN had more complications in other studies. A study by Moore et al. (1989) examined the impact of early TEN versus TPN in 75 abdominal trauma patients. Albumin, transferrin, and retinol binding protein levels increased in patients receiving TEN and decreased in patients receiving TPN. Seventeen percent of patients in the TEN group and 37 percent of patients in the TPN had septic morbidity. Use of TPN was significantly correlated with development of pneumonia. TPN should be reserved for indicated conditions because its use is associated with serious complications (Skipper 1998). Trujillo et al. (1999) studied inappropriate use of parenteral nutrition based on the ASPEN guidelines. About 200 patients receiving peripheral or central PN were included in this study. Sixty-two percent of 209 PN starts were indicated, 23% were preventable, and 15% were not indicated. PN was considered to be preventable when patients had a functional small bowel, but did not have enteral access available. Patients requiring PN had significantly higher metabolic complication rates (74%) compared to those receiving preventable (20%) and not indicated (6%) PN (Trujillo et al. 1999).

Other Outcomes

Bassili and Deitel (1981) studied the effects of nutrition support on the outcome of mechanical ventilation in surgical and medical patients in the ICU. Group A had 33 patients receiving intravenous (IV) dextrose or electrolytes and group B had 14 patients receiving TPN or TEN. Reasons for providing this support were postoperative pulmonary complications, sepsis, acute respiratory failure, aspiration pneumonia, pulmonary edema, and chest trauma; these are underlying diseases that increase nutritional demands. Most group B patients (92.8%) but only half of group A patients were weaned off the ventilator. Patients who died of multiple organ failure were those who were not able to be weaned off the ventilator.

Patients with tube feedings were more likely to be discharged with home nutrition support than those with TPN. Twenty-three percent of 1680 responding hospitals discharged greater than 10 patients per month receiving home TEN but only 4% discharged greater than 10 patients per month receiving home TPN (Regenstein 1992).

Influences on Benefits of Nutrition Support

Nutrition Support Team

Optimal nutrition support requires a multidisciplinary approach that uses expertise of several health care professionals (American Dietetic Association 1991). A nutrition support team including physicians, dietitians, nurses, and pharmacists is a good team with

the right expertise needed to manage nutrition care in critically ill patients (American Gastroenterological Association 1995; Driscoll et al. 1986; Jacobs et al. 1984; Jones et al. 1986; Powers et al. 1986). One survey showed that most teams had at least four disciplines (principal health care professions specialized in enteral and parenteral nutrition support) including medicine, nursing, dietetics, and pharmacy (Regenstein 1992). Some teams included more than four disciplines. Additional team members were a coordinator, social worker, respiratory therapist, PhD, occupational therapist, laboratory technician, and hospital administrator (Driscoll et al. 1986; Regenstein 1992; Wesley 1995).

Each professional plays a different role on the team. The physician is usually responsible for directing the team, identifying patient's nutritional needs, prescribing nutrition support orders, monitoring patient's progress, and making final dietary recommendations before discharge (American Gastroenterological Association 1995; Driscoll et al. 1986; Wesley 1995). The nurse sees patients most often. He or she ensures their well-being, monitors the venous access site, maintains central lines, performs skin antigen testing, and coordinates discharge planning (Driscoll et al. 1986; Wesley 1995). The pharmacist examines compatibility of a formula, prepares TPN solutions in a sterile environment, monitors any effects of drug therapy, and may determine TPN formulas (Driscoll et al. 1986; Schwartz 1995: Wesley 1995). The dietitian's knowledge of nutrients and nutrition needs of diseases helps him or her prescribe or recommend nutrition supplementation. The dietitian is a resource person about nutrition support to the team members and sometimes serves as a team director (American Dietetic Association 1997; Schwartz 1995; Wesley 1995). The dietitian calculates energy requirements,

performs nutrition assessments, determines TEN formulas, and monitors nutrition care and transitional feeding (Driscoll et al. 1986; Schwartz 1995). In addition, each member works as a team to evaluate nutrition products, educate patients and staff, and conduct ongoing research (Driscoll et al. 1986).

RD's role in nutrition support has changed. In the 1970s the role of the nutrition support dietitian on the team was to make recommendations about formulas, rates, and volumes (Schwartz 1995). The dietitian determined the enteral formula and helped plan, implement, and evaluate nutritional therapies. In the 1980s the nutrition support dietitian helped select the appropriate route of nutrition support; designed, implemented, and monitored specialized enteral nutrition regimens; and participated in design and implementation of TPN. In Jones and coworkers' 1986 study, the role of the clinical dietitians on a team was examined in a sample of 300 clinical dietitians listed as members of nutrition support teams. Based on their perceptions of the actual and ideal role of the dietitians on the team, the dietitians thought that they should perform other tasks such as prescribing TEN more often. In the 1990s the dietitian participated in design, implementation, monitoring of parenteral and enteral nutrition regimens and acted as a patient advocate (ASPEN 1990; Schwartz 1995). The RD implements a nutrition care plan to accomplish expected outcomes and determines the most appropriate route for delivery of nutrition support with other health care professionals (ASPEN 1990).

Nutrition support teams usually prescribe PN as consultants to other medical staff. Less than half of the teams were involved in the daily prescription of PN (Gilmour and Glencorse 1998). Sixty-five percent of the teams saw all of the hospital's parenteral patients and 28% saw all enteral patients (Regenstein 1992). Agriesti-Johnson et al.

(1988) determined the degree of intercorrelation among dietitian, physician, and team nutrition support functions. A questionnaire was mailed to 880 dietitians and physicians on nutrition support teams asking which nutrition support functions were performed and who performed the function. If a function was not the responsibility of the dietitian, nurse, pharmacist, or physician, that function was considered to be a component of the team role. Most functions were viewed to be important for all team members. However, one important difference in perception of nutrition support practice was type of nutrition support. The sample tended to have an enteral orientation to the dietitian role and a parenteral orientation to the physician and team roles.

According to Driscoll et al. (1986) and Wesley (1995), the purpose of the nutrition support team is to provide nutrition care for identified malnourished patients, perform nutrition assessments, and provide nutrition support successfully and effectively. The effectiveness of nutrition support coordinated by a team is different than nutrition support given without a team (Wesley 1995). The team aims to prevent the high incidence of catheter-related complications associated with use of TPN, avoid unnecessary expense and inappropriate use, identify patients with malnutrition, and enhance the recovery process in hospitals (Driscoll et al. 1986; Schwartz 1995; Wesley 1995). Patients may experience inappropriate nutrition support and a longer stay in hospitals if hospitals don't have the team (Driscoll et al. 1986). The nutrition support team controls costs of nutrition support by decreasing inappropriate use of supplies and solutions. A team approach to providing nutrition support results in reduced morbidity, mortality, and hospital stay (Driscoll et al. 1986; Schwartz 1995; Skipper 1989). Benefits of the nutrition support team include treatment of malnutrition, reduction in hospital stay,

cost savings, reduction in morbidity and mortality, and reduction of complications of parenteral and enteral nutrition (Wesley 1995).

Powers et al. (1986) evaluated outcomes of TEN managed by a nutrition support team vs non-nutrition support team. Fifty surgical patients who were managed by the team attained energy goals and positive nitrogen balance significantly more often than 51 patients with non-team management. Patients in the team-managed group achieved energy goals significantly more days than in the non-team approach. Significantly more patients in the team group than in the non-team group received nutrition assessment, nutrition plan, and monitoring. The team made significantly more formula modifications to correct metabolic or nutritional abnormalities than the non-team managment. The non-team group tended to have higher mortality rates. The total number of complications (pulmonary, mechanical, gastrointestinal, and metabolic abnormalities) was significantly less in the team group than in the non-team group. Patients in the non-team group had significantly more untreated metabolic complications than patients in the team group.

With team effort, patient outcomes showed improved care, decreased complications, and increased cost-effectiveness of nutrition support (American Gastroenterological Association 1995; Trujillo et al. 1999). Trujillo et al. (1999) studied the influence of the nutrition support team (NST) on TPN avoidable charges and complications. The patients managed by the NST had lower avoidable charges than non-NST patients ($20.57 vs $94.57 per day). Avoidable charges were defined as charges for all preventable and not indicated PN use. Patients with NST consultation had significantly lower complication rates than patients without consultation (34% vs 66%). Hyperglycemia was the most common metabolic complication of TPN. Other

complications included hypomagnesemia, hypokalemia, hyperkalemia, hypertriglyceridemia, and hypernatremia. Jacobs et al. (1984) studied the impact of a nutrition support team on the prevention of complications in 78 surgical patients receiving TPN. There was a significantly higher incidence of catheter sepsis in the pre-team group (24% of patients) than in the trans-team (3%) and post-team group (0%). The researchers concluded that the nutrition support team reduced septic complications because the nurse had special training for catheter care and insertion.

However, the team did not significantly decrease mechanical and metabolic complications of TPN. One study from ChrisAnderson et al. (1996) did not show effects of a nutrition support team on complications and costs. One hundred patients in 1979 without a team and 106 patients in 1992 with a team were used to compare the incidence of metabolic complications. The unit dietitian made recommendations to the team if needed. Sixty-three percent of 100 medical and surgical patients in 1979 (before a team was created) and 55% of 106 patients in 1992 (after the team was formed) had at least one metabolic complication. The incidence of metabolic complications including overfeeding was not different between non-team and team years. Although the team's recommendations slightly reduced the costs of TPN in the team group, the reduction did not include team personnel costs.

Professionals' and Patient's Influence in Nutrition Support Decisions

The influence of professionals and patients on nutrition support decisions affects nutrition support outcomes. The complication rate of TPN can be reduced through careful patient selection and care by specialized health care professionals (ASPEN 1993-a).

The implementation of physicians' orders, or the development of clinical practice guidelines, protocols, or care pathways by a multi disciplinary team helps reduce TPN-associated complications (Skipper 1998).

Outcome achievement was positively associated with dietitians' recommendations. Braunschweig et al. (1988) studied the effect of dietitians' recommendations on tube feeding (TEN) tolerance and on length of time to meet nutritional requirements in general and intensive care. Nutrition assessments resulted in recommendations for formula selection, introductory feeding progression, formula strength, and rate. Sixty-nine percent of 87 patients tolerated their tube feedings. Eighty percent of those who tolerated feedings had nutrition assessments and physician compliance with recommendations (the dietitians' recommendations were incorporated into the physician's orders and implemented by the nurse within 24 hours after the nutrition assessment was conducted). When physicians followed recommendations of the nutrition assessment, patients were significantly more likely to tolerate TEN than patients who had no nutrition assessment or when recommendations were not followed. TEN intolerance included diarrhea, gastric distention, elevated TEN residuals, nausea, or vomiting. Average time to meet nutritional requirements was 4 days for patients with

recommendations followed and 7 days for those who didn't have recommendations followed.

Weddle et al. (1995) conducted a prospective study on outcomes of enteral nutrition and outcome achievement by following dietitians' recommendations. The five most frequent activities dietitians performed to meet outcomes were to assess laboratory values, assess/evaluate product administration to monitor energy intake, monitor body weight, suggest change in enteral product, and rule out complications. Planned outcomes to be achieved were to reach recommended energy intake, increase body weight, increase protein stores, maintain body weight, maintain current protein stores, wean off parenteral nutrition support, and bridge to food. A pilot study was conducted at 6 acute-care hospitals and one rehabilitation institute with 172 patients who received at least 75% of nutrition requirements from enteral nutrition products. Patients were four times more likely to reach energy goals and increase or maintain protein stores when the physician followed the RD recommendations than when recommendations were not followed.

The position of the ADA in 1992 stated that the dietitian takes an active role in developing nutrition care plan for feeding the terminally ill adult and makes recommendations on each case with the health care team. Patients use their values, risk preferences, and choices other than outcomes measures to determine which treatment to use. Involving patients in decision making can produce better outcomes. Empowering patients with the assistance and guidance of physicians and education help patients make a choice for what treatment is best for them (Geigle and Jones 1990). The patient has a right to the medical treatment and the dietitian has to respect his or her patients' choices.

Whether to provide or withdraw nutrition support raises ethical issues in the terminal ill. The wishes of the patient or his/her surrogate decision maker must be considered in any decision (American Dietetic Association 1992). Terminally ill adults have a right to choose which level of care and treatment they receive. The dietitian has a responsibility to meet the needs and wants of each patient on an individualized basis. All institutionalized adults need to be given information on their right to accept or refuse medical treatment. The competent patient has the legal right to refuse medical treatment, including oral foods or artificial feeding. The competent patient also has the option to choose a sophisticated medical procedure such as TPN, although treatment would prolong the pain of the dying process. Decision on treatment or nontreatment of incompetent patients is based on patient's wishes, a living will or durable power of attorney for health care, or the patient's best interests. Food and fluid should be withdrawn if they are ineffective and harmful in dying patients, but food usually provides patients with nourishment and comfort. The focus of palliative care is to help lessen the pain, psychological distress, or symptoms.

Registered Dietitians' Influence on Nutrition Support Decisions

The position statement of American Dietetic Association on the role of the registered dietitian in enteral and parenteral nutrition support is that "the registered dietitian with expertise in nutrition support is qualified to assume a key role in the recommendation and provision of an appropriate combination of oral, enteral, and/or parenteral therapies" (American Dietetic Association 1991, p 1440). Registered dietitians

(RDs) know human metabolism, the influence of nutrition on specific disease conditions, physiologic responses to enteral and parenteral feedings, and feeding formula and food composition. This educational and clinical background prepares them to function as a primary resource to patients with parenteral or enteral support.

The role of the registered dietitian in the provision of enteral and parenteral nutrition support is "to assume responsibility for the assessment, planning, implementing, and monitoring of enteral, parenteral, and specialized oral therapies in patient care" (American Dietetic Association 1997, p 302; 1991, p 1440). The RD can help select appropriate oral supplementation, enteral formula, and design of parenteral prescription in order to meet the patient's need (American Dietetic Association 1991). In a study of dietitians in nutrition support, dietitians were involved in assessment of nutrient requirements, biochemical monitoring (such as transitional feeding), and advising on individual constituents of the PN regimen (such as the fat-to-carbohydrate ratio and fluid volume of the regimen) (Gilmour and Glencorse 1998). The role of the RD in enteral and parenteral nutrition support also includes advocacy, education, research, and administration (American Dietetic Assocaition 1991). RDs need to participate in the decision making of withholding nutrition care or selecting the most effective care for the terminally ill patients (American Dietetic Association 1997).

In a study by Winkler (1993), dietitians ranked the importance of their role in nutrition support. Identification of patients at nutritional risk; performance of nutrition assessment; and participation in design, implementation, and monitoring of nutrition regimens were ranked very important by 90% of dietitians. Monitoring transitional feeding and documenting nutrition care plans were ranked very important by 87%.

Another study examined RDs' role expansion. Olree and Skipper (1997) studied current and ideal frequencies of 15 tasks by nutrition support dietitians and chief clinical dietitians at 300 randomly selected general medical and surgical hospitals with 300 or more beds in the US and Puerto Rico. The findings were that the ideal task frequency was significantly greater than the actual task frequency. This suggested that dietitians would like to expand their role with specialized clinical skills. The ideal frequency of tasks indicated by nutrition support dietitians such as determining macronutrient composition of PN and performing physical examinations related to nutritional status, fluid status, and gastrointestinal function, were greater than the frequency indicated by chief clinical dietitians.

Nutrition support dietitians spent about half (45±31%) of their time in the provision of nutrition care to patients. Seventy-nine percent of nutrition support dietitians worked with patients who received enteral nutrition therapy and 69% with patients receiving parenteral nutrition support. Sixty-eight percent reported following the ASPEN standards of practice (Winkler 1993). In another study, more than 55% of nutrition support dietitians indicated they were at least sometimes involved in determining the route of nutrition support (Olree and Skipper 1997). The most common role of nutrition support practitioners was to "recommend PN to a physician or another health care professional". The most frequent level of participation in 5 aspects of PN orders (macronutrients, electrolytes, vitamins, trace elements, insulin, and H-2 receptor antagonists) was "recommend". Overall, 37% of dietitians wrote PN orders for nutrients, but not insulin and H-2 receptor, some or all of the time (Mueller et al. 1996).

Dietitians do not usually make independent nutrition support decisions. Other

factors influence the RD's role in nutrition support decisions. Davis et al. (1995) reported on one hospital where dietitians had clinical privileges. Authorized individuals were allowed to prescribe or order food and nutrition products in a timely manner. The purposes of clinical privileges were to allow the clinician who wishes to provide services independently to do so with their scope of practice, ensure correct communication and supervision, and increase professional credibility and effectiveness. The dietitian who had clinical privileges wrote orders for nutrition supplementation, prepared TPN solution and tube feeding orders, performed transitional feeding, and wrote home care orders and laboratory test orders. The request for dietitian's privileges in the provision of nutrition support was approved based on certification in nutrition support (CNSD), advanced degree, post-graduate training, experience, continuing education, and clinical competencies (Davis et al. 1995).

Influences on the dietitian's Nutrition Support Decisions

Experience

Randomly selected members of The American Dietetic Association's Dietitians in Nutrition Support dietetic practice group and American Society for Parenteral and Enteral Nutrition received a survey. Sixty-two percent of 460 responding dietitians considered themselves to be nutrition support dietitians (Winkler 1993). Fifty-seven percent of the nutrition support dietitians had practiced for 10 or more years (Winkler 1993). Studies on the influence of a dietitian's years of experience in nutrition support decision making have reported conflicting results. In one study, dietitians with 7 or more years of clinical

experience were more likely to make decisions on TPN formulations (Gaare et al. 1990). However, in another study, when gender, years of practice, specialty area (nutrition support, diabetes, management, etc.), and type of practice setting (nonteaching and teaching hospital, and other) were controlled, authors did not find any differences in perceptions of the dietitian and physician's role regarding the diet order (Boyhtari and Cardinal 1997).

Team Membership

Dietitians who wrote PN orders were more likely to be a member of a nutrition support team (Mueller et al. 1996). In one report, with special training in TPN, the dietitian on the team could interact with pharmacists or physicians in the transitional feeding from TPN to TEN (Wesley 1995). Fifty-five percent of the dietitians on the team always or almost always prescribed enteral formulas, 46% formulated special enteral formulas, and 34% determined composition of parenteral solutions (Jones et al. 1986).

Certification as a Nutrition Support Dietitian

Dietitians with an identified specialty were more likely to change diet orders. Clinical dietitians who were generalists or who specialized in one area (such as nutrition support, diabetes, or management) believed in using a team approach in the interaction between physician and dietitian to change the diet order (Boyhtari and Cardinal 1997). Clinical dietitians who were specialized in 2 or more areas wanted a bigger role in the diet order. Mueller et al. (1996) observed the involvement in parenteral nutrition (PN)

orders by registered dietitians. Specialists (nutrition support or critical care dietitians) were significantly more likely to sign a PN order than clinical managers. Specialists and managers were significantly more likely to set policy for PN indications and to supervise order writing than clinical dietitians. Specialists were significantly more likely to write all elements of the order than clinical dietitians and managers.

Influence of Professionals and Patients

Occupation was significantly associated with perceptions about which professionals should change the diet order. Boyhtari and Cardinal (1997) surveyed perceptions of the change of a patient's diet order by dietitians and physicians. Thirty-four percent of physicians and 2% of dietitians said that the physician alone should change the diet order. No physicians but 17% of dietitians believed that the dietitian alone should change the diet order. A study by Gaare et al. (1990) examined perceptions of decision making in diet prescription by 157 dietitians and 105 physicians. The diet prescription included the choice of caloric supplements, the selection of amino acid modified products, the selection of tube feeding products, the determination of TPN macronutrients, and the determination of diet progression from liquid to solids. There were differences in both the actual and ideal role perceptions between the dietitians and physicians. In the actual situation, 71% of dietitians perceived themselves as the primary decision maker in the selection of caloric supplements, 37% for amino acid modified products, 30% for TEN, 18% for TPN macronutrients, and 13% for progression of diet, while 10% or less of the physicians perceived the dietitians as the primary decision

maker; most physicians (67% to 91%) believed that they were the primary decision maker. In the ideal situation, the majority (52% to 92%) of the dietitians and 10% to 35% of the physicians believed that the dietitians should have primary decision making in diet prescription. About 40% of MDs wanted RDs to be more involved in decision making. Another study showed significant differences between physician's and dietitian's perceptions for 10 of 15 questions regarding roles of dietitians. Foodservice functions and the decision making and management of medical nutrition therapy for patients were two major areas perceived most differently by two groups (Boyhtari and Cardinal 1997). Physicians believed that dietitians should perform foodservice duties and wanted to remain the dominant decision making for patient medical care.

Gilmour and Glencorse (1998) reported on British dietitians' and other professionals' role in the prescription of parenteral nutrition (PN) and dietitians' attitudes towards the involvement of medical staff in PN. Dietitians felt that they had better nutrition knowledge than doctors, they were experts in nutritional assessment, and PN was a form of nutrition so dietitians should assume a great responsibility for PN. Unfortunately, dietitians had little involvement in PN prescription; doctors and pharmacists took the most responsibility for PN although they had not received much training in clinical nutrition. Dietitians took total responsibility for 5% and 14% of PN orders in 1993 and 1995, respectively. Doctors at the trainee level prescribed the majority of PN (43% in 1993 and 42% in 1995). Pharmacists prescribed 8% of PN in 1993 and 18% in 1995. Other reasons for non-involvement in PN from dietitians included not having enough time, not viewing PN as a priority, the high ratio of patients to dietitians on staff, and the question of who makes decision in the presence or absence of a nutrition

support team (Gilmour and Glencorse 1998; Winkler 1993).

Some dietitians felt they were not able to establish requirements, record adequacy of intake, or recommend an appropriate formula because physicians, nurses, and pharmacists had more influence in nutrition support decisions (Winkler 1993). Although dietitians felt they did not have much influence in nutrition support decisions, they spent more time on nutrition support than other professionals. The percentage of time spent providing nutrition support was 58% for dietitians, 52% for nurses, 36% for pharmacists, 31% for PhDs, and 17% for physicians (Regenstein 1992). Dietitians felt that if the physician decided to initiate nutrition support, an evaluation of the prescription and a recommendation for the care by the RD should follow (Winkler 1993).

Patients should also be involved in nutrition support decision making, especially when nutrition support does not have any beneficial effects on their illness. Termination of TPN in a patient with terminal illness or poor prognosis is a difficult ethical decision. The patient's wishes, the medical risks of continuing therapy, and cost of continuing home TPN should be considered in making decisions (Skipper 1998).

Registered Dietitian as a Team Member

The American Society for Parenteral and Enteral Nutrition (ASPEN) conducted a survey about the prevalence of nutrition support teams (NSTs) in large (more than 150-bed) hospitals in the United States in 1991 (Regenstein 1992). Twenty-nine percent of chief clinical dietitians reported that their hospitals had a team. In Gilmour and Glencorse's study (1998), 40% of dietitians registered with the parenteral and enteral

nutrition group had a nutrition support team in their hospital.

Some studies reported dietitian's characteristics on the team. In Jones and coworker's (1986) study, 225 clinical dietitians listed as members of nutrition support teams had an average of 5.5 years of work experience; 87% were members of a nutrition support service; and 53% of their hospitals had a capacity of 201 to 500 beds (Jones et al. 1986). Based on two studies, 13% or 14% of dietitians were a team leader. Seventy-four or sixty-four percent of the team leaders were physicians, 8% or 7% pharmacists, 9% or 3% nurses, and 6% or 2% other disciplines (Jones et al. 1986; Regenstein 1992).

Influences on Membership on a Nutrition Support Team

Size of Hospital

The larger the hospitals, the more likely it was to have a team; over half of hospitals with more than 500 beds had a team (Regenstein 1992). Forty percent of chief clinical dietitians and nutrition support dietitians in hospitals with 300 or more beds worked with a nutrition support team (Olree and Skipper 1997).

Residency Program

Most hospitals (70%) in a random sample did not have an affiliation with a medical school or university, however, 17% of hospitals with a team and 8% of hospitals without a team had this affiliation. Half of hospitals had medical residents (Regenstein

1992).

Trauma Center

Ninety-one percent of chief clinical dietitians responded that their hospitals had a medical intensive care unit (ICU) and 77% had a surgical ICU. More hospitals with a team had an ICU than hospitals without a team (Regenstein 1992).

Certified Nutrition Support Dietitian Credential

Those dietitians with competency in nutrition support hold specialty titles and may have certification in nutrition support. Competency represents knowledge, skills, and professionalism necessary for safe and effective delivery of nutrition support. They have been called Certified Nutrition Support Dietitian since 1988 (American Dietetic Association 1997). The National Board of Nutrition Support Certification (NBNSC) is an independent credentialing board to administer certification programs in specialized nutrition support for health professionals (ASPEN 2000). This program is designed to establish knowledge necessary for certification, test knowledge necessary to deliver parenteral or enteral nutrition support, recognize specialty knowledge, and promote individuals' professional development in delivering nutrition support. Registered dietitians with at least two years of experience in nutrition support are eligible for certification. Certification is obtained by taking the nutrition support certification examination. The test covers nutrition assessment, therapeutic plan and implementation,

patient monitoring, patient evaluation and management, and professional issues.

Influences on CNSD Credential

Size of Hospital

Eleven percent of chief clinical dietitians and 48% of nutrition support dietitians who worked in hospitals with 300 or more beds had earned the CNSD credential. The authors defined nutrition support dietitians as those who spend at least 50% of her or his time managing patients who receive enteral and parenteral nutrition (Olree and Skipper 1997).

Dietitians' Knowledge of Appropriate Nutrition Support

Nutrition assessment evaluates GI function and determines the need for nutrition support and the feeding route (ASPEN 1990-a). Selection of the feeding route and nutrition support formula in stressed patients is based on GI function, expected duration of nutrition therapy, aspiration risk, the development of organ dysfunction, baseline nutritional status, and the risks associated with each feeding method (ASPEN 1990-a; Skipper 1998). The provision of TEN or TPN in terminally ill patients should follow written protocols in facilities, the patient's informed preference for the level of treatment, an anticipated time of death, and potential benefits vs burdens of nutrition support (American Dietetic Association 1992). Oral feedings are the preferred choice, and then

tube feeding, the second choice. Parenteral nutrition should be considered only when other routes are impossible or cannot meet the comfort needs of the patient.

Indications and Contradictions for TEN

Patients in a hypermetabolic state should be considered for enteral nutrition support. Sepsis, burns, multiple trauma, and major surgery cause hypermetabolism and increase energy demand more than oral food intake can provide (Lysen and Winkler 1993). TEN should be the primary route for nutrition support in the critically ill patients because its use is simple, economical, and well tolerated in most patients (American Gastroenterological Association 1995; Heymsfield et al. 1979). Enteral feeding is indicated for patients who cannot eat, have inadequate oral intake, are at risk of malnutrition, have a functional gut, and whose GI can be safely accessed (American Gastroenterological Association 1995; ASPEN board of directors 1998; Lord et al. 1998; Skipper 1998). TEN should be initiated after 1 to 2 weeks without nutrient intake (American Gastroenterological Association 1995). Patients may become malnourished when their oral intake is less than two-thirds or three- quarters of their daily needs.

Patients who have a functional gut but are unable to eat should be considered for TEN (ASPEN 1998; Lord et al. 1998). A bowel of sufficient length (a minimum of 100 centimeters of small intestine) and condition for adequate nutrient absorption are required for successful enteral feeding. An intact ileocecal valve and adequate GI motility are essential to improve absorption (Skipper 1998).

TEN is difficult to use in patients with severe head injury although TEN is the preferred route of nutrition support because severe head injury is associated with altered gastric function and intolerance of gastric tube feedings (Trujillo et al. 1998). Obstruction is the only absolute contraindication for enteral feeding (Skipper 1998). Other contraindications to enteral feeding may include terminal illness, GI inflammation, diffuse peritonitis, intestinal obstruction, intractable vomiting, paralytic ileus, severe diarrhea, GI ischemia, short-bowel syndrome, pancreatitis, intestinal dysmotility, upper gastrointestinal tract hemorrhage, and upper gastrointestinal high-output fistula (American Gastroenterological Association 1995; ASPEN 1998; Heymsfield et al. 1979; Lord et al. 1998; Lysen and Winkler 1993; Skipper 1998). TEN may be more appropriate distal to the pylorus if patients have an aspiration risk (ASPEN 1990-a). The potential problems of TEN may outweigh the benefits in terminally ill patients. Potential problems include aspiration, diarrhea, overhydration, discomfort, interference with personal dignity, and cost (Lord et al. 1998).

Indications and Contradictions for TPN

The nature of the patient's GI dysfunction, the severity of malnutrition, the length of therapy, the degree of hyper-catabolism and metabolism, the medical prognosis, and the patient's advance directive affect use of TPN (Sitzmann et al. 1989; Skipper 1998; Trujillo et al. 1998). The basic indication for TPN is that patients are unable to meet nutrition goals through use of the GI tract (Sitzmann et al. 1989). Patients should be considered for TPN if they have a nonfunctional gastrointestinal tract, are not fed

adequately by TEN, or are unable to return to adequate enteral intake (American Gastroenterological Association 1995; ASPEN 1990-1; Heymsfield et al. 1979; Skipper 1998; Skipper and Millikan 1998; Trujillo et al. 1998; Winkler and Lysen 1993). When TEN is not tolerated (diarrhea, gastric residuals, abdominal distension, or cramping) or is contraindicated, TPN can be administered (American Gastroenterological Association 1995; ASPEN 1990-a; Trujillo et al. 1998).

TPN rarely treats the disease itself, but may influence malnutrition, one of the secondary effects (Sitzmann et al. 1989). Postoperative TPN is indicated when enteral feeding is not anticipated within 7 to 10 days in nourished patients or within 5 to 7 days in malnourished or critically ill patients (Skipper 1998; Trujillo et al. 1998). Sitzmann et al. (1989) stated that TPN should not be indicated if patients had no preexisting malnutrition and were expected to consume nothing for only 5 to 7 days. Intravenous nutrition does not benefit patients who will be able to take enteral nutrition 4 to 5 days after illness onset (ASPEN 1993-b). In critically ill patients, PN is indicated if hypermetabolism is expected to last more than 4 to 5 days and TEN is not possible (Skipper and Millikan 1998).

Indications for TPN include malabsorption, malnutrition with GI tract compromise, hyper metabolism and catabolism, the need for at least 7 days of PN use, and NPO greater than 7 days with major stress (ASPEN 1990-a; ChrisAnderson et al. 1996; Lakshman and Blackburn 1986; Sitzmann et al. 1989; Skipper 1998; Skipper and Millikan 1998). TPN should not be discontinued until the patient tolerates at least 50% of nutrition goal by TEN or oral diet (Winkler and Lysen 1993).

Parenteral nutrition is not indicated when patients are well nourished, have a do not resuscitate order, are expected to die shortly, or receive adequate nutrition by enteral nutrition (Trujillo et al. 1999). Other contraindications to TPN are inability of the patient to tolerate intravenous nutrients, failure to gain vascular access, and lack of physician expertise in TPN (Sitzmann et al. 1989).

Routes of Nutrition Support for Different Types of Patients

Sepsis is the most common long-term complication occurring in 2-7% of TPN patients. It is a life-threatening complication (Sitzmann et al. 1989). According to the ASPEN guidelines for nutrition support, patients with sepsis and a functional GI who cannot meet energy needs orally should receive TEN. Gastric atony associated with sepsis may limit the use of intragastric TEN (ASPEN 1993-b). Patients with sepsis who have a GI hemorrhage, intestinal obstruction, paralytic ileus, or severe short bowel syndrome should receive TPN (Trujillo et al. 1998).

TPN is indicated for patients with postoperative complications (Sitzmann et al. 1989). Postoperative complications include wound dehiscence, intraabdominal abscesses, thromboembolism, pneumonia, and cardiac failure. PN is also considered to be indicated when patients have peritonitis, intestinal hemorrhage, intestinal obstruction, intractable vomiting, paralytic ileus, severe pancreatitis, high-output enterocutaneous fistula, short bowel syndrome, or bone marrow transplantation (ChrisAnderson et al. 1996; Sitzmann et al. 1989; Trujillo et al. 1999). Chronic intestinal disorders, inflammatory bowel

disease, chemotherapy, burn, and trauma are also indications for TPN (ChrisAnderson et al. 1996; Sitzmann et al. 1989).

Critically ill or postoperative patients commonly have an adynamic or paralytic ileus (Lord et al. 1998; Skipper 1998). An ileus occurs when bowel movement is lost. The absence of bowel sounds and flatus, nausea, vomiting, and abdominal distention are symptoms of an ileus (Skipper 1998). TPN may be indicated in patients with postoperative ileus and hypermetabolism (Skipper 1998); however, postpyloric feeding-tube placement and gastric decompression may be used to treat patients with persistent gastric ileus (Lord et al. 1998).

Short bowel syndrome (SBS) patients have more catheter sepsis than non-SBS patients (Forbes and Chadwick 1998). Patients with short bowel syndrome (SBS) who cannot receive one-third of nutrients orally or enterally. or develop intolerance of enteral nutrition should be considered for parenteral feedings for at least 1 to 3 months after surgery (Forbes and Chadwick 1998; Lord et al. 1998; SitCmann et al. 1989; Skipper 1998; Skipper and Millikan 1998). If patients have less than 60 cm of functioning small bowel, PN will be required indefinitely (Marotta 1993; Skipper and Millikan 1998). Patients with a jejunal length of less than 60 to 100 cm may require long term TPN (Skipper 1998). Patients with more than 200 cm of small bowel resected need TPN during the postoperative phase (Marotta 1993). Patients with less severe resection may need TPN if they have prior malnutrition or postsurgical complications (Skipper 1998). If patients with intestinal failure are able to eat and absorb nutrients, these patients do not need TPN. After malnutrition is treated, patients can receive TPN 3 to 4 nights a week (Forbes and Chadwick 1998). Early initiation of TEN improves adaptation of the

remaining bowel for adequate nutrient absorption (Lord et al. 1998).

According to Silverman (1993), MODS patients should receive TEN first. Critically ill patients may receive TEN if they have two or fewer failing organ systems (Skipper 1998). In some conditions patients with multiple organ failure are not adequately fed by TPN because the failure of certain organs may modify or limit the utilization of TPN. Patients with sepsis often have carbohydrate intolerance (Klein et al. 1998). MODS patients with a nonfunctioning GI tract or inability to tolerate TEN should be considered for TPN (Silverman 1993). Jejunostomy tube feedings are indicated for MODS patients who have GI obstruction or gastric ileus (Silverman 1993). MODS patients with the presence of ileus, or GI bleeding may avoid use of TEN and should receive TPN (Silverman 1993). MODS patients with encephalopathy due to sepsis may need TPN (Skipper 1998). Patients can use TPN in conjunction with TEN until adequate oral or enteral intake is achieved (Silverman 1993).

Some patients receive more than one type of nutrition therapy (TEN and TPN) in order to meet the patient's nutritional requirements and to promote GI tract integrity (American Dietetic Association 1991; American Gastroenterological Assocaition 1995; Trujillo et al. 1998). Patients with a partially functioning gut may require both types of feedings to meet energy needs (Lord et al. 1998). Patients with severe or rapidly progressive moderate undernutrition may receive enteral, enteral plus peripheral venous, or central venous feedings for nutrition support. Patients with mild or slowly progressive moderate undernutrition may receive enteral feedings, enteral plus peripheral venous feedings, or food intake (Heymsfield et al. 1979). The successful transition from parenteral to enteral and/or oral feeding is important to provide effective nutrition support

for patients (American Dietetic Association 1991). Transitional feeding is a process of changing from one mode of feeding to another when it is indicated in patients (ASPEN 1990-a).

Influences on Dietitians' Knowledge of Appropriate Feedings

Team Membership

Trujillo et al. (1999) studied the influence of a nutrition support service on TPN use. The nutrition support team provided consultation to 23% of patients. When the NST was consulted, PN was initiation appropriately significantly more often than without consultation (82% vs 56%). The authors concluded that the team prevented inappropriate PN use (Trujillo et al. 1999).

Professionals' Influence on Nutrition Support Decisions

In the study by Winkler (1993), more than half of the nutrition support dietitians (NSDs) applied the standards of assessment, therapeutic plan, implementation, and patient monitoring to 75% to 100% of their patients. RDs can select patients who would benefit from nutrition support by selecting appropriate nutrition support candidates, determining the most appropriate type of nutrition support and route of delivery, and assessing macro- and micronutrient needs (American Dietetic Association 1997). The RD makes recommendations to adjust or change the delivery of nutrition support to the

patients based on metabolic, nutritional, and medical status changes (American Dietetic Association 1991). But Winkler's study (1993) found no difference in the application of standards for therapeutic plan among NSDs, non-NSDs, and supervisors of NSDs for recommendation of appropriate route to provide nutrition support. However, the standards for implementation and monitoring of enteral and parenteral formulations and prescriptions, clinical and metabolic response, and transitional feeding were applied more frequently by NSDs than by non-NSDs (Winkler 1993).

In one study by Gilmour and Glencorse (1998), 72% of dietitians registered with the parenteral and enteral nutrition group did not feel that doctors had adequate knowledge to prescribe PN. Fifty-eight percent said that medical staff had prescribed inappropriate PN. Twenty percent said that PN was used in an inappropriate patient group such as patients with a functioning GI tract (Gilmour and Glencorse 1998).

CHAPTER III

METHODOLOGY

The purpose of the study was to examine the influence of the dietitian's characteristics and hospital services on perceived outcomes of nutrition support and RD's knowledge of feeding patients in septic and MODS patients. This chapter includes the research design, study population, data collection, procedures, and data analysis.

Research Design

The study was a descriptive study that described dietitian's perception of nutrition support outcomes and knowledge of appropriate feedings. The study did not include any treatment or intervention.

Sample Population

The study subjects were registered dietitians in the U.S. The dietitians received a questionnaire by mail. The mailing list was purchased from the American Dietetic Association (ADA). One thousand names were randomly selected by the ADA from 3000

dietitians who were ADA members and who belonged to the Nutrition Support Dietetic Practice Group. From this list, researchers systematically selected 300 labels by picking the first, fourth, and seventh mailing label out of every ten labels. The questionnaire and cover letter were copied by the Duplication Center at OSU. A questionnaire, cover letter, and pre-paid return envelope were mailed in a 6" by 9" envelope.

Data Collection

Instrumentation

The 2-page researcher-developed questionnaire included 12 questions (see Appendix A). The questionnaire asked information about the dietitian's background and the dietitian's employing institution, the effectiveness of nutrition support, the importance of different professionals and patients in nutrition support decision making, and the choice of appropriate feedings. Specific questions included frequency of treating septic patients, years of experience in ICU and nutrition support, effectiveness of nutrition support in treating septic patients, number of beds in their facility, nutrition support team membership, certification as a Certified Nutrition Support Dietitian (CNSD), the existence of a medical residency program, the existence of a trauma center, and the level of the trauma center. Two questions asked about the benefits of nutrition support in septic patients and septic patients at risk of MODS. The benefits of nutrition support included nutritional status, length of stay, treatment costs, mortality, complications, and other outcomes. The respondents were asked to rate the benefits from negative outcome (-2) to

improved outcome (+ 2). One question asked about the importance of physicians, nurses, dietitians, pharmacists, and patients or families in nutrition support decisions. Respondents rated the perceived influence of each professional from no influence (0) to great influence (4). The last question asked about recommendations for different types of feedings (TEN, TPN, TEN and TPN, or no nutrition support) in different types of patients. The patients included those with sepsis who had a functional gastrointestinal system but could not meet energy needs orally; and patients with sepsis who had a gastrointestinal hemorrhage, intestinal obstruction, paralytic ileus in the colon, paralytic ileus in the small bowel, a functional GI tract and septic complications, severe short bowel syndrome, or MODS. These patients were selected using ASPEN guidelines for determining route of nutrition support in critically ill patients (Trujillo et al., 1998).

A cover letter informed dietitians of the purpose of the study, provided contact persons, and asked for their participation (see Appendix B). The questionnaire was anonymous. Dietitians who returned the completed questionnaire were advised that they were consenting to participate in the study.

Procedure

Approval for this study was obtained from the Institutional Review Board for review of research involving human subjects at Oklahoma State University (see Appendix C). A pilot study was conducted with 8 registered dietitians at hospitals in Tulsa and Oklahoma City. Based on their responses, the researchers revised the questionnaire. The pilot questionnaire did not include ratings in perceived benefits but

included a checklist of perceived benefits of nutrition support in septic and MODS patients. Pilot respondents indicated that they could not answer yes or no to perceived benefits, so a 5-point rating scale from negative to improved outcome was developed to determine the effect of nutrition support on five perceived benefits.

Two patients were added to the recommendation of feedings section after the pilot study had been conducted. Pilot subjects indicated that septic patients with paralytic ileus in the colon were treated differently than patients with an ileus in the small bowel. Researchers added another patient who had sepsis and MODS. Their comments about the role of nutrition support in patients with sepsis or those at risk of MODS were added.

The pilot study was mailed on July 5, 1999 and all subjects returned the questionnaires within 2 weeks. The final questionnaire was mailed on July 22, 1999 and respondents were asked to return questionnaires by August 23, 1999. Responses received by September 8, 1999 were analyzed.

Data Analysis

All data analyses were completed using the Statistical Package for the Social Sciences (SPSS) version 9.0 for Windows (SPSS Inc., Chicago, IL). Paired t tests, independent t tests, Kendall's tau-b tests, Chi-Square tests, and Spearman's correlations were used to analyze hypotheses. A significance level of $p < 0.05$ was used to detect differences.

Hypothesis 1. There is no difference between perceptions of the benefits of nutrition support in septic patients and MODS patients.

An average of the dietitian's 5 outcome scores for each patient was used to analyze the benefits of nutrition support. A comparison of septic patients to MODS patients for the benefits of nutrition support was analyzed using the paired t test. Each outcome of nutrition support for septic patients and MODS patients was analyzed using descriptive analysis.

Hypothesis 2-A. There is no relationship between perceived benefits of nutrition support (in septic patients, MODS patients, and treatment of septic patients) and years of experience, size of hospital, and influence of professionals and patients in decision making.

The relationships between perceived benefits of nutrition support (in septic patients, MODS patients, and treatment of septic patients) and years of experience, and size of hospital were analyzed using Spearman's correlation. The relationships between perceived benefits of nutrition support and influence of professionals and patients in nutrition support decisions were analyzed using descriptive analysis. The relationships between effectiveness of nutrition support in treating septic patients and influence of dietitian, pharmacist, and patient in nutrition support decisions were analyzed using Kendall's tau-b tests. Effectiveness of nutrition support was reduced from 6 to 3 categories. Influence of professionals and patients and perceived benefits of nutrition support were reduced from 5 to 3 categories.

Hypothesis 2-B. There is no difference in perceived benefits of nutrition support (in septic patients, MODS patients, and treatment of septic patients) by dietitians who are CNSDs or hospitals with and without nutrition support teams, residency program, and trauma center.

The differences in perceived benefits of nutrition support (in septic patients, MODS patients, and treatment of septic patients) by CNSD or hospitals with and without nutrition support teams, residency program, and trauma center were analyzed using independent t-tests.

Hypothesis 3-A. There is no relationship between RD influence in nutrition support decisions and years of experience, size of hospital, and influence of other professionals and patient in nutrition support decisions.

The relationships between RD influence in nutrition support decisions and years of experience, size of hospital, and influence of other professionals in nutrition support decisions were analyzed using Kendall's tau-b tests. The relationship between RD and patient's influence was analyzed using descriptive analysis. Influence of professionals and patients was reduced from 5 to 3 categories. Years of experience were divided into 2 categories 0 to 10 years and 11 to 27 years. Number of beds was divided into 3 categories 1 to 199, 200 to 500, and 501 to 800 beds.

Hypothesis 3-B. There is no difference in RD influence in nutrition support by membership on a nutrition support team, CNSD credential, and hospitals with a residency program.

The differences in RD influence in nutrition support by a member of nutrition support team, CNSD credential, and hospitals with a residency program were analyzed using independent t-tests.

Hypothesis 4-A. There is no relationship between RD membership on a nutrition support team, dietitians with and without CNSD credential, and hospital with and without a residency program and trauma center.

The relationships between RD membership on a nutrition support team, dietitians with and without CNSD credential, and hospital with and without residency program and trauma center were analyzed using X^2 tests.

Hypothesis 4-B. There is no difference between dietitians who are and are not a team member by number of patients per month, years of experience, and size of hospital.

The differences between dietitians who are and are not a team member by number of patients per month, years of experience and size of hospital were analyzed using independent t-tests. The number of patients per month was reduced from 6 to 3 categories.

Hypothesis 5-A. There is no difference between dietitians with and without CNSD credential by number of patients per month, years of experience, and size of hospital.

The differences between dietitians with and without CNSD credential by number of patients per month, years of experience, and size of hospital were analyzed using independent t-tests. The number of patients per month was reduced from 6 to 3 categories.

Hypothesis 5-B. There is no relationship between dietitians with and without CNSD credential in the presence of residency program and trauma center.

The relationships between dietitians with CNSD credential, the presence of a residency program, and the presence of a trauma center were analyzed using X^2 tests.

Hypothesis 6-A. There is no relationship between dietitian's knowledge of feeding patients (number of total correct scores) and number of patients per month, perceived effectiveness of nutrition support in treating septic patients, benefits of

nutrition support in septic patients and MODS patients, years of experience, size of hospitals, and professionals' and patient's influence in decisions.

The relationships between dietitian's knowledge of feedings and dietitian's experience and size of hospital were analyzed using Spearman's correlation. The relationships between knowledge of feeding patients and number of patients per month, perceived effectiveness of nutrition support in treating septic patients, benefits of nutrition support in septic patients and MODS patients, and professionals' and patient's influence in decisions were analyzed using Kendall's tau-b tests. Number of patients and effectiveness of nutrition support were reduced from 6 to 3 categories. Perceived benefits and professionals and patients' influence were reduced from 5 to 3 categories. The maximum correct knowledge score was 8 and the minimum was 1. Scores less than or equal to 5 were considered to indicate lack of appropriate knowledge of feedings and scores above 5 indicated appropriate knowledge.

Hypothesis 6-B. There is no difference in knowledge of feeding patients between dietitians who work with and without nutrition support team, with and without CNSD credential, and in hospitals with and without a residency program and trauma center.

The differences in knowledge of feeding patients between dietitians who work with and without nutrition support team, with and without CNSD credential, and in hospitals with and without a residency program and trauma center were analyzed using independent t-tests.

CHAPTER IV

RESULTS

Characteristics of Registered Dietitians and Hospitals

Seventy-eight of 300 questionnaires were returned, with a response rate of 26%. Of these returned questionnaires, 25 were not completed, one was returned due to incorrect address, and 52 were usable with a usable rate of 17.3%. Almost one third of returned questionnaires were not filled out (25 out of 78). The dietitians who returned incomplete surveys indicated they worked in long term care, nursing home, pediatric institution, and other settings; others indicated they did not work in patient care, acute care, and ICU; and the others indicated they were retired, were educator, were not in clinical practice, and were not working.

Characteristics of the 52 registered dietitians and hospitals are shown in table 1. Eighteen dietitians responded that they treated greater than one patient per day during 1998 who met the following criteria: at least one preexisting condition, sepsis, at least 50 years old, ICU treatment, and length of stay greater than 7 days. The dietitians treated an average of about 14 patients who met this criteria each month. Twenty-eight dietitians had less than 10 years of experience and 22 dietitians had 11 to 27 years of experience in

Table 1. Characteristics of registered dietitians and hospitals (n=52)

	n	%	Mean ± SD.
Numbers of patients treated			14.5 ± 12.2
1 patient/month	6	11.5	Per month
2 to 3 patients/month	11	21.2	
1 patient/week	3	5.8	
2 to 3 patients/week	11	21.2	
1 patient/day	3	5.8	
>1 patient/day	18	34.6	
Years of experience with intensive care patients (n=50)			11.2 ± 6.4
0-10 years	28	53.8	
11-27 years	22	42.3	
Hospital size (n=51)			330 ± 221
<200 beds	16	30.8	
200-500 beds	25	48.1	
>500 beds	10	19.2	
Member of a nutrition support team (n=50)			
Yes	16	30.8	
No	34	65.4	
Certified Nutrition Support Dietitian			
Yes	21	40.4	
No	31	59.6	
Medical residency program at hospital			
Yes	29	55.8	
No	23	44.2	
Trauma center			
Yes	25	48.1	
No	27	51.9	
Level of trauma center (n=22)			2.5±1.2
1	6	11.5	
2	5	9.6	
3	5	9.6	
4	6	11.5	

nutrition support with intensive care patients. The average was approximately 12 years of experience. Three dietitians had more than 20 years of work experience. The average hospital size was 330 beds. Twenty-five hospitals had between 200 and 500 beds. The number of dietitians not on a nutrition support team was greater than the number on the team. Thirty-four dietitians were not members of a team. Most dietitians (n=31) were not certified as certified nutrition support dietitians (CNSD). Twenty-nine dietitians worked in hospitals with a medical residency program. Twenty-seven hospitals did not have a trauma center. Twenty-five hospitals had a trauma center, but only 22 dietitians indicated the level of trauma center. The level of trauma center was equally distributed from the highest level 1 to the lowest level 4.

Perceived Benefits of Nutrition Support

Table 2 shows perceived benefits of nutrition support in septic and MODS patients. Dietitians indicated that nutrition support was effective in treating septic patients. The average effectiveness was close to 4 (0, not effective to 5, very effective). Dietitians perceived similar benefits of nutrition support in septic and MODS patients. Most dietitians indicated that nutrition support improved nutritional status, length of stay, treatment costs, mortality, and complications in both types of patients. Respondents were more likely to indicate that nutrition support improved these benefits in septic patients. However, some dietitians reported that nutrition support provided no effects in MODS patients. Few dietitians perceived adverse effects of nutrition support in either type of patient. The average perceived benefit of nutrition support was significantly higher ($p<$

0.001) in septic patients (1.2 ± 0.5; -2 adverse outcome, to 2 improved outcome) than in MODS patients (0.8 ± 0.6).

Table 2.
Perceived benefits of nutrition support in septic and MODS patients

	n	Not effective			Very effective			Mean ± SD.
		0	1	2	3	4	5	
Effectiveness of nutrition support in treating septic patients								
	50	1	0	0	18	15	16	3.9 ± 1.0
		Adverse outcome			Improved outcome			
		-2	-1	0	0.5	1	2	
Septic patients								
Nutritional status	49	0	0	1	0	28	20	1.4 ± 0.5
Length of stay	48	0	0	5	0	26	17	1.3 ± 0.6
Treatment costs	48	0	5	5	0	27	11	0.9 ± 0.9
Mortality	48	0	0	6	1	34	7	1.0 ± 0.5
Complications	49	0	1	1	1	34	12	1.2 ± 0.6
MODS patients								
Nutritional status	46	0	1	6	0	28	11	1.1 ± 0.7
Length of stay	47	0	2	12	0	27	6	0.8 ± 0.7
Treatment costs	44	0	5	11	0	22	6	0.7 ± 0.9
Mortality	45	0	3	15	1	22	4	0.6 ± 0.8
Complications	46	0	1	7	0	34	4	0.9 ± 0.6

Influences on Perceived Benefits of Nutrition Support

Years of Experience and Size of Hospital

There were no significant correlations between perceived benefits of nutrition support, and years of experience and size of hospital (Table 2.1). Effectiveness of

0.001) in septic patients (1.2 ± 0.5; -2 adverse outcome, to 2 improved outcome) than in MODS patients (0.8 ± 0.6).

Table 2.
Perceived benefits of nutrition support in septic and MODS patients

	n	Not effective			Very effective			Mean ± SD.
		0	1	2	3	4	5	
Effectiveness of nutrition support in treating septic patients								
	50	1	0	0	18	15	16	3.9 ± 1.0
		Adverse outcome			Improved outcome			
		-2	-1	0	0.5	1	2	
Septic patients								
Nutritional status	49	0	0	1	0	28	20	1.4 ± 0.5
Length of stay	48	0	0	5	0	26	17	1.3 ± 0.6
Treatment costs	48	0	5	5	0	27	11	0.9 ± 0.9
Mortality	48	0	0	6	1	34	7	1.0 ± 0.5
Complications	49	0	1	1	1	34	12	1.2 ± 0.6
MODS patients								
Nutritional status	46	0	1	6	0	28	11	1.1 ± 0.7
Length of stay	47	0	2	12	0	27	6	0.8 ± 0.7
Treatment costs	44	0	5	11	0	22	6	0.7 ± 0.9
Mortality	45	0	3	15	1	22	4	0.6 ± 0.8
Complications	46	0	1	7	0	34	4	0.9 ± 0.6

Influences on Perceived Benefits of Nutrition Support

Years of Experience and Size of Hospital

There were no significant correlations between perceived benefits of nutrition support, and years of experience and size of hospital (Table 2.1). Effectiveness of

nutrition support in treating septic patients and perceived benefits of nutrition support in septic patients and MODS patients were not related to dietitians' years of experience in intensive care unit or their hospital size.

Table 2.1
Spearman's correlations between perceived benefits of nutrition support, and years of experience and size of hospital.

	Perceived benefits		Effectiveness of nutrition support
	Sepsis	MODS	in treating septic patients
Years of experience	0.14	-0.15	0.004
Number of beds	0.21	-0.01	0.25

Professionals' and Patients' Influence in Nutrition Support Decisions

There was a significant relationship between the effectiveness of nutrition support in treating septic patients and registered dietitian's influence in nutrition support decisions (Table 2.2). Thirty out of 44 dietitians who felt they had great influence also perceived nutrition support to be very effective in treating septic patients. Of the six dietitians who felt they had less influence, only one perceived nutrition support to be very effective in treating septic patients. Effectiveness of nutrition support in treating septic patients was not related to physician, nurse, pharmacist, or patient's influence in nutrition support decisions. Perceived benefits of nutrition support in septic and MODS patients were not related to influence of professionals and patients (Table 2.2).

Table 2.2
Relationships between perceived benefits of nutrition support and professionals and patients' influence in nutrition support decisions

	Effectiveness of nutrition support in septic patients			
	0 to 1	2 to 3	4 to 5	Kendall's tau-b
Physician's influence				
0-1	0	0	0	
2	0	0	2	
3-4	1	18	29	
Nurse's influence				
0-1	0	10	9	
2	0	4	13	
3-4	1	4	9	
Dietitian's influence				0.33*
0-1	0	0	0	
2	0	5	1	
3-4	1	13	30	
Pharmacist's influence				0.17
0-1	0	9	12	
2	1	6	6	
3-4	0	3	13	
Patient's influence				0.10
0-1	0	9	13	
2	1	7	10	
3-4	0	2	8	
	Perceived outcomes of nutrition support in septic patients			
	-2 to -1	0	1 to 2	
Physician's influence				
0-1	0	0	0	
2	0	0	2	
3-4	0	3	43	
Nurse's influence				
0-1	0	2	17	
2	0	0	15	
3-4	0	1	13	
Dietitian's influence				
0-1	0	0	1	
2	0	0	6	
3-4	0	3	38	

Table 2.2 Continued

	Perceived outcomes of nutrition support in septic patients		
	-2 to -1	0	1 to 2
Pharmacist's influence			
0-1	0	2	19
2	0	0	13
3-4	0	1	13
Patient's influence			
0-1	0	3	19
2	0	0	16
3-4	0	0	10
	Perceived outcomes of nutrition support in MODS patients		
	-2 to -1	0	1 to 2
Physician's influence			
0-1	0	0	0
2	0	0	2
3-4	1	9	31
Nurse's influence			
0-1	0	5	13
2	0	1	13
3-4	1	3	7
Dietitian's influence			
0-1	0	0	0
2	0	1	4
3-4	1	8	29
Pharmacist's influence			
0-1	0	4	14
2	1	4	7
3-4	0	1	12
Patient's influence			
0-1	0	3	16
2	1	4	9
3-4	0	2	8

* There was a significant relationship at $p<0.05$ using Kendall's tau b test.

Member of Team, CNSD, Residency Program, and Trauma Center

There was a significant difference in perceived benefits of nutrition support in MODS patients by the presence of a trauma center (Table 2.3). Dietitians who worked in hospitals without a trauma team perceived significantly better benefits of nutrition support in MODS patients (1.0 ± 0.5) than dietitians who worked in hospitals with a trauma center (0.6 ± 0.7). There were no differences in perceived benefits of nutrition support in septic patients or in effectiveness of nutrition support in septic patients in hospitals with or without a trauma center. There were no differences in benefits of nutrition support or effectiveness of nutrition support perceived by dietitians who were or were not a team member, who had CNSD credential or no credential, and who worked in hospitals with or without a residency program.

Table 2.3
Differences in perceived benefits of nutrition support by member of the team, CNSD, residency program, and trauma center.

		Perceived benefits				Effectiveness of nutrition support in septic patients	
		Sepsis		MODS			
		n	Mean ± SD.	n	Mean ± SD.	n	Mean ± SD.
Team	Yes	15	1.3 ± 0.5	15	1.0 ± 0.8	16	3.9 ± 1.3
Member	No	32	1.1 ± 0.5	27	0.7 ± 0.5	32	3.9 ± 0.8
CNSD	Yes	17	1.3 ± 0.6	16	0.8 ± 0.7	20	3.8 ± 1.2
	No	31	1.1 ± 0.5	27	0.9 ± 0.6	30	4.0 ± 0.9
Residency	Yes	26	1.1 ± 0.5	25	0.8 ± 0.7	29	3.9 ± 1.1
Program	No	22	1.2 ± 0.5	18	0.9 ± 0.5	21	3.9 ± 0.9
Trauma	Yes	23	1.1 ± 0.6	21	0.6* ± 0.7	24	4.0 ± 1.2
Center	No	25	1.2 ± 0.4	22	1.0* ± 0.5	26	3.8 ± 0.8

* Means were significantly different at $p < 0.05$ using the independent t test for unequal variances.

Nutrition Support Decisions by Influence of Professionals and Patients

Table 3 shows the influence of professionals and patients in nutrition support decisions. Physicians were perceived to have the greatest influence in decision making, followed by dietitians. The influence of nurses, pharmacists, and patients or families varied; for example 9 dietitians felt that patients had no influence while 3 felt patients had great influence in nutrition support decisions.

Table 3.
Influence of professionals and patients on nutrition support decisions (n=52)

	No influence					Great influence			
	0	0.5	1	2	2.5	3	3.5	4	Mean ± SD.
Physician	0	0	0	2	0	14	0	36	3.7 ± 0.6
Dietitian	0	0	1	6	0	17	1	27	3.4 ± 0.8
Nurse	6	0	14	17	0	14	0	1	1.8 ± 1.0
Pharmacist	13	1	9	13	0	13	0	3	1.7 ± 1.3
Patient	9	0	15	17	1	7	0	3	1.6 ± 1.1

Influences on Registered Dietitians' Nutrition Support Decisions

Years of Experience, Size of Hospitals, and Professionals' and Patients' Influences on Nutrition Support

There was a significant relationship between the dietitian's perceived influence in nutrition support decisions and size of hospital (Table 3.1). Some dietitians who worked in small hospitals perceived themselves to have less influence in nutrition support decisions; all 10 dietitians from hospitals with greater than 500 beds felt they had great

influence. There were no relationships between dietitians' influence in nutrition support decisions, and years of experience, and influence of physician, nurse, pharmacist, and patient in nutrition support.

Table 3.1
Relationships between dietitian's influence in nutrition support decisions and years of experience, size of hospitals, and professionals and patients' influence in nutrition support.

	Dietitian's influence in nutrition support decisions			
	0 to 1	2	3 to 4	Kendall's tau-b
Years of experience				0.20
0-10	1	4	23	
11-27	0	1	21	
Number of beds				0.33*
1-199	1	4	11	
200-500	0	2	23	
501-800	0	0	10	
Physician's influence				-0.08
0-1	0	0	0	
2	0	0	2	
3-4	1	6	43	
Nurse's influence				0.15
0-1	1	2	17	
2	0	4	13	
3-4	0	0	15	
Pharmacist's influence				0.12
0-1	1	2	20	
2	0	4	9	
3-4	0	0	16	
Patient and family's influence				
0-1	1	1	22	
2	0	2	16	
3-4	0	3	7	

* There was significant relationship at $p<0.05$ using Kendall's tau b test.

Team Member, CNSD, and Residency Program.

There were no differences in RD's influence in nutrition support decisions by team membership, CNSD credential, or presence of a residency program (Table 3.2). Dietitians on a team had the same influence as dietitians not on a team. Dietitians with CNSD credential had the same influence as dietitians without CNSD credential. Dietitian who worked in hospitals with a residency program had the same influence as dietitians who worked in hospitals without a residency program.

Table 3.2
Differences in RD's influence in nutrition support decisions by team member, CNSD, and residency program.

		Influence of RD					
		n Mean ± SD.		n Mean ± SD.		n Mean ± SD.	
Team	Yes	16	3.5 ± 0.7	CNSD	21	3.5 ± 0.7	Residency	29	3.5 ± 0.6
Member	No	34	3.3 ± 0.8		31	3.3 ± 0.8	Program	23	3.2 ± 0.9

Influences on Membership of Nutrition Support Team

CNSD, Residency Program, and Trauma Center.

There were no relationships between team membership, CNSD credential, residency program, and trauma center (Table 4.1). The membership on the team was not related to the CNSD credential, residency program at dietitians' hospitals, and trauma center at dietitians' hospitals.

Table 4.1
Relationships between team membership, and CNSD credential, residency program, and trauma center.

	CNSD		Residency program		Trauma center	
	Yes	No	Yes	No	Yes	No
Team member Yes	7	9	7	9	5	11
No	13	21	21	13	19	15

Number of Patients, Years of Experience, and Size of Hospitals.

There were no differences between dietitians who were and were not a team member in number of patients, years of experience, or size of hospitals (Table 4.2). Dietitians on the team treated a similar number of patients per month, had similar years of experience, and worked in similar size of hospitals as dietitians not on the team.

Table 4.2
Differences in number of patients per month, years of experience, and size of hospitals by team membership.

	Team membership			
	Yes		No	
	N	Mean ± SD.	N	Mean ± SD.
Number of patients	16	14.4 ± 11.1	34	12.0 ± 10.6
Years of experience	16	10.1 ± 7.0	32	12.0 ± 6.3
Number of beds	16	342 ± 234	33	334 ± 221

Number of Patients, Years of Experience, and Size of Hospital.

There were no differences between dietitians with and without CNSD credential in number of patients, years of experience, and size of hospitals (Table 5.1). Dietitians with the CNSD credential did not treat a different number of patients per month, had similar years of experience, and worked in no different size of hospitals than dietitians without CNSD credential.

Table 5.1
Differences in number of patients per month, years of experience, and size of hospital by CNSD credential.

	CNSD credential			
	Yes		No	
	N	Mean ± SD.	N	Mean ± SD.
Number of patients	21	14.1 ± 10.9	31	11.5 ± 10.4
Years of experience	21	11.8 ± 5.6	29	10.7 ± 7.0
Number of beds	20	388 ± 240	31	292 ± 203

Residency Program and Trauma Center.

There were no relationships between the CNSD credential, and residency program and trauma center (Table 5.2). The dietitians' CNSD credential was not related to hospitals with a residency program or trauma center.

Table 5.2
Relationships between CNSD credential, and residency program and trauma center.

		Residency program		Trauma center	
		Yes	No	Yes	No
CNSD	Yes	14	7	11	10
	No	15	16	14	17

Feeding Recommendations for Septic Patients

Table 6 shows recommendations of feedings in septic patients with various conditions. Most dietitians recommended TEN in patients with sepsis, a functional gut, and inadequate intake; and in patients with a functional gut and septic complications. Most dietitians recommended TPN in septic patients who had a GI hemorrhage, intestinal obstruction, and paralytic ileus in the small bowel. Many dietitians recommended TPN and TEN in septic patients who had paralytic ileus in the colon, severe short bowel syndrome, and multiple organ dysfunction syndrome.

Most dietitians identified the correct feedings (compared to ASPEN 1998 recommendations) in septic patients with a functional GI tract and inadequate intake, a GI hemorrhage, intestinal obstruction, paralytic ileus in the small bowel, a functional GI and septic complications, and multiple organ dysfunction syndrome. Many dietitians recommended different feedings than the guidelines in septic patients with paralytic ileus in the colon and severe short bowel syndrome (Table 6). Nineteen dietitians received knowledge score of feedings less than or equal to 5 and 32 dietitians received score greater than 5.

Table 6.
Recommendations for appropriate feedings for different patients

Type of patient	n	TEN n (%)	TPN n (%)	TEN and TPN n (%)	No nutrition support n (%)	other answers n (%)
Sepsis, functional gut, inadequate intake	51	44[1] (84.6)	0	6 (11.5)	0	1 (1.9)
Sepsis, GI hemorrhage	50	3 (5.8)	36[1] (69.2)	8 (15.4)	1 (1.9)	2 (3.8)
Sepsis, intestinal obstruction	51	2 (3.8)	47[1] (90.4)	1 (1.9)	1 (1.9)	0
Sepsis, paralytic ileus in the colon	51	9 (17.3)	23[1] (44.2)	17 (32.7)	1 (1.9)	1 (1.9)
Sepsis, paralytic ileus in the small bowel	51	5 (9.6)	38[1] (73.1)	7 (13.5)	1 (1.9)	0
Functional gut, septic complications	51	37[1] (71.2)	2 (2.8)	9 (17.3)	3 (5.8)	0
Sepsis, severe short bowel syndrome	51	1 (1.9)	23[1] (44.2)	23 (44.2)	1 (1.9)	3 (5.7)
Sepsis, MODS	51	18[1] (34.6)	6[1] (11.5)	24[1] (46.2)	1 (1.9)	2 (3.8)

[1] Number of registered dietitians who responded correctly according to ASPEN guidelines (Trujillo et al., 1998)

Influences on Dietitian's Knowledge of Feeding Septic Patients

Number of Patients Treated, Effectiveness of Nutrition Support, Perceived Benefits of Nutrition Support, and Professionals and Patients' Influences in Nutrition Support Decisions.

Dietitians' knowledge of feeding septic patients was not related to number of patients treated per month, effectiveness of nutrition support in septic patients, perceived benefits of nutrition support in septic and MODS patients, or professionals and patients' influence in nutrition support decisions (Table 6.1).

Years of Experience and Size of Hospitals.

Dietitians' knowledge of feeding septic patients was not related to years of experience ($r = -0.21$) or size of hospital ($r = -0.18$).

Team Membership, CNSD Credential, Residency Program, and Trauma Center.

Dietitians on the team had almost the same knowledge as dietitians not on the team (Table 6.2). Dietitians with CNSD had almost the same knowledge as dietitians without CNSD credential. Dietitians in hospitals with a residency program or trauma center had almost the same knowledge as dietitians in hospitals without a residency program or trauma center.

Table 6.1
Relationships between dietitians' knowledge of feeding patients and number of patients treated, effectiveness of nutrition support, perceived benefits of nutrition support, and professionals and patients' influence in nutrition support decisions.

	Number of patients treated per month			
Knowledge	1 to 2.5	4 to 10	20 to 30	Kendall's tau-b
Failed	6	5	8	-0.02
Passed	11	8	13	
	Effectiveness of nutrition support in septic patients			0.17
	0 to 1	2 to 3	4 to 5	
Failed	0	9	9	
Passed	1	9	22	
	Perceived benefits of nutrition support in septic patients			-0.004
	-2 to -1	0	1 to 2	
Failed	0	1	15	
Passed	0	2	29	
	Perceived benefits of nutrition support In MODS patients			0.19
Failed	0	5	9	
Passed	1	4	24	
	Physician's influence			0.05
	0 to 1	2	3 to 4	
Failed	0	1	18	
Passed	0	1	31	
	Nurse's influence			0.07
Failed	8	6	5	
Passed	11	11	10	
	Dietitian's influence			-0.16
Failed	0	1	18	
Passed	0	5	27	
	Pharmacist's influence			0.17
Failed	10	5	4	
Passed	12	8	12	
	Patient and family's influence			0.11
Failed	10	6	3	
Passed	13	12	7	

Table 6.2
Differences in dietitian's knowledge of feeding septic patients by team membership, CNSD credential, residency program, and trauma center.

		Knowledge of feeding septic patients with different conditions					
		N	Mean ± SD.			N	Mean ± SD.
Team member	Yes	16	6.1 ± 0.9	CNSD	Yes	21	5.7 ± 1.2
	No	33	5.6 ± 1.6		No	30	5.9 ± 1.5
Residency	Yes	29	5.7 ± 1.2	Trauma	Yes	24	5.8 ± 1.1
Program	No	22	6.0 ± 1.6	Center	No	27	5.8 ± 1.6

Comments from Respondents

Responding registered dietitians wrote comments about different questions (See Appendix D). Dietitians indicated that other perceived outcomes of nutrition support in septic and MODS patients included improved patient and family satisfaction regarding care. Two dietitians indicated that knowledge about nutrition support and advance directives increased patient's and family' influence in nutrition support decisions. One dietitian reported being an informal team member; other dietitians were not a team member because their committee was expired, they did not have a team, or they were not currently a team member.

Regarding type of nutrition support, many dietitians commented on specific conditions that they felt influenced the type of nutrition support. One dietitian recommended "no nutrition support with shock until renal done perfusing levels obtained with pressors" in septic patients with a functional gut and inadequate intake receiving TEN. Another dietitian recommended feeding depending on how well enteral was tolerated in the same type of patients.

One dietitian recommended TEN in septic patient with GI hemorrhage, but noted that if there was a hemorrhage, TEN was stopped for 2-3 days. Two dietitians recommended TPN in the same patient; one indicated it depends on the location of hemorrhage and another said TPN was indicated for long term bleeding. Three dietitians responded that they would recommend TPN initially and then TEN when bleeding stopped in the same type of patient. One dietitian recommended NPO for 1 –2 days in the same patient; then if they cannot use TEN, start TPN. One dietitian recommended TEN and no nutrition support in the same patient.

Two dietitians recommended TEN in septic patients with intestinal obstruction if the tube could be placed distal to the obstruction. Two dietitians recommended TPN in the same patient but said the choice of feeding depends on extent of problem and the location of the obstruction. One dietitian recommended TEN and TPN depending on where obstruction is.

Two dietitians recommended TPN in septic patients with paralytic ileus in the colon depending on the extent of the problem and remaining bowel function and access port for alimentation. One dietitian recommended feeding in the same patient based on how well enteral feedings were tolerated.

One dietitian recommended TEN into the small bowel in septic patients with paralytic ileus in the small bowel. Two dietitians recommended TPN in the same patient depending on the extent of the problem and remaining bowel function and access port for alimentation. One dietitian recommended EN and TPN in the same patient based on tolerance.

One dietitian recommended TEN first and then EN with TPN in patients with a functional gut and septic complications. One dietitian recommended no nutrition support unless the same patient was malnourished and unable to take adequate orally.

One dietitian recommended TPN with elemental feeding in septic patients with severe short bowel syndrome. One dietitian recommended TPN initially and then TEN with TPN in the same patient. One dietitian recommended TEN in the same patient, but if TEN not tolerated try both TEN and TPN, if not adequate go to TPN. One dietitian recommended feeding in the same patient based on how well enteral was tolerated.

One dietitian recommended TEN in septic patients with MODS or not feeding the patient if the gut was functional and the patient was not terminal. One dietitian recommended TPN and no nutrition support in the same patient.

In the area for general comments, dietitians indicated the following comments. "It is difficult to measure the outcomes specifically related to nutrition support alone." "At times, we do not see immediate positive result of nutrition support; however, without nutrition support no survival. No food, no life is very true in MODS patients." "Nutrition plays a supportive role in MODS if selected appropriately." "Early nutrition support is important to maintain patient's immunity." "Early start of Enteral nutrition support can reduce use of TPN." "TEN can maintain integrity of the gut and avoid bacterial translocation." "Immune-enhancing enteral formulas do make a difference, given by lower in fat and 1.5 to 1.7 gm protein/kg." "Physicians tend to overfeed patients and cause more complications. They need to be educated that more is not better." "Be cautious of overfeeding in septic patient because that can push patient into organ failure.

Appropriate feeding in patient with colonic ileus depends on dilated bowel and in SBS patient depends on length of remaining bowel."

CHAPTER V

CONCLUSIONS, LIMITATIONS, IMPLICATIONS, RECOMMENDATIONS

Conclusions

Our study showed dietitians' perceptions of outcomes of nutrition support in septic and MODS patients, their influence in nutrition support decisions, and their recommendations for appropriate feedings in septic patients.

Perceived Benefits of Nutrition Support

Dietitians perceived that nutrition support was effective in treating septic patients and improved nutritional status, length of stay, treatment costs, mortality, and complications in septic and MODS patients. Dietitians indicated that nutrition support was most likely to improve nutritional status in both types of patients. The goal of nutrition support is to provide adequate nutrients to injured or stressed patients (ASPEN 1993-b; Silverman 1993; Trujillo et al. 1998). Two studies showed improved nutritional status in septic patients receiving nutrition support (Bower et al. 1995; Sitzmann et al. 1989).

Dietitians felt nutrition support was least likely to improve treatment costs in septic patients and mortality in MODS patients. One study showed that neither TEN nor TPN had a beneficial effect on the incidence or mortality in MODS patients (Cerra et al. 1988). However, Beal and Cerra (1994) indicated that nutrition support in MODS patients can prevent mortality and morbidity caused by nutrition.

Dietitians perceived significantly greater improvement in outcomes of nutrition support in septic patients than MODS patients. This difference in perceived outcomes between the two types of patients would suggest that different medical conditions or severity of illnesses influence outcomes of nutrition care. The American Gastroenterological Association (1995) reported that the effect of the underlying disease can lead to increased patient complications and that more critically ill patients are more likely to have feeding-related problems because of illness. Null hypothesis 1, there is no difference in perceptions of benefits of nutrition support between septic and MODS patients, therefore, was rejected.

The dietitian's credentials may have influenced perceived outcomes of nutrition support. Dietitians who felt they had great influence in nutrition support decisions perceived significantly greater effectiveness of nutrition support in treating septic patients. Braunschweig et al. (1988) found that outcome achievement was positively associated with following a dietitian's recommendations in nutrition plans. When physicians followed the recommendations, patients were significantly more likely to tolerate TEN and meet nutritional goals in a shorter time than patients whose physicians did not follow the recommendations. A similar study showed that patients were four times more likely to meet energy goals when the physician followed the RD

recommendations (Weddle et al. 1995). RDs with great influence would perceive positive outcomes of nutrition support. Therefore, part of null hypothesis 2-A testing no relation between dietitian's perceived influence and effectiveness of nutrition support in treating septic patients was rejected.

However, other parts of null hypothesis 2-A failed to be rejected. Null hypothesis 2-A tested no relationships between perceived benefits of nutrition support (in septic patients, MODS patients, and treatment of septic patients) and years of experience, size of hospital, and influence of professionals and patients in decision making.

Hospital characteristics influenced perceived outcomes of nutrition support. Dietitians in hospitals without a trauma center perceived significantly better outcomes for MODS patients than those in hospitals with a trauma center. Dietitians in hospitals with a trauma center may be more likely to see MODS patients than in hospitals without a trauma center because MODS is a leading cause of death for patients who experience major burns, trauma, and sepsis (Beal and Cerra 1994; Bower et al. 1995). Patients with MODS had a mortality rate of 68% (Henao et al. 1991). Therefore, dietitians may not perceive better outcomes of nutrition support in their MODS patients who were admitted to a trauma center and therefore had a higher mortality rate. Part of null hypothesis 2-B that tested no difference in perceived benefits of nutrition support in MODS patients by hospitals with and without a trauma center was rejected. Other parts of null hypothesis 2-B testing no differences in perceived benefits of nutrition support by dietitians who are CNSD, or hospitals with and without a team, residency program, and trauma center were not rejected.

Nutrition Support Decisions

Dietitians perceived that physicians had the most influence in nutrition support decisions, followed by dietitians. One study showed that physicians wanted to remain a dominant role in nutrition care and made most of the nutrition support decisions (Boyhtari and Cardinal 1997). Because dietitians have knowledge about nutrition support and their jobs are involved in patient care related to nutrition support, they should participate in any decisions about provision of nutrition support (American Dietetic Association 1991; Gilmour and Glencorse 1998). They are qualified to assume a key role in the recommendation and provision of TEN and TPN (American Dietetic Association 1991). According to two studies, nutrition support dietitians spent half of their time in the provision of nutrition support and more than half of dietitians were involved in determining the route of nutrition support (Olree and Skipper 1997; Winkler 1993)

Pharmacists and patients had the least perceived influence in nutrition support decisions. One dietitian indicated that advance directives increase the patient and family's influence in the provision of nutrition support. Skipper (1998) indicated that the wishes of terminally ill patients, the medical risks of continuing therapy, and cost of continuing home TPN should be considered in making decisions.

Hospital characteristics had some influence for dietitians with nutrition support decisions. Size of hospital was significantly related to dietitian's perceived influence in nutrition support; the larger the hospital, the greater the dietitians perceived influence. The larger the hospital, the more patients the dietitians treated. Larger hospitals may empower dietitians in their work. Part of null hypothesis 3-A testing no relationship

between RD influence and size of hospital was rejected. Other parts of null hypothesis 3-A testing no relationships between RD influence in nutrition support decisions and years of experience and influence of other professionals and patients were not rejected. Null hypothesis 3-B testing no differences in RD influence in nutrition support by membership on a team, CNSD credential, and hospitals with a trauma center was not rejected.

Member of Nutrition Support Team

Approximately 30% of dietitians in our study were members of a nutrition support team. The prevalence of dietitians on the team was similar to two other studies (Olree and Skipper 1997; Regenstein 1992). Null hypotheses 4-A and B testing no influence of CNSD credential, number of patients treated per month, years of experience, and hospital services on RD's membership on a nutrition support team were not rejected.

The CNSD Credential

About 40% of dietitians in our study were certified as CNSD. The finding was similar to another study that 48% of nutrition support dietitians who worked in hospitals with 300 or more beds had earned the CNSD credential (Olree and Skipper 1997). Null hypotheses 5-A and B testing no influence of number of patients treated per month, years of experience, and hospital services on CNSD credential were not rejected.

Feeding Recommendations for Septic Patients

Almost two thirds of dietitians knew correct feedings for septic patients according to ASPEN guidelines. Winkler (1993) found that most dietitians applied the standards of nutrition care to their patients. Most dietitians correctly recommended TEN in septic patients with a functional GI tract who had an inadequate intake or septic complications. Most dietitians correctly recommended TPN in septic patients with a GI hemorrhage, intestinal obstruction, or paralytic ileus in the small bowel. Most dietitians correctly recommended TEN and TPN in septic patients with MODS.

Dietitians recommended different feedings than the ASPEN guidelines (Trujillo et al., 1998) in septic patients with paralytic ileus in the colon and severe short bowel syndrome. The ASPEN guidelines recommended TPN in these patients, but respondents in our study recommended TEN, TPN, or both in septic patients with paralytic ileus; and TPN or both TEN and TPN in septic patients with severe short bowel syndrome. Other studies had different suggestions of feedings in short bowel syndrome patients. Forbes and Chadwick (1998) indicated that if patients with intestinal failure are able to eat and absorb nutrients, they do not need TPN. Early initiation of TEN improves adaptation of the remaining bowel for adequate nutrient absorption (Lord et al. 1998). Null hypotheses 6-A and B testing no influence of RDs' characteristics and hospital services on RDs' knowledge of feedings in septic and MODS patients were not rejected.

Our study found that there was difference in perceived outcomes of nutrition support between septic and MODS patients; that influence of dietitians on nutrition support decisions was related to the effectiveness of nutrition support in treating septic

patient; that the present of a trauma center influenced perceived outcomes of nutrition support in MODS patients; and that size of hospital was related to dietitians' influence in nutrition support.

Overall, 4 out of 56 analyses showed significant relationships or differences. This indicates that there was possible problem with hypotheses related to the purpose of the study or with the sample size. The main purpose of our study was to show perceived outcomes of nutrition support in septic and MODS patients and to examine if there was any influence on perceived outcomes. Some data analyses or hypotheses (such as hypotheses 3, 4, 5, and 6) would not be necessary. In addition to this problem, although hypothesis 2 was close to the purpose of the study, researchers should find better ways to study the various influences based on literature or clinical experience and examine one influence at a time.

Limitations

This study examined RDs' perceptions of nutrition support outcomes. It was a self-reported descriptive study. Therefore, we could not account for the causes of the difference in perceptions of nutrition support outcomes in septic and MODS patients. Definitions of sepsis and MODS should have been provided in the questionnaire. A low response rate, small sample size, and a tendency toward consistent perceptions limited data analysis and reduced the power and accuracy of data analysis.

Implications

The role of registered dietitians is to provide better nutrition care to critically ill patients. The present study showed that many dietitians perceived themselves to have great influence in nutrition support decisions and appropriate knowledge of feeding septic patients. Dietitians stated confidence in their ability to influence nutrition support services and had good knowledge about nutrition support. One of our results showed that dietitian's influence on nutrition support decisions was significantly related to perceived effect of nutrition support in treating septic patients. The greater influence they felt, the more effective of nutrition support in treating patients they perceived. Dietitians are or should be the ideal professional to take the real role in coordinating nutrition care.

This study showed different perceptions of nutrition support outcomes in septic and MODS patients. This finding might assist dietitians to provide nutrition support to their patients. They will use different approaches that fit each patient's condition and generate more effective care.

Recommendations

Further study is needed to determine factors affecting different perceptions of nutrition support outcomes between septic and MODS patients. Incorporating a psychological analysis into nutrition support studies might help determine how dietitians perceive differently.

The present study asked dietitians' perception and opinions of nutrition support given in septic and MODS patients. In the future, researchers should conduct outcomes studies so they can gather more information relative to effectiveness of different types of nutrition support such as routes, time, and, types of nutrition delivery for different types of patients. If the effect of different types of nutrition support is examined without any intervention involved, both a retrospective and prospective study design could be applied. If routes, time, or types of nutrition delivery are hypothesized to affect outcomes of nutrition support, a prospective study design should be used to further discover which routes, time, or types show better outcomes than another. A prospective study design could help health care providers find a better way to improve patient care and reduce treatment cost. On the other hand, a retrospective study could evaluate dietitians' practice and seek if any improvement for patient care is needed. Nevertheless, a study to identify appropriate outcomes and determine desirable values should be conducted before outcomes studies begin.

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APPENDIX A
QUESTIONNAIRE

Questionnaire

1. During the last year how frequently did you treat patients who met all the following criteria: at least one preexisting condition (such as cardiac disease, diabetes, hypertension, obesity, etc.). sepsis, at least 50 years old, ICU treatment, and length of stay greater than 7 days?

   __ 1 patient/month __ 2 to 3 patients/month __ 1 patient/week
   __ 2 to 3 patients/week __ 1 patient/day __ > 1 patient/day

2. How long have you worked in nutrition support with intensive care patients? _____ Years

3. In your experience, how effective has nutrition support been in treating most patients with sepsis? (circle one number)

   Not effective 0 1 2 3 4 5 Very effective

4. How beneficial is nutrition support to **most septic patients?** (circle one number for each outcome)

	Negative outcome		No effect	Improved outcome	
Nutritional status	-2	-1	0	1	2
Length of stay	-2	-1	0	1	2
Treatment costs	-2	-1	0	1	2
Mortality	-2	-1	0	1	2
Post injury, operative, or metabolic complications	-2	-1	0	1	2

   Other outcomes such as _____

5. How beneficial is nutrition support to **septic patients with Multiple Organ Dysfunction Syndrome?** (circle one number for each outcome)

	Negative outcome		No effect	Improved outcome	
Nutritional status	-2	-1	0	1	2
Length of stay	-2	-1	0	1	2
Treatment costs	-2	-1	0	1	2
Mortality	-2	-1	0	1	2
Post injury, operative, or metabolic complications	-2	-1	0	1	2

   Other outcomes such as _____

6. In your facility, how much influence do the following individuals have in determining the type and amount of nutrition support used in the treatment of septic patients? (circle one number for each individual)

	No influence				Great influence
Physician	0	1	2	3	4
Nurse	0	1	2	3	4
Dietitian	0	1	2	3	4
Pharmacist	0	1	2	3	4
Patient or family	0	1	2	3	4

Please complete both sides of the questionnaire

7. How many beds are in your facility? _____ Number of licensed beds

8. Are you a member of a nutrition support team? Yes No

9. Are you certified as a CNSD? Yes No

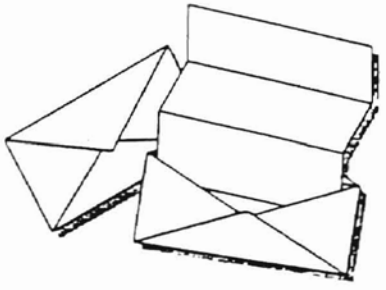
10. Does your hospital sponsor a medical residency program? Yes No

11. Does your hospital operate a trauma center? Yes No
If your hospital operates a trauma center, the level of the trauma center is
_____ Level I _____ Level II _____ Level III _____ Level IV

12. For the following type of patients, which type of feeding would you recommend most often
Check the most appropriate box.

Type of patient	TEN	TPN	TEN & TPN	No nutrition support
Patient with sepsis and functional GI who cannot meet energy needs orally				
Patient with sepsis who has a GI hemorrhage				
Patient with sepsis who has intestinal obstruction				
Patient with sepsis who has paralytic ileus in the **colon**				
Patient with sepsis who has paralytic ileus in the **small bowel**				
Patient with functional GI who has septic complications (abdominal abscess, pneumonia, bacteriumia, catheter sepsis, others)				
Patient with sepsis who has severe short bowel syndrome				
Patient who has sepsis and Multiple Organ Dysfunction Syndrome				

Please add other comments about the role of nutrition support in patients with sepsis or those at risk of MODS.



We will sincerely appreciate the time and effort you spend completing this questionnaire. Please immediately mail the completed questionnaire in the enclosed prepaid envelope by **August 23**.

Gail Gates, PhD, RD/LD 425 HES, Stillwater, OK 74078-6141

APPENDIX B
COVER LETTER

OSU

Department of Nutritional Sciences
425 Human Environmental Sciences
Stillwater, Oklahoma 74078-6141
405-744-5040, Fax 405-744-7113
Email nutrsci@oxway.okstate.edu
http://www.okstate.edu/hes/nsci/nutsci.html

July 22, 1999

Dear Dietitian:

I am a graduate student in the Nutritional Sciences Department at Oklahoma State University. My advisor, Dr. Gail Gates; a Clinical Dietitian, Jane Schane; and I are currently working on a study that examines dietitians' opinions about the treatment of septic patients and their recommendations for the appropriate treatment of septic patients at risk for Multiple Organ Dysfunction Syndrome (MODS). We encourage you to take about 10 minutes to participate in our study.

Sepsis is the metabolic response to an infectious insult and can lead to MODS. The body's hypermetabolic response to MODS leads to increased energy expenditure, enhanced protein breakdown, and loss of lean body mass.

The questionnaire is anonymous. By returning the questionnaire, you are indicating consent to participate in this portion of the study. All information on the questionnaire will be held in confidence by the researchers. Please feel free to fill out the questionnaire, individual responses will not be published. Please respond by **August 23**.

Your participation is vital to the success of this study and will benefit your patients with nutrition care. If you have questions about the questionnaire, call Dr. Gates at 405-744-5040 or me at 405-330-6892. If you have questions about your right to participate in this study, call Sharon Bacher at 405-744-5700 of the Oklahoma State University Institutional Review Board.

We are looking forward to your response.

Sincerely,

Mei-Ling Lu
Graduate Student

Gail Gates, PhD, RD/LD
Associate Professor

APPENDIX C
APPROVAL OF STUDY FROM
THE INSTITUTIONAL REVIEW BOARD

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD

Date:	April 13, 1999	IRB #:	HE-99-028

Proposal Title: "THE EFFECTIVENESS OF NUTRITION SUPPORT TO SEPTIC PATIENTS HAVING A RISK OF MULTIPLE ORGAN DYSFUNCTION SYNDROME (MODS)"

Principal Investigator(s): Gail Gates
Mei-Ling Lu

Reviewed and Processed as: Expedited

Approval Status Recommended by Reviewer(s): Approved

Signature

Carol Olson, Director of University Research Compliance

April 13, 1999
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modification to the research project approved by the IRB must be submitted for approval. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

APPENDIX D
COMMENTS FROM RESPONDENTS

Frequency
28-Do RD's treat?

Years of experience
32-no longer work with intensive care pts on reg basis. (previously, not currently)
52-Our facility has intensive care patients but no NS team; has RD assigned to ICU and I sometimes relieve as needed.

Effect of nutrition support
(0) 49-does not treat them-provides nutrition?
(5) 45-well tolerated (how effective?).

Septic patients
Blank (1 -6) 9-we don't have any outcome data-can't assess without. 2 8-what is outcome measure of nutritional status? I don't know because we don't do research at our hospital. I can only give you my opinion which of course is biased. 45-difficult to assess.

Septic patients I

Septic 2
7-don't know

Septic 3
7-don't know

Septic 4
7-don't know

Septic 5

Septic 6
20-do not have outcome documentation for above.
4 1 -Patient and family satisfaction regarding care.

MODS
Blank (1-6) 9-we don't have any outcome data-can't assess without. 45-same (difficult to assess). 51 (but 2)-These pts are transferred to another facility.

MODS I

MODS 2
7-don't know

MODS 3
7-don't know

MODS 4
7-don't know

MODS 5

MODS 6
20-do not follow for documented outcomes with nutrition.
41 -Improved patient and family satisfaction.
49-adding fluids that the patient has to deal with along with nutrition substrate.

Role 1

Role 2

Role 3

Role 4
(4) 39-Pharmal

Role 5
(2) 14-family may not be too aware of nutritional support but if they were better informed, they would push nutrition support. 20-advance directives.

# of beds
10-Moses Cone
20-with 5 IUC beds and surgical beds
34-22 ICU, 30 PCU.
36-may be 405 with current changes.

Member of a nutrition support team
Blank 35-NA.
(1) 28-informal
(2) 10-committee expired 9/98. 23-no team. 32-not currently.

CNSD
(2) 34-was but let it lapse

Medical residency program

Trauma center

Level
Blank 44-don't know?
(2) 4-starting any day
(4) 23-low
Type of patients
Blank(type 1-8) 44-no input.

Type I
(1) 36-no nutrition support with shock until renal done perfusion levels obtained with pressors.
(5) 9-It depends on how well enteral is tolerated
Type 2
(1) 2-If hemorrhage, stopped within 2-3 days.
(2) 34-depends where. 47-if long term bleed.
(3) 14-When bleeding stops TEN. TPN initially. 28-go to EN, when bleed resolve. 45-(1), (2), and (3). Need more info.
(5) 7-allow NPO 1-2 days then if cannot use Tf, start TPN.
(7) 20-(1) and (4)
Type 3
(1) 34-if tube can be placed distal to obstruction. depends where. 40-if can feed past obstruction.
(2) 16-depends on extent of problem. 36-where?.
(3) 3-depends where obstruction is.
Type 4
(2) 16-depends on extent of problem. 26-dependent on remaining bowel function and access port for alimentation.
(3) 14-(2) and (3). 22-(1) and (2). 28-depends. 45-(1) 1st and (3).
(5) 9-It depends on how well enteral. is tolerated
Type 5
(1) 36-unidentified recommendation. 47-feed into SB.
(2) 16-depends on extent of problem. 26-dependent on remaining bowel function and access port for
alimentation.
(3) 10-Based on tolerance
Type 6
(3) 36-(1) first choice and (3) 2nd choice.
(4) 32-unless malnourished, unable to take adeq PO.
Type 7
(2) 10-? Might try. 40-or possibly elemental feeding.
(3) 14-inititially (2), eventually (3). 22-(1) and (2). 28-(2) or (3), depends.
(5) 7-(1), try TF, if not tolerated try TF and TPPN, if not adeq, go to TPN. 9-It depends on how well enteral is tolerated
(6) 19-no experience with this
Type 8
(1) 9-usually. 47-if gut fut (function).
(3) 22-(1) and (2). 36-(1) and (3)-2nd choice
(5) 16-(1), if gut functional and pt, not with terminal status, may opt not to feed.
(7) 49-(2) or (4).

Comments
10-currently not working out of home: 3 yrs Duke Med Center Durham NC, 91/2 yrs Moses Cone Health G'boro NC, + private practice

12-While I endorse aggressive nutrition support (when appropriate) for patients with sepsis/MODS, it is very difficult to measure the outcome(s) specifically related to nutrition support alone. Nutritional support outcome studies are critical for the future of nutrition support.
13-Part of our recs are based on the conservative nature of the physicians here.
17-I believe that nutrition plays primarily a supportive role (if selected appropriately) in MODS.
18-When feasible, enteral feeding is recommended (perhaps as a slow drip) to maintain integrity of the gut and avoid bacterial translocation.
28-Thanks for your interest in nutrition for septic pt. TPN-total.... TEN-total...., so EN and PN might be better words?
34-I find that immune-enhancing enteral formulas really do make a difference. I limit fat and give 1.5-1.7 gm pro/kg.
35-Good luck?
38-Tend to see more complications with patients that MD's overfeed. Physicians need to be educated that more (increase kcal/pro) is not necessarily better.
45-difficult to answer some questions without more information.
46-be cautious of overfeeding in this patient population. This can actually push patient into organ failure. Colonic ileus-depends on dilated bowel, etc. SBS-depends on length of remaining bowel.
50-At times, we do not see immediate positive result of nutrition support, however without nutrition No-survival. Early start of nutrition support is important to maintain Pt's immunity. No-Food, No-life is very true in MODS Pt's.
52-with early nutritional support less TPN can be utilized ie: starting early enteral nutritional support.

VITA

Mei-Ling Lu

Candidate for the Degree of

Master of Science

Thesis: PERCEIVED EFFECTIVENESS OF NUTRITION SUPPORT IN PATIENTS WITH SEPSIS AND MULTIPLE ORGAN DYSFUNCTION SYNDROME

Major Field: Nutritional Sciences

Biographical:

Personal data: Born in Taipei, Taiwan, on June 5, 1970.

Education: Graduated from Tai-Chiang Senior High School, Taipei, Taiwan in May 1988. Received Bachelor of Science degree in Dietetics from Central Missouri State University in December 1996. Completed the requirements for the approved internship program in Dietetics at Oklahoma State University in March 2001. Completed the requirements for the Master of Science degree in Nutritional Sciences at Oklahoma State University in May 2001.

Professional Memberships: American Dietetic Association and Kappa Omicron Nu Honor Society.