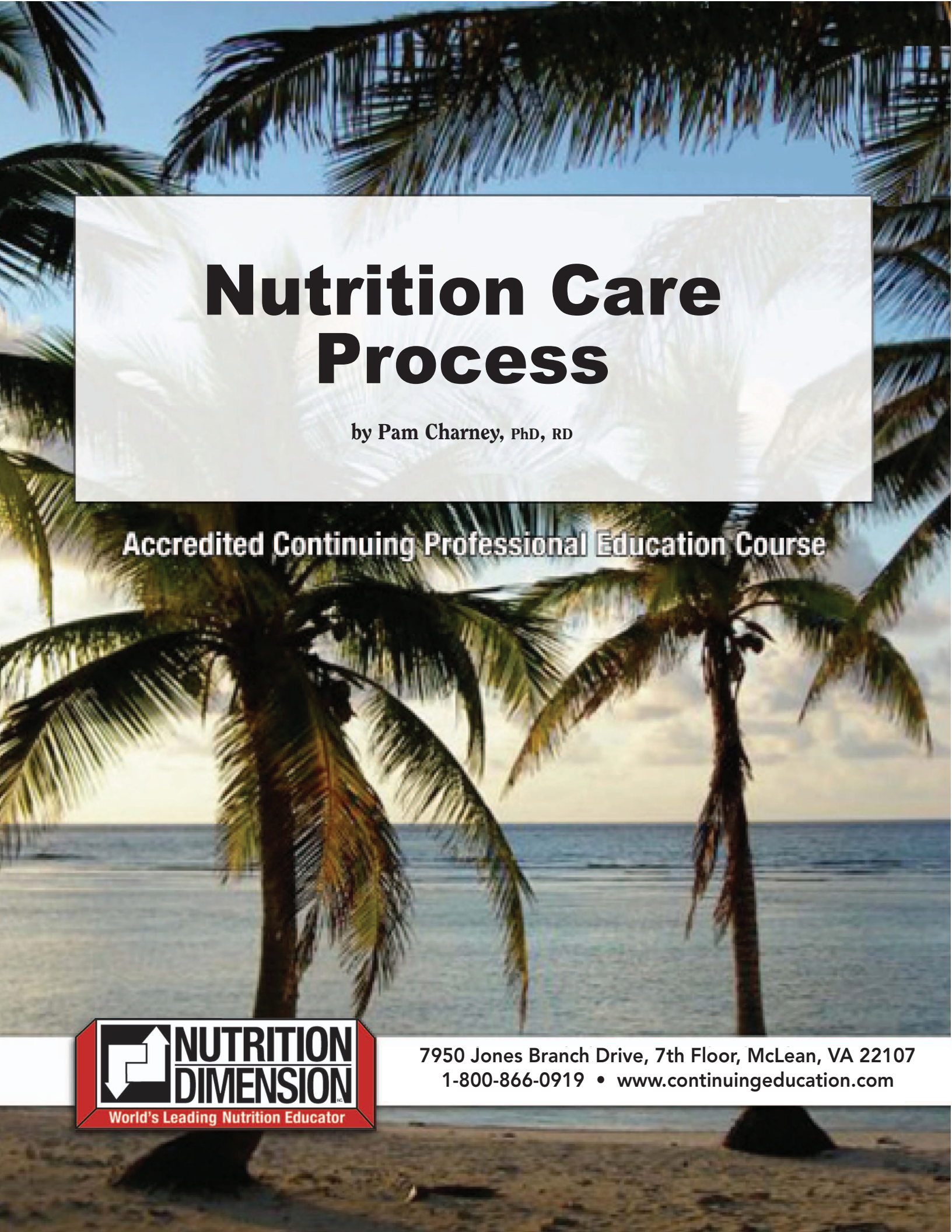

Nutrition Care Process

by Pam Charney, PhD, RD

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Nutrition Care Process

by Pam Charney, PhD, RD

About the author:

Pam Charney, PhD, RD has more than 20 years experience in nutrition support in a variety of care settings. She has managed clinical nutrition departments, nutrition support teams, and multidisciplinary clinics, and consults with groups to improve team effectiveness, implement nutrition informatics, evaluate healthcare quality, and develop advanced practice qualifications. She holds faculty appointments at the University of Washington and in the nutrition program at University of Medicine and Dentistry of New Jersey, where she completed her doctorate. Pam has served the American Dietetic Assn. in many capacities; she currently sits on the ADA Board of Directors and is a member of the House of Delegates Leadership Team. She has served on the Board of Directors of the American Society for Parenteral and Enteral Nutrition (ASPEN). She has received many awards and honors, including ADA's Award for Excellence in Clinical Nutrition, Dietitians in Nutrition Support's Distinguished Nutrition Support Dietitian Award, ASPEN's Outstanding Nutrition Support Dietitian Award, and the ADA Foundation Medallion Award. In 2006 she was named Outstanding Alumna by the University of Medicine and Dentistry of New Jersey. She is the first dietitian to be selected to receive a National Library of Medicine Fellowship. Her current emphasis is on developing informatics competencies for RDs, as well as to investigate knowledge sources in nutrition to ensure proper representation of dietetics in the electronic health record.

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RD, DTR.....8 CPEU
CDM..... 8 Clock Hours

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Contents

Learning Objectives

Upon successful completion of the course, learners will be able to:

1. *Relate the developments in health care that support use of a care process by dietitians.*
2. *Describe each of the components of the Nutrition Care Process and Model.*
3. *Discuss the benefits associated with using a standardized terminology in dietetics practice.*
4. *Identify the components of nutrition assessment as described in the Nutrition Care Process.*
5. *Gather information from a patient history using a case study.*
6. *Critically evaluate patient information to complete a nutrition assessment.*
7. *Discuss the differences between the medical diagnosis and the nutrition diagnosis.*
8. *Given a case scenario, correctly diagnose nutrition problems.*
9. *Write clear, concise P-E-S statements for brief case scenarios.*
10. *Given a case scenario, select interventions appropriate for a given nutrition diagnosis*
11. *Discuss rationale for selecting a nutrition intervention.*
12. *Determine own level of autonomy for implementing nutrition interventions depending on practice setting and level of experience.*
13. *Describe how goals are set for nutrition intervention.*
14. *List at least 2-3 goals for a given nutrition intervention.*
15. *Identify standards for comparison when selecting monitoring and evaluation parameters.*
16. *Define nutrition informatics.*
17. *Locate nutrition-related information using a search engine.*
18. *Critically evaluate appropriateness of web page content.*
19. *Develop an understanding of critical thinking skills.*

Introduction

In 2003, the American Dietetic Association (ADA) formally adopted the Nutrition Care Process and Model (NCPM). The NCPM gives dietetics professionals a framework for critical thinking and decision-making, regardless of area of practice or responsibilities. The seven years since adoption of the NCPM have been marked by a great deal of discussion focused on what the NCPM is, to whom it applies, and when it should be used. A simple answer to the second question is: if you are a dietetics professional, the NCPM applies to you. The first and third questions are the subject of this course.

Much of the confusion regarding the NCPM and the NCP can be clarified through simply learning more about what a care process is, who uses care processes, and the potential benefits associated with use of a care process.

The term "care process" describes an organized path for thinking that members of a health profession utilize to approach care. Dietetics is not the only health care profession that has a formal care process. Nursing, Occupational Therapy, and Physical Therapy, for example, have all defined care processes that make each profession unique and different from all others.

Some fear that using a care process will result in "cookie cutter" care being provided. These fears are simply the result of incomplete understanding of how care processes are used to ensure that patients/clients receive high-quality care. When professionals use a care process to guide their approach to care, it's less likely that important aspects of care will be overlooked.

For example, when physicians write patient-care orders for a patient admitted to acute care, the same framework is followed, regardless of the situation, in 99 percent of admissions. Orders include admitting diagnosis, patient condition, frequency of vital signs, medications, diet order, lab tests, nursing orders, and IV fluids.

These categories are always included (which helps define this as an "admission care process"), but that does not mean that each patient receives the same treatment during their admission. Each patient is different, and these differences are seen in orders that tell staff how often to check vital signs, what medications to give, which lab tests should be done, and what type of IV fluid to infuse.

Another reason to adopt a formal care process has to do with quality improvement. The past few years have seen a huge emphasis put on health-care quality and outcomes. Quality management experts have learned that it's impossible to improve care quality without completely understanding the processes used to deliver care. For example, let's say that a facility has noticed that the rate of post-operative surgical wound infections has increased. There are many reasons that patients might get a post-operative wound infection. Without fully understanding the process by which post-operative care is provided, it would be impossible to know which intervention would improve surgical outcomes.

The NCPM includes the four steps of the NCP, along with the characteristics of the RD and the systems in which RDs work. The internal characteristics include knowledge and skills, ability to communicate when working with teams, experience and training. In most cases, RDs can change many of the internal characteristics — additional training and education can be arranged, and personnel can be assigned to a particular type of patient. External characteristics of health-care systems include funding, patient socioeconomic status, and health-care system design. In many cases, external characteristics cannot be changed or at least are not under the RD's control. Both the internal characteristics of the RD and the external characteristics of the health-care system impact how RDs use the NCP to guide decision-making.

The NCP itself consists of four interrelated steps:

- Nutrition Assessment
- Nutrition Diagnosis
- Nutrition Intervention
- Nutrition Monitoring and Evaluation

In reality, RDs have always used some form of care process. Before 2003, dietetics students learned how to assess nutrition status, to identify a nutrition problem, to do something about the problem, and to evaluate the results of actions taken during the supervised practice component of dietetics education. Without an accepted care process, however, there was no consistent guidance for educators to teach a systematic approach to care. The NCPM provides that framework.

When all dietetics professionals use the NCPM to guide care decisions, other providers, patients, and clients can take comfort in knowing that RDs are responsible for assessing nutrition status, diagnosing nutrition problems when they exist, implementing nutrition interventions that treat those problems, and monitoring and evaluating the outcomes of the care provided.

Use of the NCP is supported in clinical settings through use of the International Dietetics and Nutrition Terminology (IDNT), a standardized terminology that dietetics professionals use to describe the work they do. As with care processes, other health professions utilize standardized terminologies to describe care provided. Some of these terminologies include the ICD terms used to define medical/surgical diagnoses for billing purposes, and CPT terms used to describe medical/surgical procedures. There are also several nursing terminologies in use as well.

This course begins with an overview of the NCP and how it supports dietetics practice regardless of the setting. It's often mistakenly assumed that the NCP only applies to clinical practice, but RDs can use the NCP to support decision-making regardless of the setting.

Each step of the NCP is described in detail in separate chapters. It will become apparent that while RDs have always been responsible for the steps of the NCP, a major change for most is the act of diagnosing nutrition problems. RDs must learn to utilize a diagnostic thought process to accurately evaluate information gathered during the nutrition assessment to arrive at the correct diagnosis. The diagnostic thought process is described, with examples of how RDs diagnose.

The next 10 years will see major changes in health care as the move is made to electronic medical records and increased use of technology. Electronic medical records utilize standard terminologies to store information in large databases. When the IDNT is used in electronic medical records, it becomes possible to create large amounts of information that can be used to evaluate nutrition care provided across care settings and demonstrate the positive benefits associated with nutrition care provided by RDs!

Because of the relationship between the IDNT, the NCP and electronic medical records, the course also includes an overview of nutrition informatics, which is the area of practice focusing on using technology to facilitate dietetics practice. Dietitians need to utilize technology as they never have before, and some find the prospect intimidating, as the rapid pace of change can be confusing. This chapter will help to bolster their confidence.

Notes

Chapter One: The Nutrition Care Process

The Nutrition Care Process and Model (NCPM) was formally adopted by the American Dietetic Association's (ADA) House of Delegates (HOD) in 2003. The NCPM includes the four-step Nutrition Care Process (NCP) along with a conceptual framework that describes the relationship between the dietetics professional and the setting in which they function.

Since its adoption, ADA has focused much time and attention on encouraging dietetics professionals (RD/DTR) to utilize the four-step NCP in practice. While acceptance of the NCP is improving, some professionals continue to resist. As we will see, this resistance is most often due to lack of understanding of what a care process is, how health care professionals use care processes, and how care processes can be used to demonstrate effectiveness of interventions in improving health outcomes.

This course will begin with a brief overview of the importance of how health care quality is defined and evaluated, explain why care processes are an important component of evaluation, and note how other health care providers utilize care processes.

Understanding of the NCP and the role of the RD/DTR in health care is greatly facilitated through knowledge of how nutrition care fits in overall health care evaluation.

Following this introduction, the NCP itself will be broken down and described in detail.

The health care environment

There is currently a great deal of interest being given to the quality, quantity and cost of health care provided in the US. The US has the most expensive health care system in the world, yet outcomes of care provided do not match associated costs.

The World Health Organization (WHO) reported that the US ranked 37th in the world in measures of "overall performance" (OP) of our health system, 54th in terms of fairness of individual financial contribution to health systems, and 15th in terms of overall health system ability to translate spending into health, which is termed "overall attainment"(OA) (WHO, 2000).

The WHO ranking system methodology has been criticized as subjectively biased. In WHO's words, it "...compares each country's system to what the experts estimate to be the upper limit of what can be done with the level of resources available in that country." By this criteria, the US is held to a higher standard than less affluent nations. At the same time, the US is penalized for spending "too high" a percentage of its gross domestic product (GDP) on health care.

Critics also cite structural flaws, especially in the OP figure most often cited by critics of our system (37th ranking). This ranking weights such factors as *Health Level* (25 percent), *Health Distributio*n (25 percent), *Responsiveness* (12.5 percent), *Responsiveness Distribution* (12.5 percent) *Financial Fairness* (25 percent) (Whitman, 2008). The OP figure is criticized on the grounds that only Health Level and Responsiveness are relevant to the quality of care. The others are seen as political criteria — equal entitlement to care is valued twice as much as short waiting times for diagnostic and surgical procedures. A place in line is worth more than the actual care.

The OA rankings are questioned because there is a sizeable margin of error in the underlying study, which is usually not cited in reports. Instead of 15th, the US might rank as high as 7th, or as low as 24th (Whitman, 2008).

Moreover, critics say, the ranking system ignores statistical, cultural and societal differences. Health Level uses *Disability Adjusted Life Expectancy* (DALE) as a prime criteria, but countries differ in their scoring methods. In Canada, Germany, and Austria, for example, a premature baby weighing less than 500 gm is not considered a living child. But in the US, such very low birth weight babies are considered live births. The mortality rate of such babies is extraordinarily high, so this discrepancy negatively skews US infant mortality statistics.

Cultural and societal factors affecting life expectancy include such things as obesity, reliance on automobiles instead of safer mass transit, ethnic diversity, pastimes and hobbies (motorsports, gun sports, extreme sports), liberal immigration policies and individual and group idiosyncracies in health care usage (patients who seek alternative cures or avoid health care on religious or philosophical grounds).

A series of reports by the Institute of Medicine (IOM) highlighted an unacceptably high occurrence of medical errors in the US (Kohn, Corrigan, *et al.*, 1999; Institute of Medicine, 2007) and the need to make fundamental changes in health care systems.

Recent attention given to how health care is provided, funded and evaluated has brought to light the need to closely look at all aspects of health care systems in order to improve effectiveness (Shortell and Singer, 2008).

While many focus on the outcomes of care, it is important to remember that outcomes cannot be improved unless the process by which care is provided is fully understood. Thus, dietetics professionals desiring to demonstrate the importance of nutrition care must first understand the process (NCP) by which nutrition care is provided.

Defining health-care quality

There are many concepts that are thought to be important components of quality health care. It can be difficult to describe the quality of care provided due to the complex interrelationships between these components. One definition of quality health care states that "The definition of quality may be almost anything anyone wishes it to be, although it is, ordinarily, a reflection of the goals current in the medical care system and in the larger society of which it is a part." (Donabedian, 1966)

Additionally, care quality is often defined differently depending on the viewpoint of interested stakeholders. Patients, health care providers, managers of health systems, and third party payers all would define health care quality differently. The chart below lists some of the differences in stakeholder definitions of health care quality. It should be remembered that health outcomes are not always the first priority when determining quality of healthcare.

Definitions of Quality Health Care

Stakeholder	Perceived Components of Quality Health Care
Health care provider	Smooth system functioning Timely and accurate communication Patient outcomes commensurate with inputs (taking into account factors beyond clinician control)
Patient/client	Timeliness of care Feeling that needs are heard and addressed Health outcomes within reasonable expectations
Health care manager	Cost-effectiveness Judicious use of resources
Third party payer	Cost-effectiveness Efficiency of care systems Care provided most likely to produce

Ransom ER, Joshi MS, Nash DB, Ransom SB eds. The Health Care Quality Book, second edition. Chicago, IL: Health Administration Press; 2008.

The RD must understand what the drivers for satisfaction are for stakeholders when describing healthcare quality. Without knowing what customers expect, it is impossible to provide high-quality nutrition care valued by patients/clients, other providers, health systems managers, and third-party payers. While most RD/DTRs are aware that in many settings the patient/client is the customer, they might not understand that other providers, employers and third party payers can also be seen as "customers."

Health care professionals who work alongside the RD/DTR are also customers, in that they expect a quick response to questions and concerns about nutrition care for patients. They also expect the RD/DTR to provide nutrition therapy that is evidence-based, takes into account the unique needs of the patient/client, is not in conflict with other therapies, and supports the patient/client's return to health. Employers to some extent are customers, in that they expect the RD/DTR to work efficiently, to meet expectations for skills and knowledge, and to represent the employer in a positive light.

Third-party payers are customers, in that they expect to reimburse for services provided that are effective, correctly billed, timely and evidence-based. All of these drivers for satisfaction help determine which measures of quality are important. To fully evaluate each component of quality care as defined by each stakeholder, the RD/DTR must determine not only what happened as a result of nutrition therapy but also how nutrition therapy was delivered — the process of care. Only then can a full description of the value of nutrition therapy in complex health systems be shared.

Defining 'Care Process'

Care processes have been defined as "the content of care, *i.e*, how the patient was moved into, through, and out of the health care system and the services that were provided during the care episode" (Council on Medical Service, 1986).

Evaluation of quality of care provided is accomplished through the study of care outcomes, as well as the methods by which care is provided. It sometimes seems that there is a greater focus on studying care outcomes to the detriment of evaluation of care processes. While this may make sense — after all, third party payers focus on outcomes for reimbursement — it's virtually impossible to improve outcomes without knowing what processes went into achieving a given outcome.

Because of this interrelationship, it's important to take a look at what a care process is and how consistent care processes support improved outcomes.

Avedis Donabedian was a pioneer in the evaluation of health care quality (Baker, 1993). Donabedian advocated for evaluation of care processes as a key component of the quality triad which includes *process*, *structure*, and *outcome* (Donabedian, 1966).

For example, trauma teams consist of individuals with different expertise, making it difficult to ascribe patient outcomes to actions taken by one individual. Evaluation of care processes associated with trauma care identified recurrent errors in some care processes, and that allowed focused interventions which have the potential to improve team function, and thus patient outcome (Hoyt, Hollingsworth-Fridlund, *et al.*, 1994).

When patient outcomes are not as expected, evaluation of care processes can determine if systems supporting the provider should receive closer scrutiny. We know that patients/clients who have chronic illness don't always receive care according to accepted guidelines. Similar experiences in surgical practice led to development and implementation of a surgical care process (Ostrom, 2008).

Lack of consistency in providing health care identifies the need to further evaluate care processes, including how nutrition care is provided. The chart below shows some of the problems that can be found following evaluation of care processes. We know that nutrition care is a vital component of the overall health care process, so it makes sense to fully understand the process by which we provide nutrition services in all care settings.

Deficiencies Identified by Process Measures

Actions not taken	Diagnosis delayed Necessary investigations not made Indicated treatment not given Treatment not being adhered to
Inappropriate actions taken	Wrong diagnosis Inappropriate investigations requested Inappropriate treatment given

Reprinted with permission from: Crombie IK, Davies HTO. Beyond health outcomes: the advantages of measuring process. *Journal of Evaluation in Clinical Practice*. 1998;4(1):31-38.

Care processes used by other providers

While we focus on the NCP and its impact on nutrition care it can be easy to overlook how other allied health professions use formal care processes. Nurses, physical therapists, and occupational therapists are just a few of the allied health professions that provide care based on a formal care process. Each of these professions has been using their care process for many years, making dietetics a late bloomer when it comes to describing a framework for how care is provided.

There are more than 3 million Registered Nurses in the US today. Nurses practice in a wide variety of settings and come from several educational pathways. What they all have in common is a framework for practice, the *Nursing Process*.

The American Nurses Association (ANA) defines the Nursing Process as "the essential core of practice for the registered nurse to deliver holistic, patient-focused care" (ANA, 2008). The Nursing Process as defined by ANA consists of five steps; assessment, diagnosis, outcomes/planning, implementation, and evaluation.

Occupational Therapists and Physical Therapists also use care processes to guide professional practice.

Occupational Therapists utilize the *Occupational Therapy Practice Framework*: *Domain and Process* to "articulate occupational therapy's unique focus on occupation and daily life activities…" (The American Occupational Therapy Association Inc., 2002). Physical therapists also utilize a care process, known as the *Guide to Physical Therapist Practice*, to provide a framework for describing the role of physical therapy in all health care settings (American Physical Therapy Association, 1995).

Each of these processes have similarities to the NCP in their focus on the relationship between the healthcare professional and the patient/client, including a series of interrelated actions, and provide a framework for describing their unique practice.

The Nutrition Care Process and Model (NCPM)

The NCPM includes the four-step NCP, along with descriptions of the unique knowledge and skills of the dietetics professional and the settings in which they practice (Lacey and Pritchett, 2003). In 2008, ADA published an update to the NCPM that included only minor changes, along with a more detailed explanation of the new International Dietetics and Nutrition Terminology (IDNT) (Writing Group of the Nutrition Care Process/Standardized Language Committee, 2008). Each of the four steps of the NCP will be described in the following chapters.

The NCPM includes a description of the knowledge and skills of the dietetics professional that describe professional practice. The important characteristics unique to the RD/DTR include:

- Critical thinking
- Collaboration
- Communication
- Evidence-based practice
- Code of ethics
- Dietetics knowledge
- Skills and competencies

Individuals should consult documents including ADA's Code of Ethics and Standards of Performance and Standards of Professional Practice (SOP/SOPP) for more information (The American Dietetic Association, 2008 and 2009). These documents allow the RD/DTR to best describe the skills, knowledge, and experience needed to perform a given task in dietetics practice.

The NCPM also includes characteristics of the practice setting that impact dietetics practice. These include:

- Social systems
- Health care systems
- Practice settings
- Economics

Each of these factors influence what the RD/DTR is capable of accomplishing through impact on time available, beliefs and attitudes prevalent in the care setting, financial incentives or barriers to nutrition practice, and access to nutrition therapy. It is obviously important that dietetics professionals be aware of current healthcare policy and funding in order to advocate for access to nutrition services.

Four steps of the NCP

The NCP includes four steps: *Nutrition Assessment, Nutrition Diagnosis, Nutrition Intervention*, and *Nutrition Monitoring and Evaluation*. While the terminology used to label the steps imply that the NCP is only for use in clinical settings, the process can be used by dietetics professionals regardless of the work setting or area of practice.

For example, consider the RD/DTR working as a nutrition and wellness professional in a business setting. When new opportunities for expansion of programs or product development arise, the RD/DTR might be expected to assess the business climate, diagnose opportunities and threats that might be present, develop an intervention to optimize product development and then monitor results. While examples from other practice areas will be used when possible, the focus of this discussion will remain on using the NCP in clinical practice.

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Chapter Two: Nutrition Assessment

Nutrition assessment is the first step of the NCP (Lacey and Pritchett, 2003) and chances are that it's the step dietetics professionals are most familiar with. Dietetics professionals are taught to assess nutrition status at the individual and population level. However, prior to adoption of the NCP, dietetics practice lacked a framework to ensure that each nutrition assessment utilized a common thought process, was comprehensive, evidence-based, and provided information that could be understood by others.

Nutrition assessment has five components:

- Food/nutrition-related history;
- Anthropometric measurements;
- Biochemical data, medical tests and procedures;
- Nutrition-focused physical findings; and
- Client history

If these components seem familiar, it's because they probably are! In the past, students and dietetics interns were often taught to assess nutrition status using an *A-B-C-D* approach: A stood for *anthropometrics*, B stood for *biochemical tests*, C stood for *clinical information* and D was *diet evaluation*.

The nutrition assessment is done following referral from some sort of screening process. Information contained in the referral varies with the practice setting. At a minimum, the referral provides information that identifies the patient — *e.g.* name, gender, age, medical diagnosis, and a brief explanation of the request.

Nutrition assessment begins as the RD reviews information on the referral and formulates a conceptual framework consisting of each assessment component. As information becomes available, it's stored for use later in diagnosing the nutrition problem. Let's briefly review each component of the nutrition assessment step of the NCP.

• **Food/nutrition-related history**. In order to determine if an individual or group's diet is adequate, information regarding intake must be gathered and evaluated.

There are many ways to gather the food/nutrition-related history; the method selected depends on the setting, the patient/client, and the type of information needed. For all methods, interviewers must have adequate training in order to assure greatest accuracy.

One of the simplest methods is to simply ask "What do you eat?" This is the tactic most often used by other health-care providers and usually results in responses that are vague and unhelpful. A 24-hour diet recall is a more focused way to ask "What do you eat?" Rephrasing the question to ask "Could you describe the foods and beverages you've consumed in the past 24 hours?" brings some focus to the evaluation. The interviewer then asks a series of non-leading questions in order to determine the amount and types of foods eaten. Examples of non-leading questions are shown below.

Non-Leading Questions to Obtain a Diet History

- At what time do you eat the first food or drink of the day?
- What are some examples of foods and/or drinks you would have at this time?
- How many times do you eat each day?
- How do you feel about eating?
- Are there any foods or drinks that you avoid and if so, why do you avoid them?
- What happens when you consume (specific food or beverage)?
- Are you following a special diet? If so, has someone explained the diet to you? What sort of foods or drinks do you consume? Do any of the other people you are living with follow the same diet?
- Have you noticed any changes in the amounts of foods and/or drinks you eat every day?

Accuracy of the 24-hour recall has been questioned (Karvetti and Knuts 1985); interviewers must be skilled in evaluating responses quickly and must ask additional questions when needed. Because this method is quick and provides reasonable accuracy when combined with other assessment information, it is often used in acute care.

Nutrition researchers and those working in community settings often require greater accuracy than the 24-hour recall can provide. *Food frequency questionnaires* (FFQ) and *food records* are often used in these settings.

When an FFQ is used, the interviewer typically provides the questionnaire, which can be paper or electronic, and explains how to respond to questions. The interviewee then completes the FFQ.

There are many FFQs available that have been validated in research focused on determining intake of specific nutrients or to evaluate general diet adequacy. FFQs that have been developed to evaluate intake in specific groups are also available. Care must be taken when developing FFQs in order to determine the types of foods to be included as well as the length of the survey instrument itself (Molag, de Vries *et al*., 2007, 2010). It is important to carefully review methodology used to develop and validate FFQs considered for use regardless of the practice setting (Masson, McNeill *et al*., 2003).

It is sometimes necessary to more closely evaluate the types and amounts of foods and beverages consumed; food records can provide great detail regarding nutrient intake (Kolar, Patterson *et al*., 2005). When completing a food record, patients/clients are asked to document each type of food or beverage consumed, the amount, and other factors such as recipes or cooking methods, so that sufficient information is available to calculate nutrient intake. There is a significant amount of training required for the person who will be doing the recording of intake. Because of the time commitment for training, actual recording of intake and for evaluating results, food records are most often utilized in outpatient or research settings.

Other components of the intake assessment include medication history, physical activity, prior nutrition interventions, and beliefs centered around food and nutrition (Cresci, 2009).

Use of prescription as well as over-the-counter medications is important due to potential interactions between medications and food. Additionally, use of complementary and alternative medications is becoming more popular. These substances also have the potential to interact with foods consumed, thus it is important to note any treatments or medications not prescribed by the patient's primary health care provider.

• **Anthropometric measurements** provide either an estimated or actual determination of some aspect of body composition. Body weight measured using scales provides an actual measure of total body weight; determination of body fat percentages using skinfold measurements provides an estimation of total body fat. It's important to remember the difference between actual and estimated anthropometric measures.

There are a variety of anthropometric measurements used in different practice settings. All require attention to technique used as well as calibration of equipment used. The choice of measurement is heavily dependent on the practice setting, time available, and need for accuracy. In most clinical settings, measures of body weight and height should be obtained on admission.

Body mass index (BMI) describes relative weight for height and is significantly correlated with total body fat content, though it doesn't describe fat content *per se.* It is used to assess overweight and obesity and to monitor changes in body weight. In adults, BMI is determined by dividing a person's weight in kilograms (kg) by height in meters squared (m^2). Even though the metric calculation has always been the standard, the US Preventive Services Task Force (USPSTF) also suggests using a non-metric calculation: weight in pounds (lb) divided by height in inches squared ($in.^2$), multiplied by 703. The results are not identical, but are sufficiently accurate for measurement purposes.

BMI is commonly used as a measure of obesity (Kyle, Unger, *et al.*, 2002; Cole, Flegal, *et al.*, 2007). In pediatric practice, height (or length) and weight are used to determine adequacy of growth by plotting measurements on standardized growth charts.

Body weight provides a measure of total body mass. In some cases, the RD/DTR will need information about the body compartments that combine to make up total weight. For example, in an infectious diseases clinic, percentages of fat and fat-free mass may change due to side effects of medication, while total body weight might not change at all. Thus, it would be important to know if body fat was increasing in spite of no change in total weight.

Bioelectric Impedance Analysis (BIA) is one method used to estimate body fat, based on electrical conductance of different body tissues (Pietrobelli, Andreoli, *et al.*, 2003; Jaffrin and Morel, 2008). Equipment used to determine BIA is portable and can be used in most care settings. Other measures of body composition such as Dual Energy x-ray Absorptiometry (DEXA) use equipment that is expensive, not portable, and most often used only in research settings.

• **Biochemical data, medical tests and procedures**. There are literally hundreds of diagnostic tests used to aid health-care providers in diagnosing medical conditions. In most care settings, dietetics professionals evaluate test results that have been ordered by another provider as part of a diagnostic work-up for a medical problem or to evaluate management of chronic disease. Based on the patient history and reason for the referral, additional tests might be requested as part of the nutrition assessment.

It is important to remember that invasive testing, which includes blood tests, should not be requested or ordered unless the results will clarify the nutrition diagnosis or lead to a change in patient management. For example, blood urea nitrogen (BUN) and serum creatinine are often used as surrogate measures of kidney function. These tests should not be requested unless the RD/DTR is concerned that kidney disease might be present (diagnosis) or will be using the results to evaluate the need to change a nutrition intervention based on the results (patient management).

Availability of laboratory and medical test results varies depending on the practice setting and how test results are reported. Federal statutes mandate transition to electronic medical records (EMR) by 2014 (Blumenthal, 2009). When fully implemented, an EMR allows clinicians to view electronically transmitted test results (National Institutes of Health, 2006).

During the transition period to use of EMRs, laboratory and test results might be communicated verbally or via a faxed, mailed or hand-carried document. Results will most likely be more readily available in acute and long-term care settings. Outpatient, ambulatory and community settings might not have quick access to timely test results and so might have to rely on other components of the nutrition assessment to accurately diagnose nutrition problems.

Numerous biochemical data, medical tests and procedures that could be valuable in assessing nutritional status are available. Most of the time a battery of testing is ordered when a patient is admitted to acute or long term care settings. These tests often include a metabolic panel (although this might be known by other names) that includes serum glucose, sodium, potassium, chloride, bicarbonate, BUN and creatinine. The table on the following page provides helpful information for evaluating these tests.

Other blood tests might be ordered depending on the *differential diagnosis*, sometimes called "the differential" or abbreviated as "the ddx." The differential is a "short list" of possible diagnoses that might be causing the patient's signs and symptoms. Additional testing is ordered in order to narrow this list and allow diagnosis of the correct condition. For example, the differential for a patient who has edema on physical examination and low serum sodium level might include congestive heart failure and liver failure. Further testing would be ordered to determine if either of these conditions is present.

Laboratory tests are available for evaluation of organ system function. A lipid panel includes measures of serum cholesterol (HDL, LDL and total) and triglycerides. Liver function tests include alanine aminotransferase (ALT) and aspartate aminotransferase (AST). If anemia is suspected, lab testing might include hemoglobin, hematocrit, mean corpuscular volume, serum folate and/or serum vitamin B_{12}.

Dietetics professionals must be familiar with many of these laboratory tests, including reasons for ordering and interpretation of results, in order to appropriately evaluate other information gathered during the nutrition assessment and to arrive at the correct nutrition diagnosis.

In addition to laboratory testing, other procedures might be included in the physician's search for the correct diagnosis, particularly when signs and symptoms are vague or non-specific. Diagnosing celiac disease provides one example. It is known that celiac disease might be present even in the absence of the common signs/symptoms; diarrhea, weight loss, and bloating (Barker and Liu, 2008). The definitive test for celiac disease is an intestinal biopsy done while the patient is consuming a diet including gluten-containing foods (Hopper, Hadjivassiliou, *et al.*, 2007). Tissue biopsies are often done when dysfunction or abnormality in a specific organ or organ system is suspected. It's important to understand why tests are ordered and the nutritional implications of results in order to assess current nutritional status, as well as to have an eye on future implications of positive or negative medical test results.

Evaluation of Basic Metabolic Panel Results

Test	Normal Values*	Comments
Glucose	70 -120 mg/dL	Elevated fasting blood glucose indicates need for further evaluation for diabetes
Sodium	135-145 mEq/L	Evaluates fluid and electrolyte balance in conjunction with physical exam
Potassium	3.5-5.2 mEq/L	Important in some patients with chronic kidney disease or those taking some diuretics
Chloride	101-110 mmol/L	Can be associated with disturbances in acid base balance. Evaluate in conjunction with other information
Carbon Dioxide (CO_2)	20-29 mmol/L	Can be used to evaluate acid/ base disorders
Blood Urea Nitrogen (BUN)	7-20 mg/dL	Measures waste products of protein metabolism (urea nitrogen). Normally filtered by kidney, elevated BUN might indicate declining kidney function.
Creatinine	0.8 -1.5 mg/dL	Waste product of muscle metabolism. Healthy kidneys excrete most creatinine produced. Elevated creatinine may indicate kidney disease.

*Normal range for laboratory tests may vary depending on the test methods and local practice. Be sure to check with your lab for normal values.

Medline Plus: Basic Metabolic Panel. http://www.nlm.nih.gov/medlineplus/ency/article/003462.htm Accessed March 3, 2010.

• **Nutrition-focused physical assessment (NFPA)**. Physicians and nurses are taught physical examination skills early in their careers. Until recently, dietetics was a very "hands-off" profession. Most RDs observe for physical signs of nutrient deficiencies but do not practice other physical assessment skills including percussion, palpation, or auscultation (Fuhrman, 2008). Advancing knowledge regarding the physical signs of nutrition problems makes it imperative that the RD learn physical examination skills commensurate with their knowledge, skill and experience.

The NFPA should be conducted using a format consistent from patient to patient in order to ensure that nothing is forgotten. Consistency in conducting the exam also reinforces what "normal" looks like, so that abnormal findings are more likely to be identified (Campbell and Lynn, 1990). Prior to beginning, explain to the patient the purpose and what will be done during the examination. Begin at the head and follow a systems approach.

Clinical manifestations of nutrient deficiency or excess are often nonspecific and subtle and must be evaluated in conjunction with other components of the nutrition assessment. Any abnormal findings must be communicated to the referring provider.

Examination begins without even touching the patient — the first component should be to simply observe the patient for changes that might signify presence of nutrition problems. For example, if poor dentition is noted in a patient who has lost weight, chewing difficulties or pain on eating might be associated with the weight loss.

Nutrition-focused physical assessment is covered in detail in Chapter Three.

• **Client history**. Obtaining a complete and accurate client history is an important component of practice for all health care professionals (Gillis, 2006). History taking begins with the reason the patient was referred for nutrition assessment, or the chief complaint. Next, determine current health concerns. This might include recent acute illnesses or surgery, changes in appetite or intake, weight changes (intentional or unintentional), usual weight, changes in ability to eat, functional status, appetite, and recent psychosocial stressors. As with the physical exam, information from this discussion of current health concerns might provide information that guides diagnostic decision-making.

Questioning then proceeds to the status of any chronic conditions that might be present. For example, the patient might mention having diabetes. Additional questions should determine whether this is type 1 or type 2 diabetes, when the diagnosis was made, how the disease is managed, and what is the patient's ability to self-manage. Other medical conditions, even if well-managed from a medical standpoint, have the potential to impact nutritional status. Thus it is important to thoroughly investigate the history and current status of each chronic condition.

The surgical history is as important as a history of chronic medical conditions. If the patient reports having surgery recently, the type of surgery, complications experienced, and nutrition concerns following surgery must be determined. While any surgical procedure can have nutritional implications, a history of gastrointestinal (GI) surgery should always signal the need for further probing.

Nutritional consequences of GI surgery might include dumping syndrome, early satiety, weight loss or deficiency of specific nutrients. Patients might present with vague complaints of post-meal nausea, light-headedness or fatigue; a complete history will assist in determining if these symptoms are due to dumping syndrome following gastric resection surgery. Similarly, a history of gastric resection surgery points to the need to evaluate vitamin B_{12} status.

Finally, the social history must be obtained. This includes socioeconomic status, role in the family, housing availability, transportation, support systems, and educational level. This information will facilitate planning the nutrition intervention. Nutrition education might need to be adjusted depending on health and nutrition literacy levels. Recommendations for services would be appropriate for patients/clients who are eligible based on income or other criteria. Information regarding meal planning or food purchasing also depend on resources available in the home.

Nutrition assessment: should we change?

RDs have been responsible for assessment of nutritional status in all care settings since well before the NCP was adopted. Does use of the NCP as a framework for critical thinking in dietetics practice mean that prior guidelines for assessing nutrition status were wrong? Let's look at one tool for assessing nutritional status, the *Subjective Global Assessment* (SGA) to determine if it can fit in the NCP.

The SGA was first described in a 1982 article published in the *New England Journal of Medicine* (Baker, Detksy, *et al.*, 1982). Following initial publication, the SGA has been validated in several care settings (Hirsch, de Obaldia, *et al.*, 1991; Hasse, Strong, *et al.*, 1993; Sacks, Dearman, *et al.*, 2000; Julien, Combe, *et al.*, 2001; Martineau, Bauer, *et al.*, 2005; Norman, Schutz, *et al.*, 2005).

The SGA relies heavily on the expertise of the clinician in gathering and evaluating information from the patient's history and NFPA. The SGA is entirely subjective in nature and relies on evaluating information with an eye towards how signs and symptoms observed impact nutritional status.

The medical history portion of the SGA evaluates changes in weight and food intake, along with gastrointestinal symptoms that have interfered with eating for more than two weeks and a quick evaluation of functional status. The physical examination portion focuses on the presence of subcutaneous fat stores, muscle wasting and edema. Each of these categories is rated using a subjective scale, followed by determination that the patient/client has either normal nutritional status, is mildly-moderately malnourished or has severe malnutrition.

The history and physical examination component of the SGA fit the nutrition assessment categories of the NCP. Weight change is an anthropometric finding; GI symptoms, muscle wasting, subcutaneous fat stores, and edema are nutrition-focused physical findings; changes in intake and functional status are part of the food/nutrition-related history.

Thus, RDs using the nutrition assessment categories of the NCP can utilize a validated nutrition assessment tool as well.

ADA's terminology for nutrition assessment

In 2005, ADA approved a specialized terminology for dietetics practice, the International Dietetics and Nutrition Terminology (IDNT).

IDNT contains four sets of terms and definitions, one for each step of the NCP (ADA, 2009). The nutrition assessment terminology section can be used to document information regarding findings from the assessment in the medical record. Many of the terms have a code associated with them, which makes use in an electronic documentation format easier. However, many terms are also included in terminologies currently in use in electronic medical record products.

RDs wishing to utilize the IDNT to document nutrition assessment information should talk to their information technology and informatics departments to determine the best way to implement for their facility. The reference manual for the IDNT can be purchased from ADA's website.

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Chapter Three: Nutrition-focused Physical Assessment

All healthcare professionals who obtain patient histories and conduct physical examinations learn the same overall techniques. Each profession then tailors the basic techniques to meet their diagnostic needs. For all providers, the physical assessment begins with a careful and thorough health history and moves to a step-by-step examination of the patient.

RDs are unique among healthcare providers, in that the RD conducts a history and physical examination that are focused on the nutritional components of health. Information gathered in the health history, combined with findings from the *nutrition-focused physical assessment* (NFPA), is used to accurately diagnose nutrition problems.

The NFPA is the next step in the NCP after the nutrition assessment and before the nutrition diagnosis. Adding the findings of a NFPA to the data from a nutrition assessment gives the RD the complete information to make a nutrition diagnosis.

Overview

Once the health history and nutrition assessment has been obtained, the "hands on" component of the NFPA begins. Physical examination consists of four components:

- inspection (visual);
- palpation (using fingertips and light pressure to identify subcutaneous structures beneath the skin);
- auscultation (listening with a stethoscope); and
- percussion (tapping on a body surface to assess fluid and solid structures) (Fuhrman, 2008).

Not all components are used for each section of the body. Each component will be discussed in relationship to the different systems of the body.

Palpation, auscultation and percussion are not always taught during the supervised practice component of dietetics education. Thus, RDs may have to undertake additional training to gain these skills. RDs who are able to conduct a complete NFPA are an invaluable asset to the team. The unique ability to evaluate findings related to food and nutrient intake and adequacy is vital.

For example, auscultation of bowel sounds ideally requires that the clinician listen for several minutes over each of the four abdominal quadrants. Physicians and nurses often do not take the time to do this. An expert RD would thoroughly listen in order to identify the safest route for feeding critically ill patients. Thus, it is important for RDs to develop skills needed to not only obtain a thorough nutrition history but also to conduct a NFPA and to communicate results to other healthcare team members.

Although many RDs would agree that NFPA skills are important to learn, it is likely that very few are able to conduct a head-to-toe examination. Physical examination skills are not a requirement for entry level dietetics practice (Commission on Accreditation for Dietetics Education, 2008). There is little information available describing why RDs aren't comfortable learning these skills; however, some of the following factors may apply:

- Few opportunities to practice skills.
- No role models and/or peer support (Edmunds, *et al.*, 2010).
- Lack of self-confidence.
- Belief that RDs should not be responsible for physical examination.

RDs must remember that while NFPA skills are a positive addition to their skill set, they do not have the ability to diagnose medical problems. Rather, the RD adds to information gathered all team members by noting that results of the examination are normal or abnormal and obtaining confirmation of any abnormal findings with a licensed independent provider in order to ensure that patients receive safe, high quality care.

Physical examination – an art and a science

Accurate physical assessment is an art as well as a science (Bickley and Szilagyi, 2007). It requires great focus and critical thinking skills to evaluate information gathered during the nutrition history and hands-on examination, which together facilitate correct nutrition diagnoses. RDs specializing in different areas of dietetics practice might have expertise in different components of the NFPA.

For example, RDs working in diabetes care must be able to evaluate foot care and insulin injection sites, and detect the presence of peripheral neuropathy. Sports nutrition experts need skills in evaluating gross and fine motor control. Nutrition support RDs must be able to evaluate gastrointestinal function and oral condition.

Also, RDs must learn to function as an interprofessional health care team member in order to avoid redundancy in the physical examination. Team members share information and results so that each component is done once unless there's a reason to question the results.

Filtering Nutrition Assessment Information

Component	Example	Nutrition Focus
Personal History	Age	• Nutrient needs vary according to age • The very young and very old may require assistance procur ing, preparing and consuming foods and beverages
	Gender	• Gender differences in nutrient requirements
	Socioeconomic status	• Income level impacts food purchasing ability • Family structure and roles in food preparation • Social support available in the community
	Educational level	• Education may drive selection of educational materials
	Race/ethnicity	• Cultural issues may impede or facilitate implementation of nutrition interventions • RD must have knowledge about cultural food choices • Translators may be required if language differences exist
Chief Complaint–Nutrition	Reason the patient/client was referred to the RD. The chief complaint can be a stated in the patient's own words or can be provided by the referring provider	• RD must assess patient/client understanding of impact of nutrition status on overall health and wellness • Include source of referral for sending reports and future communication
Past medical and Nutrition History	Chronic and acute health problems beginning with childhood illness	• Focus on conditions that have an impact on food choices and nutrition status • Include weight history, patient/client understanding of impact of weight on overall health status
Family History	Health concerns/cause of death of siblings, parents and grandparents	• Conditions with strong familial component • Includes nutrition concerns associated with inherited conditions

The RD must learn to take information gathered from the patient, medical record and health care providers and determine how to filter and focus nutrition assessment patient information. The chart on the previous page gives examples.

Conducting the NFPA

Review of Systems. The NFPA begins with the *review of systems* (ROS). When medical and nursing students learn to compete the ROS, they are typically taught a series of questions to ask patients. Learning to gather and sort a large amount of information is thought to help make the connection between a patient's description of a risk factor, symptom, or event and an actual clinical condition.

This list of questions is often shortened and customized based on the situation as the clinician gains experience. For example, when a patient who is complaining of a swollen, painful finger is brought to the emergency department, an experienced physician will focus on events that would be related to possible causes of the finger pain and swelling. Other questions might be asked depending on known risk factors (probing for subclinical problems; *e.g.*, if the patient is an overweight, middle-aged male, additional questions might focus on risk for cardiovascular disease), but the focus of the ROS is on the finger pain. A medical student conducting a ROS in the example above would ask more questions initially and take longer to begin to focus the questions on finger pain and swelling (Coderre, *et al.*, 2003).

What ROS questions should be included in the NFPA (Cresci, 2009)? First and foremost, it's important to evaluate weight status, as unintentional weight loss may be associated with serious health conditions (DeWys, *et al.*, 1980; Lankisch, *et al.*, 2001). It's also a good idea to ask about other health care providers the patient/client is seeing. (Remember that quite often information about other providers seen and therapies used might not be mentioned unless patients are asked.)

Remaining questions would depend on the reason for the visit, but might include:

- Skin (poorly healing wounds, discoloration; association with nutrient intake)
- Sleep habits (sleep apnea, mood disorders, night-time eating).
- Problems with chewing and swallowing; heartburn (avoidance of difficult to chew foods, need for education regarding nutrition interventions for heartburn).
- Shortness of breath, coughing (early satiety, subclinical aspiration).
- Gastrointestinal symptoms such as nausea, vomiting, diarrhea, constipation (food intolerances, food safety, irritable bowel syndrome).
- Muscle or joint pain, exercise tolerance (level of physical activity; need to collaborate with an exercise specialist for interventions).

The chart on the following page summarizes general observations and vital signs that are a part of the NFPA, with a discussion following.

Conducting A Nutrition-focused Physical Assessment

Component	Comments
General Observation	• Observe overall appearance, personal hygiene • Body positioning and posture • Presence of wounds, general skin condition • State of awareness, level of consciousness • Presence of feeding devices, IV lines, oxygen, other medical equipment • Preferred method of communication, reaction to others in area • Facial expression • Overall muscle mass • Subcutaneous fat presence and distribution
Vital Signs	• Blood pressure • Pulse • Respiration • Temperature

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Initial observation and vital signs

• **Environment.** Experienced clinicians know that the first step in conducting a NFPA is to put the patient/client at ease. Ideally the meeting takes place in a private office or exam room. If in a patient room, try to make sure there are curtains or drapes to create a quiet, personal space.

The RD should give a brief overview of what will happen at this meeting and begin by probing for the patient's reason for scheduling an appointment if this is an ambulatory or outpatient appointment. The RD might ask "When you scheduled your appointment with us, you mentioned your doctor wanted you to lose 50 lbs. Is that why you're here today?" When seeing inpatients, the RD should explain the reason for the visit; for example, "Mr Smith, your physician asked me to stop by and see you because we noticed you'd lost some weight recently."

• **Vital signs.** Although in many cases other professionals obtain vital signs, RDs must learn to obtain vital signs and to evaluate results.

For example, the RD might notice that a patient who has hypertension and a long history of poor adherence to diet and medication recommendations has a normal blood pressure noted at a clinic visit. Following the ROS, the current blood pressure results don't seem to match with past results and the patient's history. Therefore the RD decides to double check the blood pressure and finds that the earlier recording was in error.

Pulse and respiration. Once the patient is seated comfortably, it's time to check pulse and respiration. It's important to have the patient rest quietly for a few minutes before checking pulse and respiration, as values could be skewed by exertion.

Respiration is reported as breaths per minute. It's easiest, less noticeable and most convenient to check respiration while obtaining the pulse. Simply watch the patient's chest rise and fall and count breaths for 30 seconds and multiply by 2. The normal respiratory rate for adults is between 12 and 20 breaths per minute.

The pulse is the movement of blood through the arteries. When the heart beats, the walls of the arteries swell with blood. Between beats, as the blood moves along, the walls shrink back to normal size. The rhythmic swelling and shrinking is what you feel when you take a person's pulse. The pulse, which is felt with each ventricular contraction, can be obtained by placing fingertips on any large artery that is near the skin (Alexis, 2010). The radial artery, situated near the wrist, is easily accessible and most often used for measuring pulse. Never use your thumb to take a pulse. It has a pulse of its own, and what you feel while trying to locate a pulse may be your own beating heart and not the injured person's.

If both wrists are not available, other common locations to take a pulse are at the femoral artery in the groin, between the muscles on the inner side of the upper arm, or — rarely, because of the sensitivity of the area to pressure — at the carotid artery, located below the ear, on the side of the neck directly below the jaw.

As with respirations, pulse can be obtained by counting for 30 seconds and then multiplying by 2 or by counting for 15 seconds and then multiplying by 4. In addition to counting the beats, try to note if the pulse is regular or if there are changes in the feelings of "fullness" with each beat. If either of these are noted, it's a good idea to start again to verify the findings.

Abnormal pulses may be described as "thready", meaning that the pulse is barely perceptable or that the beats are not a uniform distance apart, or "bounding", where the pulse is strong and forceful. The normal pulse rate for an adult is 60 to 100 beats per minute (bpm) (Jones, Higginson, *et al*., 2010). Babies can have pulse rates up to 120 bpm; young children's pulses range from 80 to 160.

Blood Pressure. Blood pressure provides a measure of cardiac output, blood volume and resistance to flow caused by peripheral blood vessels. Most are familiar with the notation used for blood pressure, "x over y" where x represents the systolic pressure and y represents diastolic pressure. Systolic pressure is the maximum pressure generated on the arterial wall when the ventricle contracts during a heart beat. The diastolic pressure is the pressure exerted when the ventricle relaxes. Blood pressure is measured using a sphygmomanometer.

Numerous types of this device exist, from the old-fashioned bulb type to modern digit machines. Accuracy depends on regular calibration and proper fit of the arm cuff. As technology improves, more and more often readings will be automatically downloaded into the patient's electronic medical record. However, clinicians will still need to utilize clinical judgment to ensure that the correct sized cuff is used and that readings are consistent with other findings.

When manually determining blood pressure, it's important to ensure that clothing is not underneath the cuff and that the patient has had an opportunity to sit quietly for a few minutes, as emotions are known to affect blood pressure readings. The clinician is well advised to repeat the measurement if there is any doubt about accuracy.

Mercury is used as the measurement unit in documenting blood pressure results, as manual sphygmomanometers utilize the height of a column of mercury to denote results. Digital machines continue to use this standard, though they sense pressure electronically. In general, normal blood pressure for adults is less than 130 mm Hg systolic and up to 85 mm Hg diastolic (Fuhrman, 2008).

System-specific nutrition focused physical assessment

Once a general overview of the patient is conducted and vital signs are taken, the next step is a system specific nutrition focused physical assessment, which includes:

- head and neck;
- skin;
- chest;
- gastrointestinal;
- musculoskeletal and extremities; and
- neurologic.

The chart on the following page lists the various body systems and what the dietitian should be looking or listening for.

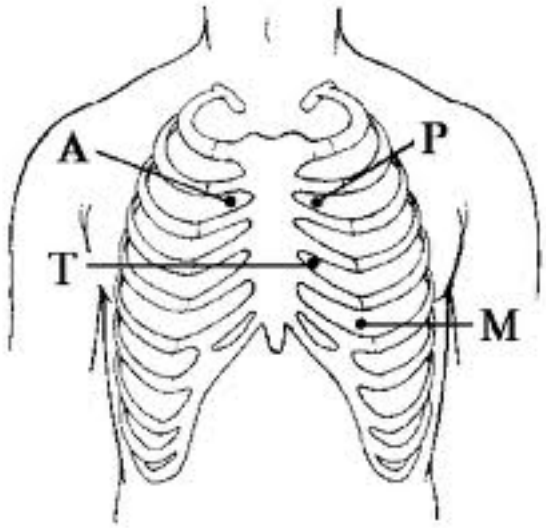
System Specific Nutrition Focused Physical Assessment

Body System	Nutrition Specific Evaluation
Head and Neck	• Condition of hair • Eyes; movement, color of sclera • Conjunctiva • Xanthomas • Mouth; lesions, dentition, tongue movement
Skin	• Color, pigmentation • Integrity; presence of wounds, bruises or other lesions • Quality of wound healing • Edema • Petechia • Temperature
Chest	• Symmetry • Breath sounds • Heart sounds • Muscle wasting
Gastrointestinal	• Ascites • Bowel sounds • Distension • Firmness to touch • Presence and quality of bowel sounds • Feeding devices and / or ostomies
Musculoskeletal and Extremities	• Amputations • Gross and fine motor control • Gait • Muscle wasting • Strength • Symmetry • Involuntary movement • Pain on movement • Presence of edema
Neurologic	• Level of consciousness • Coordination of movements • Aphasia • Dysphasia

American Dietetic Association. International Dietetics and Nutrition Terminology Reference Manual, 2nd ed. ADA, Chicago, IL, 2009
Bickley LS, Szilagyi PG. Overview of Physical Examination and History Taking. In Bickley LS, ed. Bates Guide to Physical Examination and History Taking, 9th edition. Lippincott, Williams & Wilkins, Philadelphia PA, 2007.
Fuhrman MP. Nutrition-Focused Physical Assessment. In: Charney P, Malone A. ADA Pocket Guide to Nutrition Assessment, 2nd edition. American Dietetic Association, Chicago, IL, 2009.

Systems requiring auscultation

Cardiac auscultation. Although RDs may not be called upon to auscultate lung and heart sounds, it is important to learn this skill as well as to understand the difference between normal and abnormal sounds. The graphic below shows points on the body for auscultation of heart sounds.



A=Atrial valve. P=Pulmonary valve. T=Tricuspid valve. M=Mitral valve.

Heart sounds are best heard not directly over the valve, but rather in a location where sound reverberates nearby. For this reason, RDs should practice listening to heart sounds with an experienced mentor to learn the best locations as well as to determine the difference between normal and abnormal sounds. RDs should listen for the normal "lub-dub" sounds which indicate systole and diastole.

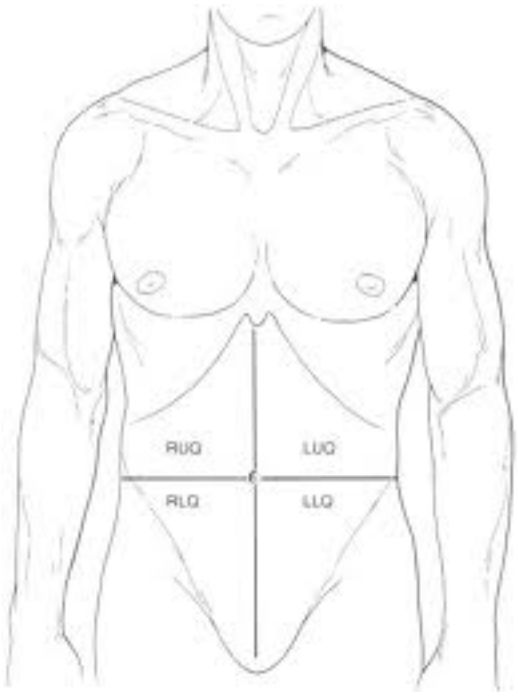
Lung Sounds. In addition to listening to heart sounds, RDs can also learn skills needed to determine if lung sounds are normal or abnormal. Additional findings that indicate respiratory abnormalities include cyanotic (bluish appearance) fingernails and clubbing of fingers. Abnormal lung sounds include "crackles" or "rales", which may indicate fluid accumulation and sound like clicking or rattling. Wheezing is a continuous whistling sound caused by a narrowing or obstruction in the lung or respiratory tract.

Bowel Sounds. As mentioned earlier, there is great variation in how healthcare professionals listen to and interpret bowel sounds.

In healthy individuals the presence or absence of bowel sounds is of little diagnostic significance (Goldberg, 2007). Bowel sounds become important when evaluating acutely ill patients to determine status of the gastrointestinal (GI) tract.

It has been recommended that if no bowel sounds are heard that the clinician listen in all four quadrants for at least 1 minute in each quadrant and for as long as 5 minutes (Baid, 2009). Quadrants are shown below.

Expert clinical judgment is needed to determine the significance of absent or faint bowel sounds. Remember that the absence of bowel sounds does not necessarily indicate the absence of GI function, bowel sounds simply indicates that additional information should be considered before decisions can be made regarding GI function and the ability to initiate oral or enteral feeding. In fact, one study found that bowel sound examination was not needed to assess GI function in patients who had undergone abdominal surgery (Madsen, *et al*., 2005).



The information gathered in a NFPA is part of a complete nutrition assessment. Once all the data from the medical record, patient interview and physical assessment is gathered, an accurate assessment of a patient's nutritional problems can be made, including a nutrition diagnosis.

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Notes

Chapter Four: Nutrition Diagnosis

Step two of the NCP is Nutrition Diagnosis, which is defined as the "identification and labeling of nutritional problems that dietetics practitioners are responsible for treating independently" (Lacey and Pritchett 2003). This concept is vital to dietetics practice, as it identifies the RD as the health-care provider who is solely responsible for diagnosing nutrition problems — in effect, solidifying the role of the RD in health care. By taking responsibility for identifying and treating nutrition problems, the RD becomes an indispensible member of the health-care team. RDs can use the NCP and other supporting documents such as *American Dietetic Association Standards of Practice and Standards of Professional Performance* to determine personal scope of practice and expertise in the diagnostic process (ADA, 2008).

There has been some controversy regarding the ability of an RD to diagnose. According to the US Bureau of Labor Statistics, dietetics is a diagnosing profession (Bureau of Labor Statistics, 2008). In fact, many RDs have been diagnosing nutritional problems for some time but have simply not called it "nutrition diagnosis." It makes sense that the RD should diagnose the nutrition problems for which he/she is responsible for treatment. Other health professions are responsible for diagnosing and treating problems that are within their scope of practice and professional domain.

Confusion arises when the term "diagnosis" is defined to mean only *medical* diagnoses. It is correct that only physicians can (and should) diagnose medical problems. However, the RD is the health professional who has the unique training and experience to diagnose nutrition problems.

ADA terminology for nutrition diagnosis

In 2005, the ADA approved a specialized terminology for dietetics practice, the International Dietetics and Nutrition Terminology (IDNT). IDNT contains four sets of terms and definitions, one for each step of the NCP. There are over 60 nutrition diagnoses included in the IDNT (ADA, 2009). Each diagnosis fits into one of three categories, explained in the table below:

- Intake
- Clinical
- Behavioral-Environmental

Definition of Categories of Nutrition Diagnoses*

Category	Definition
Intake	Too much or too little of a food or nutrient compared to actual or estimated needs
Clinical	Nutrition problems that relate to medical or physical conditions
Behavioral – Environmental	Knowledge, attitudes, beliefs, physical environment, access to food, or food safety

*American Dietetic Association. International Dietetics and Nutrition Terminology (IDNT) Reference Manual, 2nd ed. Chicago: ADA; 2009

What is a diagnostic thought process?

Health-care professionals typically use a defined thought process when faced with a diagnostic dilemma. This thought process is sometimes known as *diagnostic reasoning, clinical judgment* or *diagnostic thinking*. Several theories describing this thought process have been described in the literature (Tanner, 1987).

While there is no firm agreement on one particular theory that describes how all health-care professionals diagnose, there is growing agreement that health care professionals appear to use different thought processes depending on level of skill, training, knowledge and experience. Broad types of diagnostic thinking include the following:

- Strategy of exhaustion
- Logical algorithm
- Hypothetico-deductive reasoning
- Pattern recognition
- Intuitive approach

These theories are described in the table below. Correct diagnosis of nutrition problems is a major component of the RD role in health care. Dietetics educators must begin to teach a diagnostic thought process, and not simply choose a nutrition diagnosis. The following quote discusses this concept from a nursing perspective but is applicable to dietetics as well:

> It is agreed that effective and efficient diagnostic skills to assess and identify clients' clinical conditions are the bedrock of subsequent planning and implementation of high-quality nursing care. Hence, skilled diagnostic practice becomes an increasing concern of the nursing profession." (Lee, Chan, *et al*., 2006).

Thought Processes To Solve Diagnostic Dilemma

Theory	Definition	Comments
Strategy of exhaustion	Collect all relevant information without prior thought then sift through for the diagnosis	Most often used by novice clinicians — may also be used by more experienced when the situation is novel or unexpected
Logical algorithm	Answer a series of yes/no questions to arrive at the most likely diagnosis	Often used in areas where support personnel are managing triage, or in high volume settings (ER)
Pattern recognition	Characteristics of the case elicit memory of prior experience with the same	Works best when the condition is relatively rare and the signs/symptoms are highly specific to the condition
Hypothetico-deductive reasoning	Early problem formation guides subsequent information gathering	Supported by mathematical models describing the probability a diagnosis exists based on diagnostic test results
Intuitive approach	Relies heavily on experience of clinician making the diagnosis	Combines features of the hypothetico-deductive approach with clinician experience and knowledge in complex situations

Lee and Chan (2006)
Croskerry (2009)

According to Lee and Chan, development of diagnostic skill is dependent on characteristics of the clinician, including knowledge and experience as well as characteristics of the event, including task complexity, and psychosocial — cultural factors.

The best method to teach diagnostic skills is still debated (Bowen, 2006). While there is much research in this area in medical and nursing education very little is known about how RDs develop diagnostic skills. Research strongly suggests that a background in basic science and an understanding of the causal mechanisms of disease are essential to full development of diagnostic reasoning (de Bruin, Schmidt, *et al.*, 2005) (Woods, Brooks, *et al*., 2007).

Nurses with more than five years experience appear to utilize an intuitive diagnostic thought process more effectively than students did, lending credence to claims that diagnostic skills develop over time (Ferrario, 2003). Until research focused on how RDs learn expert diagnostic skills becomes available, extrapolations must be made from medical and nursing research. Because nutrition interventions are an integral part of health care, there is no reason to suspect that nutrition diagnostic skill development and progression to expert diagnostician would follow a different pathway from that experienced by nurses and physicians.

Diagnosing nutrition problems

Emerging research indicates that there may be differences in the number of nutrition problems diagnosed by entry level, mid-career, and expert RDs (Charney, Touger-Decker, *et al*., 2006). It is thought that as RDs gain experience they also sharpen the ability to critically evaluate information gathered during the nutrition assessment and the accuracy and applicability of that information to the current situation.

Diagnosis of nutrition problems begins with information gathering and clustering done during nutrition assessment. Let's look at this example:

FI is a 46 year-old male who was referred to the outpatient RD by his oncologist. The initial referral stated that FI has stage II esophageal cancer, had surgery three months ago and is currently receiving radiation therapy weekly. When FI arrived for his appointment with the RD, he completed a patient screening form indicating that he lost 20 lbs and has had problems with mouth pain and swallowing that began before his initial diagnosis.

The following information was gathered during the nutrition assessment:

- FI is married and has 4 children; three have finished college and the youngest will start college next year
- He is self-employed as a high tech consultant and now has health insurance but is worried that if he has to stop working he will lose his insurance, his wife also works part time as a legal assistant
- Prior to diagnosis FI was generally healthy with no other chronic illnesses

- His family history is positive for prostate cancer (paternal) and type 2 diabetes (maternal grandmother)
- Approximately four months ago FI noticed that he had trouble swallowing certain foods. This progressed over a few weeks until he felt that he was "choking" when trying to eat most solid foods. At that point, he saw his physician.
  The next week, he had diagnostic tests that revealed an esophageal tumor. At this point, his surgeon feels that the surgery was successful and no visible tumor remains; radiation therapy will continue for the next four months. Radiation therapy is causing mouth pain that FI says keeps him from enjoying eating.
- FI says that he tires very easily; before surgery, he worked out four days per week for about an hour and ran 2 to 4 miles at least once per week. He now tries to take walks every day but often is very limited by fatigue, especially since he is also trying to work at least part-time.
- FI's diet now consists of mostly soft foods like mashed potatoes, hot cereals, creamed soups and very well-cooked vegetables. His wife was instructed by the inpatient RD on optimizing calorie and protein content of the foods that he can eat. His wife is also concerned that he has not regained any of the weight he lost, and says he is "pale." FI and his wife feel that he is eating about 50 to 75 percent of most meals.
- A 24-hour recall combined with a food frequency questionnaire reveals that FI now consumes an average of 75 to 80 percent of his estimated energy and protein requirements. He has been taking a liquid multivitamin and mineral supplement daily.
- The physical exam is remarkable for evidence of loss of subcutaneous fat stores; FI has mild temporal wasting. His skin is warm and dry and he has a surgical scar that is healing well. He also has radiation markers. The RD notes that FI does appear slightly pale. The cranial nerve exam is within normal limits. There is no edema. The RD does a quick oral screening examination; FI has all of his teeth. However, the oral mucosa appear to have abnormal areas of redness and inflammation.

After gathering this information, the RD must now diagnose any existing nutrition problems. While all information gathered during the nutrition assessment is important, correct diagnosis of nutrition problems requires that the RD filter each piece of information to determine accuracy. Once accuracy is established, information must be evaluated to determine if it is abnormal and if it is, does it lead to diagnosis of a nutrition problem. The table on the following page illustrates one way that the information might be filtered. Much of this filtering is subconscious, particularly for RDs who have experience and critical thinking skills needed to diagnose.

Filtering Nutrition Assessment Information

Category	Information	Comment
Food/nutrition-related history	• Mostly soft foods • Wants to increase variety • Diet history reveals consuming 75-80 percent of estimated needs • Takes liquid vitamin/mineral supplement daily	This history is probably reliable; it was obtained from the patient and his wife. Estimated energy and protein intake are consistent with other findings from the nutrition assessment
Anthropometric measurements	• None available	The RD will request an accurate height and weight as well as a weight history
Biochemical data, medical tests and procedures	• None available	None needed at this time
Nutrition-related physical findings	• Pale appearance • Loss of subcutaneous fat stores • Mild temporal wasting • Skin warm and dry • Well-healing surgical scar • Radiation markers • No edema • Abnormal appearing oral mucosa	The loss of subcutaneous fat as well as temporal wasting are cues that the RD will use to facilitate diagnosis of nutrition problems. The RD also notes FI's pale appearance; if not consistent with a nutrition diagnosis this will be noted and communicated to FI's physician
Client history	• Wife concerned about weight • Easily fatigued; prior to illness was active and athlectic • Family history non-contributary at this time • Married with 4 children • Self-employed, has health insurance but fearful insurance will be lost if he can't work • Does not enjoy eating due to pain	FI's continuing fatigue is of concern and will be noted. The RD also notes that FI has a good prognosis following surgery and radiation but it will be vital that he maintain adequate nutrient intake during radiation therapy. It is also noted that prior to this illnes FI had been active and athletic and had no nutrition concerns. FI's quality of life is limited by pain on eating

The RD is now ready to diagnose nutrition problems that might be present and develop the *nutrition differential*, a quick list of diagnoses that might be present, based on known information (Zunkel, Cesarotti, *et al*., 2004; Papa, Oglesby, *et al.*, 2007). Knowing that weight loss is of concern in patients undergoing cancer therapy, and that FI lost weight prior to surgery and has not regained any weight, the first problem considered is "unintentional weight loss."

Other nutrition problems that might be considered include those in the table below, which also illustrates the thought process used to rule in or rule out diagnoses listed.

Nutrition Differential Diagnosis for Patient FI

Nutrition diagnosis considered*	Rational	Ruled in/Ruled out
Increased energy expenditure	Radiation therapy and recent surgery may increase energy expenditure	Ruled out: Literature does not support this diagnosis, nor does the patient history
Inadequate oral food/beverage intake	Diet history and history of weight loss	Ruled in
Swallowing difficulty	Reports of problems swallowing prior to diagnosis	Ruled out: Following surgery FI no longer reports problems with swallowing
Masticatory difficulty	Mouth pain that inhibits ability to eat normally and abnormal appearing oral mucosa	Ruled in
Impaired nutrient utilization	Weight loss, oral lesions, radiation therapy	Ruled out: Literature does not support this diagnosis
Underweight	Evidence of subcutaneous fat loss Temporal wasting	Ruled out: Without current weight or weight history it cannot be determined if FI weighs less than some reference standard.
Involuntary weight loss	Patient history Diet history	Ruled in
Malnutrition	Patient history Diet history Temporal wasting	Ruled out: FI's symptoms and physical exam do not appear to fit the defining characteristics of malnutrition at this time

*American Dietetic Association. International Dietetics and Nutrition Terminology, 2nd edition. ADA, Chicago IL. 2009.

Communicating the nutrition diagnosis — Problems, etiologies and signs/symptoms

The ADA Nutrition Care Process/Standardized Language Committee recommends that nutrition diagnoses be communicated to others through a specialized phrase called the "PES Statement" (Problem, Etiology, Signs/Symptoms) (Lacey and Pritchett 2003). PES statements include the following components:

- Problem: the nutrition diagnosis
- Etiology: the factor or factors that most likely were the cause of the problem
- Signs/Symptoms: the findings elicited by the health-care provider (temperature, pulse, heart rate) or symptoms described by the patient (fever, pain, cough) that are associated with a nutrition diagnosis

Learning to write clear, concise PES statements can be challenging at first. PES statements must communicate to others on the healthcare team a description of what the RD diagnosed, the findings that supported the diagnostic decision, and a quick snapshot of the cause of the diagnosis. Most healthcare providers are extremely busy and no longer have time to sift through extremely long or poorly written documentation. Thus it is imperative that RDs learn to write short, concise PES statements that accurately describe the nutrition diagnosis.

Here are some quick rules of thumb:

- Use as few words as possible; more than 20 to 25 words signifies the need to edit.
- Each statement should include one diagnosis, one etiology and one sign/symptom. It's not necessary to list every finding under "S".
- In order to help the reader quickly grasp why a particular diagnosis was identified, the sign/symptom included should ideally fall under the same domain as the diagnosis. (For example, if the diagnosis is from the intake domain, then the sign/symptom used to write the PES statement should describe what was abnormal about intake.)
- Each patient/client may have more than one nutrition diagnosis (just as they might have more than one medical or nursing diagnosis); facility policy regarding documentation will determine if each nutrition diagnosis must be communicated using a PES statement or if some may simply be listed based on their priority/severity.

Returning to our patient FI, we note that he has three nutrition diagnoses:

- Inadequate oral food/beverage intake
- Masticatory difficulty
- Involuntary weight loss

For the purposes of this discussion, three PES statements will be written. First, it's important to think about which diagnosis will be the focus of the initial nutrition intervention. There is no hard and fast rule for determining which diagnosis has the highest priority. RDs must use critical thinking skills and consider input from other health-care providers, as well as patient/client needs.

The impact of resolving one diagnosis over others should also be considered. For example, FI has mouth pain that leads to problems with chewing, which in turn leads to suboptimal intake and, finally, to weight loss. The RD in this case is working in an ambulatory clinic and will be seeing FI on a regular basis when he comes for radiation therapy. Given the cascade effect that FI's masticatory difficulty has on his health and nutrition status, the RD decides that this is the priority diagnosis. Therefore, the first PES statement is written as follows:

> *Masticatory difficulty related to oral pain as evidenced by patient reports and oral lesions visible on exam.*

Next, the RD considers the diagnosis statement that will be documented in FI's medical record: inadequate oral food/beverage intake. The PES statement should be concise, yet provide sufficient information for other health-care providers to quickly determine what the RD found and why the nutrition diagnosis was identified, plus a succinct description of the cause. So, this diagnosis was described as:

> *Inadequate oral food/beverage intake related to oral pain limiting ability to eat as evidenced by patient and wife report consuming 50 to 75 percent of most meals.*

Finally, the RD evaluates FI's weight status and describes her findings using a third PES statement:

> *Involuntary weight loss related to consumption of 75 to 80 percent of estimated energy needs as evidenced by 20 lb weight loss.*

Notice that the RD ensured that each PES was focused on one nutrition problem, had an etiology that briefly described the cause of the problem, and included a succinct description of the sign/symptom that was most directly related to the diagnosis.

For example, the sign/symptom used for the nutrition diagnosis "involuntary weight loss," was a description of FI's weight. Similarly, consumption of 50 to 75 percent of meals described the diagnosis "inadequate oral food/beverage intake." The symptom reported by FI ,as well as the abnormal oral exam done by the RD, were used to describe masticatory difficulty.

The RD then documents the patient visit using the format approved for use by the facility and includes the three PES statements. There is no requirement from ADA or any regulatory agency that a specific documentation format be used; the NCP is a framework for critical thinking, not a guide to practice. Thus, RDs using the NCP are not constrained to using any particular documentation method.

As we will see later, the three nutrition diagnoses, their causes and signs/symptoms will facilitate planning and implementing the nutrition intervention. The RD provides (when possible) a measurable change in the sign/symptom that will allow quick determination of the effectiveness of nutrition interventions during follow up (monitoring and evaluation) visits.

Using IDNT to document nutrition diagnoses

While not required for documenting nutrition care, it is highly recommended that RDs utilize the recently developed International Dietetics and Nutrition Terminology (IDNT) to describe each component of the NCP (ADA, 2009). Each term in the IDNT is defined and includes a "worksheet" that provides additional information helpful for ruling in or ruling out a given diagnosis.

The terms also have codes associated with them, which are necessary for use in an electronic medical record (EMR). When nutrition diagnoses and their accompanying codes are incorporated into an electronic system, development of templates and forms to describe nutrition care is possible. When information is added using codes, it becomes possible to develop large databases that can be used by researchers to evaluate the effectiveness of nutrition care. Thus, use of the IDNT and the NCP ultimately help to streamline documentation of nutrition care, enhance the role of the RD as a vital member of the health-care team, and ensure that the positive outcomes associated with nutrition care are demonstrated.

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Notes

Chapter Five: Nutrition Intervention

Nutrition Intervention is defined as "purposely planned actions intended to positively change a nutrition-related behavior, environmental condition or aspect of health for an individual (and his/her family or caregivers), target group or the community at large" (ADA, 2009).

As with other components of the NCP, RDs have always been responsible for implementing nutrition interventions. The NCP provides a framework for consistent description of interventions across care settings. Additionally, use of the NCP helps connect findings from the nutrition assessment that led to diagnosis of a specific nutrition problem to implementation of a nutrition intervention that is focused on improving the diagnosis. Finally, the NCP makes the connection between the previous steps and selection of monitoring parameters that demonstrate the impact of nutrition care provided by the qualified RD.

Nutrition interventions include direct interventions that the RD does "to" or "for" the patient or client, as well as indirect interventions where the RD might request that someone else take the desired action. The goal of both direct and indirect nutrition interventions is to improve or resolve the nutrition diagnosis.

Nutrition interventions included in the IDNT include many that can be considered either direct or indirect depending on the situation and RD. It is up to the individual RD to determine if he/she has the knowledge, skill, and experience needed to implement an intervention or should request that another healthcare professional should implement the intervention needed.

Examples of direct nutrition interventions might include nutrition education, insertion of an enteral feeding tube, or providing recipes for modified diets.

Interventions that can be done by the RD depend on the skill, knowledge and expertise of the RD as well as facility policy regarding credentialing and privileging.

The American Dietetic Association (ADA) provides a number of tools to assist the RDs who are interested in expanding the number of direct nutrition interventions that they are able to implement. At the entry level, eligibility for registration is determined through completion of educational and supervised practice requirements (Commission on Accreditation for Dietetics Education, 2003, 2008).

At this point, the Commission on Dietetic Registration (CDR) does not recognize advanced practice credentials; there are, however several specialty certifications available including oncology, pediatric, and renal nutrition (CDR, 2010). Other organizations also provide specialty certification in diabetes education and management and nutrition support. RDs holding these credentials maybe be able to justify taking on responsibility for implementation of more direct nutrition interventions. RDs wishing to better define their personal level of practice can use ADA Standards of Practice and Standards for Professional Performance to help determine their level of practice (ADA, 2008).

RDs working in healthcare settings must also abide by facility policy and other requirements for credentialing in order to take on expanded practice roles that allow implementation of some direct nutrition interventions. Examples of nutrition interventions that might require additional training or experience for safe initiation by the RD include enteral and parenteral nutrition order writing, management of some medications, and nutrition counseling. At this time, evaluation of competency is the responsibility of the RD; ADA provides a number of tools, including the Scope of Dietetics Practice Framework, Standards of Practice and Standards of Professional Performance (ADA, 2008; ADA, 2009). There is currently no agreed-upon description of advanced practice in dietetics (Skipper 2004).

Taking on responsibilities considered to be advanced practice requires unique knowledge and experience. Skipper developed a model for advanced practice in medical nutrition therapy that could be utilized to describe the characteristics required for RDs wishing to take on autonomous practice (Skipper 2006). RDs who have full or partial responsibility for writing orders for parenteral nutrition were found to have a different skill set than clinical RDs and nutrition managers (Mueller, Colaizzo-Anas, *et al.*, 1996).

Other health-care professions, including nursing, have developed formal models for advanced practice, most of which combine graduate level education with specialized training (Wong, Stewart, *et al.*, 2000). Nursing has well-defined models for Clinical Nurse Specialists (CNS) as well as Advanced Practice Nurses (APRN); each model describes the education and training required for entry to practice at that level (Manley 1997). In many settings APRNs have demonstrated competency to function as primary care providers and are functioning in some areas to fill a critical shortage of primary care physicians (Williams 2006; Wilson 2008).

As these professions move toward the future, discussion has begun regarding raising the bar to make entry level to advanced practice begin at the doctoral level (Draye, Acker, *et al.*, 2006).

Patient safety demands that RDs taking on responsibility for implementing direct nutrition interventions (such as nutrition order writing) understand the repercussions of their decisions. Skills and education required for entry level practice do not alone support taking on advanced practice roles. Recognizing the importance of formal education for those taking on additional responsibilities including order writing, clinical practice doctoral programs in nutrition which provide the training needed have been developed (Touger-Decker 2003, 2004). In addition to coursework focusing on provision of medical nutrition therapy, students acquire skills in leadership, evidence-based practice and collaborative skills.

Indirect interventions might include referrals to outside agencies, collaborating with colleagues in pharmacy for medication management, or requesting orders for nutrition education. Many of these interventions demonstrate the value of the RD in collaborative healthcare practice. The value of participation on a multidisciplinary team should not be overlooked. Involvement of an RD on a multidisciplinary neonatal care team was associated with improved growth in critically ill neonates (Sneve, Kattelmann, *et al*., 2008). Two-year success in achieving and maintaining weight loss following obesity surgery was associated with treatment by a multidisciplinary surgical team (Chevalier, Paita, *et al*., 2007).

While RDs working on these teams may not have the ability to enter orders themselves, they have proven their worth through leadership and collaboration skills. The NCP and IDNT provide a mechanism to capture this work and demonstrate the vital role that the RD plays.

Another area showing a positive outcome associated with nutrition interventions is RD participation in management of chronic health conditions. Nutrition care provided by an RD leads to improved outcomes for patients with diabetes mellitus (Gehling 2001; Urbanski, Wolf, *et al*., 2008), cancer (Isenring, Bauer, *et al*., 2007) and lipid disorders (McCoin, Sikand, *et al*., 2008). RDs have also been able to demonstrate positive outcomes associated with nutrition therapy for people with multiple chronic health conditions who live in rural areas (Gaetke, Stuart, *et al*., 2006). Women living with inborn errors of metabolism felt that RDs provided vital support that enabled adherence to complex diet regimens (Kemper, Brewer, *et al*,. 2010).

Nutrition interventions

There are two components of the intervention step of the NCP: Planning and Implementation. Each has several steps necessary to effectively implement a nutrition intervention. RDs with experience in a given area move through these steps in a seamless fashion, while those with less experience need to consciously think of each step.

Thoughtful planning ensures that the most appropriate intervention is implemented for a given nutrition diagnosis. Planning can be thought of as the thinking component of nutrition interventions while implementation is the action component. During implementation, the RD actually carries out the planned intervention.

When the intervention step of the NCP is carried out correctly, the nutrition intervention can be directly linked to the nutrition diagnosis.

A nutrition diagnosis from the Knowledge domain should be treated with nutrition education or counseling. Nutrition diagnoses in the Intake domain should be treated with nutrition interventions that focus on delivering the foods or nutrients of interest.

For example, an RD working in an inpatient cardiology unit diagnoses "excess fat intake" as one nutrition diagnosis for a patient who was admitted following a cardiac surgery. The immediate intervention related to this diagnosis is to ensure that the patient receives the desired fat content at meals while in the hospital.

The nutrition assessment for this patient also reveals that the patient is unsure how much fat should be included in his diet following discharge; thus, a nutrition-related knowledge deficit was also diagnosed. The intervention for this diagnosis is to provide a brief nutrition education session.

In both of these examples, the nutrition intervention is related directly to the nutrition diagnosis.

Planning

Once nutrition problems have been diagnosed and prioritized, planning begins. Health care is complex; patients often have more than one nutrition diagnosis. Thus, the planning phase of nutrition interventions begins with identifying and prioritizing the interventions that will be done.

If more than one nutrition diagnosis is present, the RD must prioritize the diagnoses based on severity, patient/client wishes, or collaboration with other health care professionals. This key step begins the planning phase of nutrition interventions.

Next, the RD must determine which intervention is most appropriate. In addition to considering interventions that are related to the diagnosis, RDs must also utilize resources such as evidence-based guidelines, facility policy, and past experience to verify that the nutrition intervention being considered is appropriate (ADA, 2009).

Another way to identify the best nutrition intervention for a given nutrition diagnosis is to look at the etiology or cause of the problem that was recorded in the PES statement. If the etiology is correct, then eliminating or reducing the severity of the etiology should effectively impact the nutrition problem.

For example, let's say a patient/client has the nutrition diagnosis "inadequate oral food/beverage intake related to chemotherapy-related anorexia, as evidenced by current intake less than 50 percent of meals." Given the diagnosis "Inadequate oral food/beverage intake." A first reaction might be to simply provide more food. However, knowing that inadequate intake was caused by anorexia from chemotherapy, the nutrition intervention might be to change the timing of meals, or the types and amounts of foods offered.

Nutrition prescription

The nutrition prescription developed by the RD is different from the diet order. Licensed independent providers such as physicians or nurse practitioners write a diet order in inpatient settings so that meals or feedings are provided according to some facility policy.

As many RDs have experienced, the diet order is not always ideal for the patient. The nutrition prescription is the RD's description of the food/nutrient requirements of a patient/client based on the results of the nutrition assessment. The nutrition prescription is optimized for the patient and should be documented in terms of the patient's current ability to eat.

One example might be a nutrition prescription that states "standard enteral formula, 1.7 L/day" — in this case, the RD has determined that this amount of formula will meet the patient's estimated needs. The nutrition prescription here is brief and concise yet conveys to others that this amount of formula will meet the patient's estimated nutrient requirements.

Goal setting

Once the nutrition intervention has been identified, the RD must determine the desired outcome and how to determine if progress is being made. Progress towards an outcome can be measured through setting of appropriate goals that can be measured throughout a specific time frame. Thus, an outcome determined for the nutrition diagnosis "Excessive fat intake" might be to reduce total fat intake from 45 percent to 30 percent of total energy consumed. In order to achieve this outcome, the RD and client might set the following goals:

- Reduce intake of fried foods by one serving per week to fewer than four servings, and of deep-fried foods from current servings.
- Taste several low-fat salad dressings and select two or three to replace current high-fat salad dressings; report findings at next visit.
- Over the next week consistently trim visible fat from meats before cooking.
- Choose fish or lean meats at two to three meals per week.
- Take a vegetarian cooking class next month to see if vegetarian meals might be of interest.

The RD and patient/client set these goals with the knowledge that if all or most of them are met, the outcome goal, to consume a diet that contains 30 percent or less of total energy from fat, will be met. The goals set are specific and individualized to the patient/client's needs and are set with input from the patient/client.

In addition to including the patient/client in the goal-setting step, RDs must review any evidence-based guidelines or recommendations that are available. There are a number of resources available for RDs to use in determining the most appropriate, evidence-based interventions (Agency for Healthcare Research and Quality, 2008; ADA, 2008).

The next step in the planning phase is to determine if follow-up is needed and if so, the time frame for follow-up. Attention paid to determining desired outcomes and the setting the goals that will enable achievement of those outcomes facilitates scheduling follow-up meetings for evaluating progress. Other considerations for scheduling follow up include patient/client wishes, third party payer decisions, and coordination with other health care providers.

Implementing nutrition interventions

Implementation is the action step of the NCP. As described earlier, RDs can carry out the intervention themselves, can delegate actions to others, or can collaborate with others to complete the intervention. How, when and where the RD implements nutrition interventions depends on factors such as the practice setting, time available, and patient wishes. Prior to implementing an intervention, the following key components should be considered (Wilkinson, 2007):

- Review the medical record or other pertinent information;
- Determine qualifications to act;
- Identify other input needed for successful intervention; and
- Evaluate the setting, time available, and chances for success.

When delegating a nutrition intervention to others, RDs must be responsible for ensuring that the intervention is carried out. It is not sufficient to add a request for between meal supplements without checking back to see if the patient received the supplements and is consuming them over time. Similarly, a request for changes to diets or lab tests must be followed up to ensure that the desired action was taken.

Finally, the RD is responsible for documenting the results of the intervention. RDs working for health-care organizations often have facility-based guidelines for documentation. Remember that documentation in the medical record, paper or electronic, is permanent and acts as a legal record of everything that happened during an admission.

RDs working in private practice, ambulatory care, or public health might have customized documentation formats. In all settings, it is the responsibility of the RD to ensure that information regarding nutrition interventions is communicated to other health care professionals.

Using the IDNT to document nutrition interventions

The IDNT contains terms that describe common nutrition interventions. There are four domains in the intervention section of the IDNT (ADA, 2009):

- Food and/or Nutrient Delivery
- Nutrition Education
- Nutrition Counseling
- Coordination of Nutrition Care

As with terms describing nutrition assessment and nutrition diagnoses, most of the nutrition interventions have associated codes that facilitate creation of databases for research. Nutrition intervention terms can be used to describe the actions taken by RDs in practice settings that involve work with patients, clients, or groups; they do not describe management, leadership, education, or research functions taken on by RDs.

The first domain in the nutrition intervention section of the IDNT is *Food and/or Nutrient Delivery*, which includes all aspects of an "individualized approach to food/nutrient provision" (ADA, 2009). These interventions include the amount of foods served, type of foods, meal timing, mealtime environment, and alternate methods for feeding.

RDs can utilize these terms to fully describe nutrition interventions that are associated with the amount of foods or nutrients provided for patients/clients or groups. For example, where inadequate intake of foods/beverages caused by chemotherapy induced anorexia was diagnosed, the nutrition intervention might include:

- Modifying the type and amount of foods provided (ND-1.2)
- Adjusting factors associated with meal service (odors) (ND-5.2)

RDs must understand the difference between nutrition education and nutrition counseling. Nutrition education is defined in the IDNT as "a formal process to instruct or train a patient/client in a skill or to impart knowledge…" (ADA, 2009). This is different from nutrition counseling, which is defined as "a supportive process, characterized by a collaborative counselor-patient/client relationship" (ADA, 2009).

It is important to make these distinctions, as rarely would nutrition counseling be possible in an inpatient setting; it takes more than one visit to establish a counseling relationship. In spite of this, RDs often mislabel nutrition education as nutrition counseling. Nutrition interventions from the nutrition counseling domain should be reserved for outpatient or community settings.

Coordination of nutrition care is the last domain included in the nutrition intervention terminology. As mentioned earlier, RDs can use the IDNT to describe those instances where the RD cannot take the desired action and must rely on others. This domain includes those tasks that are often not captured in other descriptions of the work of dietetics, including discharge planning (RC-2), team meetings (RC-1.1) and referral to other services, providers or agencies.

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Notes

Chapter Six: Nutrition Monitoring and Evaluation

The fourth step of the Nutrition Care Process is Monitoring and Evaluation (M/E), which is the method by which the RD determines progress made towards goals set during the nutrition intervention (ADA, 2009). When RDs use the NCP as a framework for making decisions, information gathered in the nutrition assessment ensures that the correct nutrition diagnosis is made.

Following diagnosis, RDs determine which nutrition intervention is most appropriate, based on patient/client wishes, the situation, and cause (etiology) of the nutrition diagnosis. Planning for M/E is the final component of the nutrition intervention. The RD determines which indicators will be periodically checked to assess progress.

RDs working in all practice settings use the NCP to ensure that the correct information is gathered (nutrition assessment) to facilitate identifying problems (nutrition diagnoses), solutions (nutrition interventions), and methods to ensure that the solutions worked (monitoring and evaluation). The following example shows how a dietetics educator uses NCP to solve problems.

> *MK is director of a dietetic internship who receives several email messages from interns stating that interns are unable to accomplish some competencies due to preceptors at one facility having days off when interns are there. MK looks at schedules for the interns and contacts the clinical manager at the practice site to determine if the preceptors are there when interns are scheduled (assessment). Together with the clinical manager, MK determines that on several days there are problems with scheduling interns and preceptors together (the diagnosis).*

MK and the clinical manager decide to meet to discuss possible actions that might help. Together they decide to have preceptors collaborate on schedule changes to ensure that qualified preceptors are always available when students are on site (the intervention).

Together MK and the clinical manager decide to meet again in three months to determine if interns are still experiencing problems with schedules (M/E). They decide that some glitches in scheduling are inevitable, but more than one per month would indicate the need for additional changes. They are hoping that the intervention would improve intern satisfaction with their experience at the facility.

In this example, the indicator being monitored is the number of problems with scheduling interns per month. The outcome that will be evaluated is intern satisfaction with the experience they have at the facility.

Components of Monitoring and Evaluation

The M/E step of the NCP includes:

- *Measurement* — the act of evaluating or appraising
- *Evaluation* — the determination of the significance of a thing, "usually by careful appraisal and study" (www.m-w.com)
- *Monitoring* — information is gathered. When used as a verb, the word "monitor" means "to keep watch on or to track."

In nutrition care, monitoring might involve collecting meal satisfaction surveys, locating a series of lab tests, or creating a spreadsheet with student grades. Measurement in terms of the NCP means that scores from the surveys are averaged, lab test results are placed in a time sequence with other care activities, or student grades are transformed to GPAs. Finally, these items can be evaluated by comparing to standardized data for satisfaction, normal lab values or past GPAs or grades.

In order to develop optimal plans for monitoring and evaluation of nutrition interventions, it's also important to understand the differences between data, information and knowledge.

Data → Information → Knowledge

When we talk about data, we are simply referring to a set of numbers or measurements. In a clinical setting, data might include a series of weight or blood glucose measurements. In health care, data might be considered the measurements that are collected by devices such as glucose monitors, electronic scales or blood pressure monitors. When providers look at a series of weight measurements, evaluate trends and make decisions regarding patient care, data becomes transformed into information.

In other words, information is data that has been acted upon. Information is used over time to share and enhance care through development of practice guidelines, and thus becomes knowledge.

All of these definitions are important to know when learning how to apply the M/E step of the NCP to practice. RDs typically monitor progress by gathering data at intervals following the intervention. Data gathered during monitoring is then evaluated by comparing it to appropriate standards. Let's look at each of these components to see how to use M/E to demonstrate the RD's worth!

- **Measuring.** Once data is gathered, it must be evaluated. Without measurement or evaluation of data, there is no way to know if changes in selected indicators occurred in response to the nutrition intervention.

There are many ways that RDs might measure response to nutrition interventions. When providing patient education, a quick pre-test can be given followed by a post-test after the education is provided. Changes in the patient/client's score on the pre- and post-test can then be used as a measure of the success of the nutrition education. Instructors in dietetics education obviously utilize grades to measure student outcomes in response to courses taught.

- **Evaluating.** Accurate evaluation is dependent on selection of the correct standards for the indicators being monitored. Let's say that an instructor in a dietetics program is using student GPA as an indicator of student success. If the university uses a GPA of 3.0 or greater as a baseline for continuation, and the instructor sets a GPA of 2.8 as passing for the course, this might result in confusion. Agreement on standards is essential.
- **Monitoring.** Monitoring actually begins during planning for nutrition interventions. As part of planning, RDs must decide what data are needed to decide if the planned intervention has been successful. Nutrition indicators provide the type of data needed. In order to determine this, indicators are selected that have the potential to change over the time frame selected for monitoring.

Nutrition outcomes

Nutrition outcomes can therefore be seen as results of an intervention that can be directly linked to actions taken by an RD. Quite often nutrition outcomes are intermediate steps towards a more global health outcome (ADA, 2009). This helps to explain the role of the RD in evaluating outcomes in healthcare. RDs alone are responsible for outcomes directly associated with nutrition interventions.

Current health policy demands that clinicians provide evidence that care provids results towards achievement of an outcome or outcomes that can be directly linked to the actions of the provider. Berwick (2008) states that the ultimate goal of health care is "relief of illness and pain."

As a global measure, health outcomes research evaluates the impact of care in day-to-day practice without the constraints imposed by formal research protocols (Ting, Shojania, *et al.*, 2009). As members of the health-care team, RDs are responsible for participating in evaluation of global health outcomes and for integrating nutrition outcomes into the global health outcome being studied. It is imperative that RDs participate in determination of global health outcomes as a result of the actions of the health-care team as a whole in order to demonstrate the value of nutrition interventions.

RDs must also delineate the specific nutrition outcomes that contribute to health outcomes. As an example, an RD might implement a nutrition intervention aimed at increasing food intake in a resident of a long term care facility who has had inadequate intake. The nutrition outcome in this example might be consumption of more than 80 percent of meals. The associated global health outcome might be fewer inpatient admissions for pneumonia or urinary tract infection.

What are some nutrition outcomes? Knowing that nutrition interventions should be linked to specific expected nutrition outcomes helps to narrow the type of nutrition outcome identified for a given intervention. Thus, if the nutrition intervention was to provide education regarding healthy eating on the run, the nutrition outcome linked to that would be a change in knowledge related to foods that are quick and easy to prepare and transport.

Let's take a look at an example of a nutrition outcome and how it relates to a global health outcome.

Researchers conducted a series of focus groups with women who had inborn errors of metabolism in order to determine barriers and facilitators of dietary adherence. Dietary adherence was the nutrition outcome of interest in the study; analysis of the focus group discussions showed that RD support was a promoter of dietary adherence (Kemper, Brewer, *et al.*, 2010). The nutrition indicators used to measure adherence might be self-reported adherence or attendance at clinic visits.

Individuals with inborn errors of metabolism frequently must follow very complex diets; even small deviations from prescribed amounts and types of foods can have disastrous results. Therefore, studies showing the vital role of expert RDs in promoting dietary adherence can serve to cement the role of the RD in caring for these patients. The overall health outcome related to dietary adherence might be "the contribution of adherence to overall health and well-being for patients with inborn errors of metabolism."

Another area where expert RDs have demonstrated nutrition outcomes associated with nutrition interventions is the neonatal intensive care unit (NICU). Researchers compared weight and growth parameters in a NICU before and after RDs were included in a multidisciplinary team (Sneve, Kattelmann, *et al.*, 2008). Here, the nutrition outcomes of interest were changes in weight. The indicators that were used to evaluate this outcome were total daily weight gained, total weight gain, weight at discharge, and daily weight gain from birth till initiation of enteral feeding (Sneve, Kattelmann, *et al.*, 2008).

Nutrition indicators

As we've seen, nutrition outcomes can often be described as a change in status seen following a nutrition intervention. The outcome must be directly related to the intervention. In order to determine if a change has occurred, indicators for the outcome in question must be identified and monitored. Indicators selected must be quantifiable in order to show change. The table below provides examples of some nutrition outcomes and selected indicators that might be monitored.

Nutrition Outcomes and Associated Indicators

Outcome	Indicators
Weight change	Weight Weight change Body mass index
Blood glucose control	Post-prandial blood glucose Hemoglobin A1c Mean blood glucose Number of hypoglycemic events
Dietary fat intake	Types of foods/meals Amount of fat in foods consumed Amount of fat in meals consumed Total fat intake
Knowledge regarding modified diet	Pre-test score Post-test score Self-indicated level of knowledge

Careful consideration must be given to ensuring that the right indicators are selected. The practice setting, nutrition diagnosis, and characteristics of the patient/client are all factors that might impact selection of nutrition indicators. For example, an RD in an inpatient setting might be concerned about abnormal blood glucose levels; the indicator of blood glucose control in this setting might be non-fasting blood glucose values. In an outpatient setting, the RD might select hemoglobin A1c as the indicator of blood glucose control.

Why might different indicators be chosen? Hemoglobin A1c is typically obtained every three months as an estimate of long-term blood glucose control. Because typical hospital length of stay is less than five or six days, it wouldn't be feasible to evaluate changes in hemoglobin A1c over two to three days.

Similarly, an RD might provide a brief nutrition education session regarding minimizing food odors for a patient/client who is receiving chemotherapy and experiencing decreased intake associated with nausea caused by unappetizing food odors.

In an inpatient setting, the best indicator to measure might be a quick post-test checking understanding of the information provided. Here, the RD would most likely be seeing the patient/client only one time, therefore there is no method to determine if the information resulted in the patient/client being able to minimize food odors. However, in a setting where follow-up visits are possible over time, the indicator might be how well the patient/client applied the knowledge at subsequent meals.

In addition to selecting nutrition indicators that provide the best evidence that nutrition outcomes are being met, RDs must determine what reference standard will be used to compare results of monitoring the indicator in question.

For example, RDs working in pediatrics are familiar with growth charts. Growth charts used to evaluate growth of healthy infants and children are generally accepted for use in determining adequacy of height and weight growth velocity (Lindeke, Rogers, *et al.*, 2002).

However, infants and children with health conditions that impact growth often present a challenge; should standard growth charts be used for these children? There are now several condition-specific growth charts available, some of which were developed from data gathered on as few as 100 children (Cronk 1978; Wollman, Schultz, *et al.*, 1998; Marinescu, Mainardi, *et al.*, 2000; Antonius, Draaisma, *et al.*, 2008).

Obviously, it is important to plot growth using the correct reference standard. When using growth charts developed for a very specific condition, or using data from a small population, great caution must be exercised in order to avoid misclassifying growth parameters.

There are other areas where the choice of reference standard can be complex. RDs can use the *Dietary Guidelines for Americans* as a reference standard for general health and nutrition for healthy populations (US Department of Health and Human Services and US Department of Agriculture, 2005). The guidelines target healthy Americans over 2 years of age.

Therefore, when caring for individuals or groups who are either less than 2 years of age, or who have chronic or acute health conditions, the *Dietary Guidelines for Americans* might not apply. In addition to the *Dietary Guidelines*, RDs often utilize the Dietary Reference Intakes (DRI) as reference standards for nutrient requirements (Panel on Macronutrients, 2002).

When using information from the DRIs, important parameters regarding definitions of these standards must be remembered:

- **Estimated average requirements** (EAR) include the amount of a nutrient thought to meet the needs of at least half of the population.
- **Recommended dietary allowances** (RDA) is interpreted as the daily intake of a nutrient thought to meet the needs of 97 to 98 percent of a population.
- **Adequate Intake** (AI) is an estimate established based on scientific evidence when no RDA has been determined. The AI is thought to meet the needs of nearly everyone in a given population.
- **Tolerable Upper Intake Level** (UL) is an amount of intake of a nutrient beyond which harmful effects may occur (Murphy and Poos, 2002).

Evaluation of intake can become complex when RDs are responsible for nutrition assessment, diagnosis, intervention and monitoring/evaluation of individuals or groups who for whom dietary guidelines or DRIs do not apply. In these cases, RDs must use critical judgment to determine the best reference standard.

Consider, for example, how an RD might identify reference standards to determine adequacy of oral food/beverage intake. Reference standards for energy requirements exist for healthy adults. There are no standards that pertain to acutely ill adults; therefore, the RD must use critical judgment to determine at what level intake becomes "inadequate."

Most are in agreement that the level of adequacy of intake changes, based on severity of the underlying medical problem. For example, it is probably unwise to utilize the same energy requirement for patients who have elective, uncomplicated surgery as for those who have multiple trauma.

There are many unproven or untested interventions that may or may not have therapeutic use. Supplemental use of the amino acid glutamine has been shown to be of benefit in some cases, particularly as an adjuvant treatment for some types of cancer (Wernerman, 2008). There is less evidence supporting widespread addition of glutamine to enteral nutrition formulations (Buchman, 2001; Alpers, 2006).

Use of unproven nutrition interventions poses a conundrum for the RD attempting to identify a reference standard. First, lacking strong consensus for dosing of supplemental nutrients such as glutamine, the RD must rely on "guesstimates" for the appropriate dose. Additionally, it becomes difficult to determine indicators that should be monitored and evaluated, as well as a reference standard by which to measure outcomes.

In the case of supplemental glutamine, would the outcome be weight change, oral food/beverage intake, or some other indicator? If no change is seen, could the lack of response be due to ineffectiveness of the supplemental nutrient or to inadequate dosing?

Similar questions arise when caring for patients who have poorly healing wounds or pressure ulcers. It has become popular to supplement the diet of these individuals with zinc, vitamin C and/or vitamin A, based on the role of these nutrients in wound healing in healthy individuals. Here the dilemma involves not only the appropriateness of the intervention, but also disagreement regarding the nutrition diagnosis that would justify the intervention.

Finally, what is the outcome of interest and how would the RD select, monitor and evaluate indicators that would reflect the outcome?

For some areas, ADA's Evidence Analysis Library (EAL) has systematic reviews, evidence-based guidelines and recommendations available (ADA, 2010). The table below includes evidence-based guidelines available in the Evidence Analysis Library.

ADA Evidence Analysis Library Guidelines (June 2010)

- Adult weight management
- Celiac disease
- Chronic obstructive pulmonary disease
- Critical illness
- Diabetes (Type 1 and 2 and gestational)
- Disorders of lipid metabolism
- Heart failure
- Hypertension
- Oncology
- Pediatric weight management
- Spinal cord injury
- Unintended weight loss in older adults

The National Guideline Clearinghouse, provided by the Agency for Healthcare Research and Quality (AHRQ) is a repository that contains thousands of evidence-based guidelines that have been published by institutions and organizations (AHRQ, 2008). Individuals can search the National Guideline Clearinghouse website for resources specific to a condition or patient group.

As with any other resource, however, RDs must be aware that there is no standardized guideline-development process, and so must use caution when applying guidelines to patient care (Brozek, Aki, *et al.*, 2009; Dahm, Yeung, *et al.*, 2009).

Using IDNT for monitoring and evaluating outcomes

The M/E terms in the IDNT provide RDs working in clinical nutrition a means to describe and quantify expected outcomes. Because terms used to describe nutrition assessment findings and M/E are often the same, the M/E terms are combined with nutrition assessment terms in the IDNT (ADA, 2009). The M/E terms are included in four of the five nutrition assessment domains:

- Food/Nutrition-Related History
- Biochemical Data, Medical Tests, and Procedures
- Anthropometric Measurements
- Nutrition-Focused Physical Findings

The final domain of the assessment terms, Client History, is not used for the M/E step of the NCP because terms in this domain describe historical information that is not used to monitor response to an intervention.

Case study using the M/E terms

FM is a 68-year-old female who was discharged from the hospital following an exacerbation of her congestive heart failure (CHF), thought to be caused in part by excessive sodium intake. Sodium restriction has been shown to be an effective nutrition intervention for improving health outcomes from heart failure (Levitan, Wolk, et al., 2009).

As part of the multidisciplinary health care team, the inpatient RD recommended that FM follow a sodium-restricted diet. During her hospital stay, FM met with an RD who provided a brief nutrition education focused on identifying sources of sodium in foods. The indicator for that nutrition intervention was FM's ability to identify sodium sources on a sample food label, which she was able to do with 75 percent accuracy. The inpatient health-care team recommended that FM see an outpatient RD in order to continue education on sodium in foods.

As part of an initial nutrition assessment, FM described to the RD her initial nutrition education while an inpatient. Together with the RD, FM decided that, while she could identify some sodium sources in her diet, she was still confused. She wanted to decrease the risk for readmission, and so wanted to be sure that she could adhere to her sodium-restricted diet. FM ate out several times per week and loves to cook as well. She has tried to omit salt from recipes but finds that foods taste bland.

Given this information, the outpatient RD identified the following findings on nutrition assessment:

- Food and nutrition knowledge
  - — Area and level of knowledge
  - — Readiness to change nutrition-related behaviors
- Food and nutrient intake
  - — Sodium intake
  - — Food variety

These findings were used to diagnose the following:

- Food and nutrition-related knowledge deficit related to inability to identify sodium sources in foods as evidenced by patient report.
- Excessive sodium intake related to selection of high sodium foods as evidenced by patient's diet history.

The RD decided to implement a Comprehensive Nutrition Education, covering skill development (Code E-2.5), and included components of label reading and recipe modification, with a focus on the sodium content of foods eaten. Following an evaluation of recommendations for sodium intake for patients with CHF, the RD also contacted FM's physician to discuss the most appropriate level of dietary sodium for FM, which was included in the nutrition prescription (Beich and Yancy, 2008).

FM was given nutrition education regarding sodium content of foods, label reading and recipe modification. The RD then worked with FM to determine which nutrition indicators would be monitored over time to determine if additional nutrition intervention would be required. Results of M/E would also be shared with FM's physician.

It was decided that FM would keep food records for one week and have an outcome goal to reduce sodium intake to less than 2 gm per day. She would also revise at least five recipes in the next two weeks and send them to the RD for nutrient analysis, with the goal to reduce sodium content of each recipe by at least 75 percent. Finally, the RD would check FM's knowledge regarding sodium content of foods with a brief quiz at each visit. Briefly, the nutrition outcomes agreed upon can be stated as:

- Daily sodium intake less than 2 gm
- Reduce sodium content of recipes by greater than 75 percent
- Achieve at least 90 percent correct responses on each quiz

What are the M/E indicators for these nutrition outcome goals? Based on the information available here, the M/E indicators might include:

- Sodium intake (FH-1.7.2.7)
- Self-management as agreed upon (FH-4.1.5)
- Area and level of knowledge (FH-3.1.1)

Conclusion

The final step of the NCP is monitoring of nutrition indicators and evaluating changes in nutrition indicators that signal a change in a nutrition diagnosis. Nutrition indicators can be terms in the IDNT from four of the five domains if the RD is practicing in a clinical setting.

RDs not in clinical settings still utilize the NCP. Non-clinical RDs are still responsible for monitoring and evaluating the results of interventions in their practice setting. These RDs must develop indicators that fit their practice area, monitor the indicators following an intervention, and determine if the indicators truly reflect a change in the nutrition problem that was diagnosed.

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Notes

Chapter Seven: Clinical Case Study

FE is a 28-year-old female who was admitted to the hospital from the emergency department for management of nausea and vomiting. Her complaints of epigastric pain, nausea and vomiting had been worsening over the past two days. She has a 15-year history of type 1 diabetes mellitus (T1DM), mild gastroparesis, hypertension and stage 3 chronic kidney disease (CKD). On admission she was noted to have normal fluid and electrolyte status.

Step One: Nutrition Assessment

Labs obtained in the ED were within normal limits with the exception of those shown in the chart below.

FE's Abnormal Lab Values

Lab	Admission Value
BUN	35 mg/dL
Creatinine	2.0 mg/dL
Potassium	5.0 mEq/L
Estimated glomerular filtration rate	56 mL/min/1.73 m^2
Serum glucose	156 mg/dL
Hemoglobin A1c(HgbA1c)	7.4 percent
Admission height/weight/BMI	165.1 cm/47.7 kg/17.5
Usual weight/BMI	50.9 kg/18.6
Weight change	-7 percent over previous 2 weeks

On admission to the hospital, FE was reported to be lethargic and complained of mild nausea. The admission history and physical examination noted that she appeared thin and "mildly wasted." A gastric emptying study done prior to admission was "although borderline, essentially within normal limits."

FE stated that she has seen a gastroenterologist recently, but no specific treatment was planned unless her symptoms became unmanageable. FE feels that when her blood glucose levels are too high or too low she has "flares" of gastroparesis. These flares last one to two days, during which she has nausea and pain that limit her ability to eat. Prior to this admission she and her family had been experiencing flu-like symptoms, which seemed to be improving.

Home medications were continued in the hospital and included:

- insulin glargine every morning;
- insulin aspartate per carb counting ratio (1 unit insulin: 15 gm carbohydrate);
- Lopressor®; and
- Lisinopril.

An IV was started with D5NS at 40 mL/hour, with instructions to discontinue fluids when FE is able to consume fluids by mouth.

FE is married and has a 2-year-old daughter. She is a self-employed interior designer; her husband is a civil engineer and very supportive. Health insurance is provided through his employer.

Based on information included in the initial hospital assessment, a consult was sent to the RD. Additional information gathered during the nutrition assessment included a diet history that included three meals and one or two snacks daily. FE has a small breakfast, and then a snack midmorning. If working with clients, she will usually eat out for lunch, and cook dinner at home for the family. She usually has an evening snack unless "my blood sugar is way out of whack."

She generally consumes a wide variety of foods daily, and states that she has been working with the RD at her endocrinologist's office on increasing her fiber intake, as that has been one area she felt needed improvement. The past two weeks have been difficult as, first, her daughter came down with the flu, then, her husband, and then, herself. As everyone was recovering, this latest bout with nausea and pain "knocked me for a loop." FE states that she's been living on canned soups, crackers and iced tea for the past week.

FE states that she feels fairly confident in managing her type 1 diabetes; her HgbA1c is usually in the "mid to high 6 range." She is surprised it has increased, which she states must be due to some hyperglycemia she's been having difficulty managing. She attributes this to being ill. FE also stated that she is aware that her diet will most likely need to change as her kidney disease advances. She does not desire more information about that now, as her health care team will work with her as an outpatient when that is needed.

The RD asked FE about her "flares" of suspected gastroparesis. FE stated that these have been occurring maybe once per month for the past six to eight months. While she is unable to eat much during a "flare," this usually lasts 24 hours or less, and then FE feels she actually eats a bit more than usual the following day. She lost 1 to 2 lb when this first began, but now has had a stable weight until her current illness.

FE goes to swim lessons with her daughter twice weekly and walks for 30 to 40 min. every afternoon. She says that when she's working with clients, her activity can vary depending on what she is doing, but her job can sometimes require some exertion.

Nutrition-Focused Physical Assessment. The NFPA was unremarkable except for minimal subcutaneous fat stores. There were no physical signs of vitamin/mineral deficiencies. FE reported feeling tired lately due to her illness and the demands of caring for her sick daughter and husband over the past few weeks. She reports that she has not exercised for the past two weeks and is feeling a bit weak.

The RD also knew that FE had experienced weight loss prior to admission, so asked questions about her usual weight and weight history. Finally, because the RD knew that gastroparesis can be associated with suboptimal blood glucose control, additional questions focused on how well FE was managing her diabetes. FE stated that she's had diabetes for many years and has no questions regarding diabetes management, as she regularly meets with the RD at her endocrinologist's office when she has questions.

Step two: nutrition diagnosis

Based on the information gathered during the patient interview as well as from the medical record, the RD diagnosed the following nutrition problems:

- Inadequate oral food/beverage intake related to nausea as evidenced by intake less than 50 percent usual for past week.
- Involuntary weight loss related to suboptimal intake for past two weeks as evidenced by loss of 7 percent of usual body weight.

Put in the context of the NCP, the problem the etiology and sign/symptom are shown in the chart below.

Diagnoses

Problem	Etiology	Sign/Symptom
Inadequate oral food/beverage intake	Nausea	Intake less than 50% usual for the past week
Involuntary weight loss	Inability to meet estimated energy needs due to nausea	Loss of 7% of usual body weight prior to admission

Why were these problems diagnosed? Before interviewing FE, the RD had reviewed her medical record and was aware of her medical history and current health condition. This alerted the RD that there was a need to probe for more information to determine the adequacy of current intake, for how long FE had been having trouble eating, and if there were additional areas of concern. Because FE had been having problems eating for more than a few days, and because her inability to consume enough food was a precipitating reason for her admission, "inadequate oral food/beverage intake" was diagnosed.

The RD's critical thinking here focused on determining what level of suboptimal intake was a cut-off for the diagnosis in this patient. Notice that prior to admission FE had several "flares" of GI problems that impacted her ability to eat enough. However, these episodes were short-lived and did not result in significant impairment in her ability to eat beyond each episode. It wasn't until FE's current illness that the adequacy of intake became prolonged or problematic.

The same thought process was used to evaluate FE's weight changes. When intermittent gastroparesis began, FE lost 1 to 2 lb, but following that her weight had been stable. While FE is on the "thin side," she has always been slender and has not had health problems related to her weight. As with intake, weight loss did not become problematic until the current illness.

What about some nutrition diagnoses that were not considered? When the RD presented this case at a regular staff meeting, dietetic interns asked why "food and nutrition-related knowledge deficit" was not diagnosed, as FE might not be aware of the need to better manage blood glucose levels during illness (based on the new elevation in HgbA1c) and had stated that she needed more information about modifications to her diet needed for kidney disease.

The RD explained that FE did indicate that she knew about the need to manage blood glucose during illness, based on her comments that her HgbA1c was usually in a desirable range and that blood glucose control often is erratic during acute illness. FE has had an exhausting couple of weeks dealing with her family's illness and then her own, and there is no reason to expect that she would not be able to return to her usual pattern of diabetes management. While FE did state that she would eventually need assistance with diet modifications as her kidney disease advanced, those modifications were not needed now, and so FE's knowledge regarding diet and nutrition was adequate for the current situation.

The interns next asked why the RD did not diagnose "malnutrition" based on FE's reported weakness, weight loss, and low BMI. The RD explained that information collected during the nutrition assessment, combined with review of the medical record provided information needed to support the decision that FE did not have malnutrition. All of the signs and symptoms (weight loss, poor intake, muscle weakness) were of short-term duration and could be related to the recent flu-like symptoms that FE had experienced. Therefore, the RD suspected that FE's intake would improve as her illness subsided, and following that, she would regain the weight lost and return to her usual eating and exercise pattern.

Step three: nutrition intervention

The NCP helps RDs link nutrition diagnoses to interventions that are focused on ameliorating the nutrition problem. The RD and FE collaborated to identify the nutrition interventions most suited to the situation.

Notice in the chart below that the intervention is designed with two purposes in mind — to address the problems identified in the nutrition diagnosis as well as meet the goals established by the RD and patient.

Nutrition prescriptions. The admitting physician ordered a "diabetic diet" for FE as part of her admitting orders. Food and Nutrition Services has a policy that when a "diabetic diet" is ordered, a "consistent carbohydrate" diet consisting of a limited number of carbohydrate choices at each meal will be substituted.

The RD and FE together decided that the best option for her at this time was to order a regular hospital diet, as that would allow FE to make selections based on her condition and appetite. Because FE was an experienced carbohydrate counter, she was given a list of the carbohydrate content of the foods she'd most likely consume during her admission. Therefore, the RD wrote a nutrition prescription that stated "Unrestricted diet to meet estimated needs" (FE's needs were estimated to be approximately 2100 kcal and 50 to 60 gm protein).

Nutrition Intervention

Nutrition Diagnosis	Nutrition Intervention	Goals
Inadequate oral food/ beverage intake	General hospital diet to meet estimated needs Meals and snacks offered per patient preference and tolerance	FE will consume more than 75% of meals and snacks prior to discharge
Involuntary weight loss	Collaborate with FE's RD in the endocrine clinic to ensure that FE has needed support to regain weight	Ensure FE receives meals and snacks appropriate to meet her nutritional needs FE will regain weight lost in 30-45 days.

Step four: nutrition monitoring and evaluation

RDs working in acute care settings often have the most difficulty determining how to best monitor and evaluate the effectiveness of nutrition interventions. The average inpatient length of stay is becoming ever shorter, thus limiting what can be expected to change as a result of a nutrition intervention.

In the present case, FE's expected length of stay would be less than 48 hours. Obviously, the inpatient RD cannot expect to see a valid change in weight in that short time frame. While certainly more feasible, it would also be unlikely that FE would be able to consume enough to ameliorate the inadequate oral food/beverage intake diagnosis as well. How do inpatient RDs determine what to monitor and evaluate?

It is important that RDs recognize the need to collaborate with RDs and other health-care providers who see patients following discharge. Together, this expanded health-care team can ensure that nutrition interventions that were begun in one care setting are carried out as the patient moves through the health-care continuum.

In FE's case, the RD decided to monitor several components that would either directly or indirectly indicate the outcome of the nutrition interventions. In order to do this, the RD needed to contact the RD working in FE's endocrinologist's office to discuss the plan of care. For each nutrition diagnosis, the RD determined which indicators would be monitored:

- Inadequate oral food/beverage intake
  — Daily estimate of amount of meals and snacks consumed (goal is more than 75 percent)
- Involuntary weight loss
  — Weight on discharge (goal is to regain weight lost during current episode)

The RD created a third goal: FE would not be readmitted to the hospital for the same diagnosis within the next 30 days. This indicator was selected to reflect how well both goals were met and was consistent with overall facility outcomes management goals to prevent readmission within 30 days for the same diagnosis.

Monitoring Indicators

Indicator	Diagnosis	Standard for Comparison	Time Frame
Weight change	Involuntary weight loss	Regain weight lost during the current episode	60 days
Amount of meals and snacks consumed	Inadequate oral food/beverage intake	Patient will eat over 75% of meals and snacks	Patient will keep track of her intake daily and report to her outpatient endocrine RD weekly
Hospital readmission	Involuntary weight loss Inadequate oral food/beverage intake	Patient will not be readmitted to the hospital for the same diagnosis	30 days

The inpatient RD then gathered baseline data for monitoring using information from FE's medical record and the nutrition assessment. On discharge, FE's weight was evaluated and compared to her weight on admission. An estimate of current intake was also provided; this information was conveyed to the outpatient endocrine RD.

FE agreed to follow-up with the outpatient RD 48 to 72 hours following discharge. The inpatient RD then communicated necessary information to the outpatient endocrine RD through the facility's electronic medical record. An alert was set to remind the inpatient RD to check on FE's status in the next 30 days as well as a notification if FE was readmitted.

Notes

Chapter Eight: Community Nutrition Case Study

FL is an 18-year-old female who was seen in clinic following discharge from the hospital. She had been admitted to the hospital two weeks previous, following a two-week history of severe pain, bloating and diarrhea which occurred after eating most foods. She has a history of anorexia nervosa, for which she spent three weeks in an in-patient treatment facility when she was 13 years old. She says she has not relapsed since then.

Her weight history for the past year shows stable weight until this admission. During her admission she was diagnosed with Crohn's disease. She responded to medical management and was discharged with instructions to follow up with her primary care provider and outpatient RD.

There were no medical records available for review prior to this appointment although a discharge instruction sheet containing FL's discharge diagnosis, medications, and education provided prior to discharge was faxed from the hospital to the clinic.

STEP ONE: NUTRITION ASSESSMENT

We begin the NCP with an assessment. The chart below summarizes the information the RD has on the patient.

Patient Information	
Patient History	
Age	18
Gender	Female
Alcohol/tobacco history	Denies use of alcohol or tobacco
Language spoken at home	English
Education	Dropped out of high school. Says she wants to obtain her GED but isn't sure how
Role in family	Lives with mother and 3 younger sisters
Social History	
Socioeconomic status	Was working at local coffee shop; lost her job when hospitalized; mom works part-time
Housing	Single family home, needs repairs but safe
Medical support at home	Some; mom tries to help but is busy with her job and sisters. FL is home alone most of the day
Involvement in social groups	Some; tries to keep in touch with friends, belongs to church youth group but not very active
Anthropometric Data	
Height	172 cm (68 in.)
Weight	50 kg (110 lb)
BMI	16.8
Usual weight	54.5 kg (120 lb)
% Usual weight	91 percent
Tests, Labs, Procedures	
No new labs	States that some labs were "low" when she was in the hospital but normal prior to discharge
CT scan of abdomen	FL states her physicians told her the CT scan showed them she had Crohn's
Medications	Sulfasalazine Azathioprine Metamucil Multivitamin

After gathering medical and social information about FL, the RD begins to do a nutrition evaluation, including a nutrition history and a diet assessment of her intake. It is learned that FL eats three meals daily and snacks in the afternoon and sometimes in the evening. FL states that she eats most foods. Below is a 24-hour recall list of foods FL has consumed.

Food and Nutrition History

Overall	Eats 3 meals daily and has snacks in the afternoon and evening sometimes. Says she eats most foods.
24-hour recall	
Morning meal	White toast with margarine to cover (2 slices) Coffee with milk and sugar (2 large mugs)
Midday	Canned soup (1/2 can) Handful of chips (about 1oz) Cola, iced tea or milk (12oz)
Evening meal	Meat (chicken, beef, or fish (salmon) most nights) (2–3oz) Potatoes or noodles (1/2 cup) Vegetable or salad with "lots" of dressing (1/2 – 3/4 cup)
Dessert	Fruit, cake, cookies, whatever is on hand. Always has dessert.
Snacks	Fruit (1–2 times per day) Chips, cookies, candy, depends on availability
Adequacy of recall	Appears to describe intake; is afraid she doesn't eat enough; while sick did not eat normal pattern As estimated from recall, intake meets approximately 75-85 percent of estimated requirements Pt and mother fear stress of new diagnosis, pain and diarrhea will trigger relapse of eating disorder Pt says she's not a good cook and doesn't try when she's not feeling well, but would love to improve her cooking skills for her sisters and mom!

With the medical and nutritional information gathered, the RD then completes the first part of the NCP process — the assessment — with social information, physical findings from a nutrition focused physical assessment (NFPA) as well as determining what the client feels they need. This information is shown in the chart below.

Patient Information

Activity	Until last month played on church basketball team. Very little activity during the last month
Knowledge	New diagnosis; wants to know what to eat Wants to avoid relapse of eating disorder
Physical examination and nutrition focused physical assessment	Appears very thin Mild pedal edema Skin warm and dry No obvious signs of vitamin/mineral deficiency Dentition intact, some caries

Step two: Nutrition diagnosis

As you can see, there is a lot of information, not just a diet history, that is necessary to make the correct diagnosis. Using the information gathered on FL's medical, nutritional, social and physical assessment, the RD was able to make the following diagnoses, shown in the chart below.

Diagnoses

Problem	Etiology	Sign/Symptom
Involuntary weight loss	Inability to meet estimated energy needs due to pain/ diarrhea	9 % weight loss prior to admission
Inadequate oral food/beverage intake	Pain and diarrhea limiting ability to eat	Patient history
Food/nutrition-related knowledge deficit	Diet to manage Crohn's	Patient and mom have many questions. Also have concerns regarding preventing relapse of eating disorder

Step three: nutrition interventions

Once the diagnosis is made, the RD must determine the best interventions to address the problems identified in the diagnosis. You can also think of this as the intervention is designed to meet a goal that will reverse the nutritional problems identified in the nutrition diagnosis.

In this case, the RD determines that FL's diet is adequate to meet estimated requirements for all nutrients with the exception of calories. Additional calories are needed for weight gain. FL's estimated needs for energy and protein are approximately 2200 kcal (for weight gain) and 65-75 gm protein.

After discussion with FL, the RD and patient agreed on the following nutrition interventions, shown in the chart below.

Nutrition Interventions

Diagnosis	Nutrition Intervention
Food and nutrition-related knowledge deficit	Nutrition Education • Education on relationship between diet and Crohn's disease; prevention of flares, nutrition management during flares • Provide information regarding Crohn's support groups
Food and nutrition-related knowledge deficit	Collaboration of care with others • Referral for counseling regarding prevention of relapse of eating disorder
Inadequate oral food/beverage intake	Coordination of care with others • Referral for cooking classes
Involuntary weight loss	Weight measurements • Patient to weigh self 2-3 times weekly and at clinic visits

Step four: nutrition monitoring and evaluation

Finally, the RD and FL have to decide together on how best to measure whether or not the nutrition intervention was effective. To do that, they come up with four indicators they can measure to evaluate the success of the nutrition intervention in reaching nutrition goals. As part of the monitoring process not only are the indicators monitored, but so are the standards and time frame used to reach the goal.

Since FL has lost weight, which was involuntary, the goal is to get back to FL's usual weight. To do that requires an increase in her nutrition knowledge and cooking skills, counseling to prevent a relapse of her eating disorder and monitoring of her weight. FL will keep track of her weight at home, on a chart, and call the RD with her weight every two weeks.

Monitoring Indicators

Indicator	Diagnosis	Standard for Comparison	Time Frame
Nutrition knowledge	Food/nutrition-related knowledge deficit	Patient and/or mom will score at least 85 percent on quiz following education	Immediately following education
Weight change	Involuntary weight loss	Achievement of usual weight in next 3 months (will reevaluate if Crohn's flares)	Patient will track weight on chart at home and report at bi-weekly follow up visits
Attendance at cooking classes	Inadequate oral food/beverage intake	Patient will attend all classes	Patient will report following 6 week series; her mom states she's anxious to have her daughter try new cooking skills!
Counseling to prevent eating disorder relapse	Food/nutrition-related knowledge deficit	Patient will schedule appointment with counselor	Patient report at next appointment

Chapter Nine: Electronic Medical Records

The term *informatics* refers to how we find, use, store, and manage information.

In health care, informatics practice requires knowledge of information science, computer science, and patient care. Health informatics experts are responsible for managing volumes of information created every day as health-care providers care for patients.

Although often thought of as a "high tech" field, informatics practice does not require use of computers and technology. According to Friedman (2009), informatics is associated with providing clinicians with the tools they need to provide safe, high-quality patient care, whatever the media used — paper records served well for many years. However, following development of affordable high-powered computers in the 1960s and 1970s there was a growth spurt in the field as informatics experts realized that computers greatly facilitated their work.

At this time informatics practice is a formally recognized specialty in both nursing and medicine. The past few years have seen increasing interest in how dietetics practice uses information to improve practice, leading to development of nutrition informatics as an area of practice.

Regulatory influence

In 2009 Congress passed the American Recovery and Reinvestment Act (ARRA) as a mechanism to stimulate economic growth in the US. ARRA is a huge, complex bill; among its many provisions are some that will lead to significant changes in the way all healthcare providers do their jobs. The Health Information Technology for Economic and Clinical Health (HITECH) provisions of ARRA include $19 billion earmarked to promote implementation and use of health information technology by all providers in all care settings (Blumenthal, 2009).

Two of those provisions focus on promoting use of electronic medical records (EMR) by health care providers in all care settings (Blumenthal, 2010). The first provision sets criteria for monetary incentives for providers and organizations that can demonstrate "meaningful use" of certified EMRs. The second begins the process of determining what functions must be present in an EMR in order to qualify for the "meaningful use" payments. Additionally, providers and facilities will see cuts in reimbursement for care if they are not using EMRs by 2014.

Impact on dietetics professionals

It would be difficult indeed to work in health care today and not use computers or technology at least part of the time.

Computers have been used in health care since the late 1960s. Initially, computers were used to create and store "flat" files, or documents that could not be shared or changed (*e.g.* Mrs. Smith's lab reports).

Next generation systems included those that stored data (such as laboratory values or medication lists) in files that could be searched or queried in order to show a set of records for a patient or group of patients. (*e.g.* "I want to see all of the serum glucose values from day of admission to day of discharge for Mrs. Smith.")

At this time, informatics specialists use powerful computers to not only store and share information, but also to build complex systems that allow clinicians to interact with the computer to improve patient care rather than to simply enter data. Current systems allow clinicians to ask "I want to see all of the serum glucose levels from the day of admission to the day of discharge for Mrs. Smith, along with recommendations for managing hyperglycemia based on Mrs. Smith's health profile and potential drug-drug and drug-nutrient interactions between oral hypoglycemic agents and other medications she may be taking."

We can only speculate what the proliferation and increasing power of "smart" portable devices and the spread of wireless internet access will mean in the years to come.

Like any technological change, new media bring new responsibilities and opportunities. The old adage "garbage in, garbage out" has never been more relevant.

Nutrition informatics is a vital component of all areas of dietetics practice. RDs might think that if they aren't working in clinical practice, then they have no need to learn about informatics. This couldn't be farther from the truth. RDs in all areas of practice can work smarter, faster, and more efficiently when they understand and use healthcare informatics tools. RDs can use the information management components of nutrition informatics even if they have no computer access in the workplace.

This section will briefly show how healthcare informatics facilitates each of six areas of dietetics practice; research, education, consultation, business, school foodservice, and clinical dietetics practice.

• **Research.** Nutrition research provides the foundation for all dietetics practice. Without the knowledge generated by nutrition research, RDs would have no basis for recommending particular foods, diets, or nutrients to support health and wellness. Nutrition researchers use healthcare informatics tools every day in developing research questions, searching for previous work done on a topic, conducting research and sharing the results of their work.

The foundation of research is the *research question* — you need to know what you need to know. Research proposals are used to describe a research question, review what is now known about the topic and present a novel approach to answer the question. There are currently over 4,000 biomedical journals available that publish thousands of articles every year. It's obvious that an individual could easily become overwhelmed trying to find and evaluate research focused on a particular topic without health informatics tools to help.

Researchers also use health informatics tools to collaborate with others, share information and research data, and to ensure that findings reach the appropriate audience. Evidence-based practice, which combines evaluation of research results with clinician judgment in order to provide high quality care, wouldn't be possible without the contributions of nutrition researchers.

• **Education.** Dietetics educators are responsible for training the next generation of dietetics professionals. While many educators can easily recall a time before cellular telephones and hand-held computers, students cannot imagine life without technology. Educators are responsible for ensuring that students learn to use technology and informatics tools appropriately. In order to do this, they must first understand what health informatics and technology tools can and cannot do.

For example, most clinicians are aware that there are very strict regulations regarding sharing of patient information in health care settings. Educators must understand how health informatics tools can help to safeguard protected information while allowing students to learn from case studies, scenarios and patient-care discussions. Students are also expected to enter supervised practice with knowledge of the EMR and a basic understanding of how clinical systems work. Educators must have at least basic health informatics knowledge.

• **Consultation.** Dietitians in consultative practice often visit multiple care sites during the workday. Additionally, consulting RDs may work in different care settings from long-term care to home care. They must keep records of activities, billing, patient information, and communication. Prior to the computer age, this detailed recordkeeping could take several hours every day. Now, RDs can use technology and health informatics to use relational databases to easily maintain the records needed for practice.

There are a number of regulatory requirements that must be met in long-term care. RDs working in this area are well aware of the need to keep careful records of weights, fluid status, nutrient intake and other care components. Typically records are kept as either hard copy files or as a "flat" spreadsheet. Using health and nutrition informatics knowledge, RDs can be equipped to utilize this data to demonstrate positive outcomes and cement the need for dietetics expertise in the long-term care setting.

• **Business foodservice.** Dietitians working in business and industry wear multiple hats. They may be responsible for worksite wellness programs, product research and development, or running corporate foodservice operations. There are many ways that technology and health informatics tools can give RDs the edge they need to succeed in this area.

Worksite wellness programs obviously require recordkeeping and communication. RDs must keep a record of services provided for employees and ensure that appropriate information is communicated to primary care providers and human resources as needed. There is also the need to maintain up-to-date knowledge of the best methods to ensure that employees reach wellness goals and that aggregate information regarding the cost effectiveness of wellness programs is available.

RDs in corporate research and development (R&D) areas must fully understand not only the research process but also how to quickly evaluate market trends in order to meet the public's need for healthy products. There are tools available that can alert R&D professionals to changes in purchasing habits, newly published research, and help fully develop ideas and bring them to market.

• **Public health and community nutrition**. The pediatric obesity epidemic has resulted in growing awareness of the need to ensure that schools provide appropriate, healthy food choices and teach school children good health habits. RDs must be involved in school foodservice in order to ensure that decisions made regarding foods served in the cafeteria and lessons taught in the classroom are appropriate.

Additionally, RDs must be involved in the development and implementation of community programs aimed at improving residents' health. Best practice demands that program development begin with a critical review of past successes and failures; nutrition and health informatics tools can give RDs the ability to quickly find information to support implementation of programs that promote good nutrition.

• **Clinical practice.** Approximately half of RDs in the US indicate that they work in clinical settings. As mentioned earlier, healthcare providers in all clinical settings are shifting from paper to electronic documentation.

There are several levels of EMR implementation; a fully implemented clinical system provides clinicians not only with a way to document care provided but also to enter medication orders, view test and procedure results, share care information within the facility and with other facilities, receive reminders and alerts for needed screening and immunizations.

While many are now using some of the components of a fully implemented system, fewer than 10 percent of health-care organizations in the US are using a fully implemented system at this time. This presents a huge opportunity for clinical RDs to be involved in evaluating, purchasing, building and implementing systems in their workplace.

HITECH requires that by 2014, organizations and providers use a certified EMR system or face financial penalties. Requirements for certification include the ability to enter patient-care orders, to exchange information safely and securely with other organizations, and to provide information to support clinical decision-making. Each of these components will be described later in this chapter. Clinical RDs must be aware of these requirements, as the regulations will apply in all practice settings.

Informatics beyond EMR

As mentioned earlier, many think that informatics is all about EMR. Nothing could be further from the truth. While the use of computers and technology is pervasive in all areas of health care, remember that the focus of informatics is on how to find, use, and evaluate information, which encompasses much more than just the EMR.

Think about how nutrition knowledge has increased over the past century. At the dawn of the 20th Century nutrition scientists were just beginning to understand the role of vitamins and trace elements in normal nutrition. By 2000, nutrition science had described the role of the vitamins and minerals, identified daily requirements for many of them, and delved into the interactions between nutrients during acute and chronic illness. It would be difficult, if not impossible for the individual RD to easily access this information without tools to simplify information management in practice.

Computer literacy

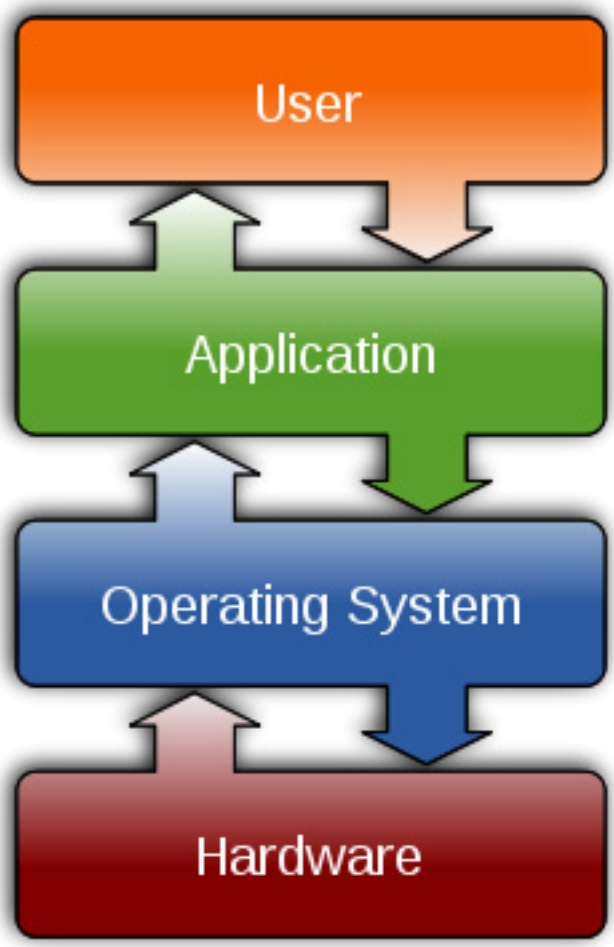
It's difficult to think of a part of modern life that has not been impacted by computers, yet many of us have a love-hate relationship with computers. While most dietetics professionals use computers, it's often overheard that "I just don't like computers."

The first step in overcoming anxiety regarding computer use is to understand a few basic principles about how computers work. It might be comforting to know that, in spite of popular opinion, computers don't think. Rather, computers act only in response to instructions as programmed. "Garbage in, garbage out" means that when something goes wrong, there is often human error — either by the person who created the computer program or the person who entered data into the computer.

Of course there are also those times when malfunctions occur with no known cause. Typically, these sort of "crashes" happen following some change to software or hardware. Sometimes the cause can be determined by working backwards to undo changes made to see if one can be singled out. As computers become more sophisticated, it is a bit comforting to know that system crashes happen with less frequency.

• *Which operating system do you have?* A computer's operating system (OS) runs behind the scenes and helps to control and coordinate all of the interactions between hardware, software and the user. Think of the OS as the middleman between the hardware (the central processing unit, mouse, and keyboard) and the software.

Operating System (OS) Relationship



Golftheman, Operating System Placement, licensed under Creative Commons Attribution – Share Alike 3.0 Unported. http://en.wikipedia.org/wiki/File:Operating_system_placement.svg, Access date: September 11, 2010.

At this time there are three main OSs in use, Microsoft Windows®, Apple's Macintosh® OS (Mac OS), and Linux. Each OS has benefits and drawbacks. The chart on the following page shows the main types of computer operating systems now in use.

Computer Operating Systems

Operating System	Pros	Cons
Microsoft Windows®	Popular	• Requires user to have some technical knowledge; not "intuitive" • Prone to infection with viruses • Complexity sometimes leads to slow downs • Depending on version, prone to crashes • Software installation and deinstal lation can be difficult and problematic
Mac OS®	• Reliable; less prone to freezing or crashing • Intuitive user interface; "plug and play" • Strong graphic and multimedia capabilities • Not prone to infection with viruses • Dual core allows runing Windows programs • Easy to install and deinstall software	• Use of Windows on dual core machines can be quirky • Most expensive option • Some limitations to software avail ability
Linux	• Open source (free) • Frequently updated • Strong community (user) support systems	• Requires some technical skill to install and update • Software may be limited

Finding and evaluating information

Clinicians desiring to provide high quality healthcare must have rapid access to information to support decision-making. Health-care providers have many information needs through out the course of a day. Providers might have questions about how to diagnose health conditions, which are the best treatment options, or how to evaluate the patient's response to therapy. However, information needs are often unmet (Cogdill, 2003; Coumou, 2006).

Although most providers understand the need to identify and use information sources to support practice, quite often they are limited by lack of time or do not have the skills needed to quickly find information. Although there are many search engines used to find information on the internet, this section will focus on *PubMed*, which is provided through the National Library of Medicine.

PubMed is a free search tool that provides users with access to the MEDLINE database, through the National Library of Medicine (2010). MEDLINE contains over 19 million citations from the biomedical literature. There are several tools that researchers can utilize to search for citations in the MEDLINE database; most of these are costly and accessed only through medical libraries. *PubMed* is free and available to anyone who has internet access. *PubMed* has a simple user interface for entering search terms with results returned in just a few seconds.

Searches often return hundreds of results, many of which don't seem to apply to the original search, making the search parameters very important. You need to be precise.

Search skills can be greatly improved simply through learning how *PubMed* searches for results. *PubMed* uses a special terminology called *Medical Subject Headings* (*MeSH*). When users type words into the search box, *PubMed* immediately attempts to match those words to terms contained in the *MeSH* terminology.

Each term is successively searched so that results include articles that contain all of the terms searched in any field (title, author, journal, abstract, etc). Because a "simple" search combines terms and searches in every field, results are quite frequently extensive, with many non-relevant citations presented. When this strategy was used to search for information about nutrition education in school settings using the terms "nutrition," "education," and "schools," *PubMed* presented 2,261 results.

Specificity of *PubMed* searches can be improved by combining terms and using the limits function (Brusco, 2010). Remember that *PubMed* automatically uses the *AND* function to combine all search terms if the user does not specify how terms should be used.

Use of the Boolean *AND*, *OR*, and *NOT* are powerful tools to improve search results. Additionally, use of quotation marks around key phrases ensures that the words will be searched together.

For example, if the topic of interest, *school nutrition*, is entered without quotations, *PubMed* will first search for school, then nutrition, and then will return all results where either of these words is included. When quotations are used ("school nutrition"), however, *PubMed* will search for that exact phrase, and return far fewer results, which are more likely to be relevant.

The Boolean *NOT* is another tool used to narrow searches. If the topic of the search is "weight loss in elderly nursing home patients" with a focus on unintentional weight loss and malnutrition, the Boolean "NOT" can be used to ensure that articles focused on obesity are not included. Here, the search terms might be "weight loss elderly NOT obesity." Results are unlikely to include articles dealing with weight reduction in obese elderly people.

Still, there might be thousands of results. It can be frustrating to sift through thousands of citations for those that are relevant to the question at hand. Therefore, it pays to learn a few simple techniques that can be used to search more effectively.

PubMed is very flexible and there are other ways to achieve these results, including use of *My NCBI*, a little-known free service offered to *PubMed* users. Basically, *My NCBI* is a shared space on NLM's system where users can save searches, request reminders when past search topics are updated, and set up preferences for *PubMed* searches. This service is invaluable when there is a need to be current on research topics.

Once a *PubMed* search strategy is optimized, saving in *My NCBI* and requesting updates allows users to receive an alert when new research is published. Registration is required to use *My NCBI.* The following figure shows a My NCBI home page.

My NCBI Home Page

From: National Center for Biotechnology Information. My NCBI Home Page. Access date: September 16, 2010 http://www.ncbi.nlm.nih.gov/sites/myncbi/

Putting limits on *PubMed* searches allows users to specify certain characteristics, such as publication date, type of publication, age range, species, and full-text availability (Booth, 2008). The link to *Search Limits* is at the top of the *PubMed* home page.

Another useful tool is the *Advanced Search* tool. *Advanced Search* is accessed by clicking on a link that is at the top of the home page, next to the limits link. Using *Advanced Search*, users can specify which fields to search (journal title, author, publication date, etc.) and how to connect terms (AND, OR, NOT).

There are also links here to the *Single Citation Matcher,* which is a quick way to find a citation when the author, journal and/or title are known. Users can also access the *MeSH* terminology here. When searching is ineffective, it's sometimes helpful to look to see how *MeSH* defines the search terms (Chang, *et al*., 2006).

Database nuts and bolts

In the past, much of the data analysis done in dietetics practice could be managed through use of spreadsheets and simple statistics. Spreadsheets allow for some calculations and manipulation of data, but require that all data used for a given function be kept in one file. Such a file is often referred to as a "flat" file, meaning that all information is stored in one file that cannot be linked to other files.

Use of EMR means that information needed by health-care providers is rapidly available; however, this information must be stored in a way that it becomes instantly accessible when needed. Relational databases serve this need.

Use of relational databases gives health informatics professionals powerful tools to store and manage information. Most dietetics professionals will never need to utilize relational database software. However, all should understand what relational databases are and how they work.

Relational databases are those that allow two tables to be linked. The link between the two tables is often referred to as the *primary key* and is most often an ID number that is included as a field in each of the tables. Usually one of the tables is labeled the *master table* and the table that includes related data is called the *child*.

Relational databases allow for management of large amounts of information without having to keep adding to one table (Thede, *et al*., 2010). For example, an RD in outpatient nutrition might have a relational database that includes a master table with demographic information about clients. Each client has an ID number that has been designated the primary key. Linked to the master table through the primary key might be additional tables containing insurance and payment information, information about each visit, medication information, and vital signs information.

While relational databases are powerful tools, it would be tedious to enter information into each table in tabular form. Thus, database designers create forms that can be used to enter information into the database. Forms can become very complex to design as the ease of use increases.

There are many tools that designers use to ensure accurate data entry. *Stops* can be built in so that if users enter information that is far from expected, the user will be asked to verify the information. Users can also be directed to enter only text or only numbers into a field. Forms can include drop down menus that limit the choices that users have for data entry.

Given this information, it can be seen that when using an EMR, the user interface for patient data entry is another type of data entry form for a relational database.

The real power of relational databases is demonstrated when health informatics experts use the data stored to answer questions related to some aspect of health care. Health-care organizations can have relational databases that include huge amounts of information. Searching for information using typical search methods can be impossible. *Data mining* is a term that refers to the ability to extract information that can be used to identify relationships and correlations within the data and thus used to build knowledge (Harrison, 2008).

Optimal use of data mining requires that relational databases be carefully constructed using structured data entry fields (using standardized terminology such as the IDNT) (Berger, *et al.*, 2004). Thus, when dietetics professionals use the IDNT when documenting patient care they participate in creating the data needed to support the need for nutrition services in healthcare.

Where do people find health information?

In 2006, the Oxford English Dictionary officially recognized the verb "to Google," meaning "To use the Google™ search engine to find information on the Internet." (*http://dictionary.oed.com*).

At this time most homes in the US have computers and a large percentage of those have access to the internet. There are many, many search engines available. Google has the largest share of users and is probably best known. Therefore, this discussion will center on using the Google search engine.

Healthcare providers and patients are using search engines like Google to find information about health-related topics. As Google's popularity has grown, so has interest in its ability to facilitate the diagnostic thought process. While studies show that it is possible to search the internet for potential diagnoses by entering a set of signs/symptoms into the search box, Google should not replace a skilled clinician's judgment (Tang, 2006). Although the search will often include the correct diagnosis among results presented, there may be sufficient "clutter" to lead non-clinicians astray.

At this time the internet is truly the Wild West; there are no rules or regulations governing what can and cannot be said in electronic format. Therefore, health-care providers and consumers alike must be able to quickly determine the accuracy of information found on the internet.

The internet now contains millions of websites, and that number is growing exponentially. While many contain information that is factual and safe, there are others that

may encourage less-than-healthy behaviors and/or delay needed health care. Dietetics professionals must have sufficient information-literacy skills in order to assist clients in determining which information is best suited for their unique needs (McNeil, *et al.*, 2006; Schulte, 2008).There are a few quick rules of thumb that can be used to rapidly evaluate websites for accuracy.

Users should first look at the domain name of the site. The domain name is the address used to locate the website and is part of the site's uniform resource locator (URL). A website's URL might be: **http://www.yourwebsite.com**

The domain name is "*yourwebsite.com*". Most reputable website owners will have a domain name that accurately reflects what they do. The domain name should be spelled correctly, and the type of domain should also reflect the type of website. In the US, domain types include the following:

- .com – used for commercial websites
- .edu – used for educational institutions
- .org – used by non-profit organizations

Following a quick review of the domain name, there should be some way to quickly identify the site's owner. Typically this is found in a tab or link to an area called *About us*. Recognizing that there is no requirement for any component of a website to be factual, it's a good idea to try to locate the site's owners using a separate search. If the owners claim to have a particular professional affiliation or level of education, find out if the organizations exist. It's not unheard of for less than ethical website owners to claim degrees they didn't earn from universities that don't exist.

Next, look at the site's content. If the site is putting forth information, particularly information that may be used by consumers to alter their health habits, the information must be factual and backed up by current references to literature that can be located using a standard search tool such as *PubMed.* There should be no misspellings. Remember that websites which have a *.com* domain are focused on selling something, and so might have some bias towards their products.

The non-commerical domain names might not be actively selling products, but they may be performing advocacy functions in support of a particular diet or nutrient. So, *rutabaga.org* does not actually sell rutabagas, but promotes them by publishing research that touts their value. Having a point of view, or advocating certain diet and nutrition practices, is not necessarily bad, but it must be understood for what it is.

Dietetics practitioners hear all kinds of exotic things from patients/clients who found them on the internet. Some of them may be the next breakthrough in nutrition and wellness. Others may be sound and wholesome. Many are certainly bogus. For those actively counseling outpatients, in particular, the Nutrition Dimension course *Nutrition Quackery* can help you tell the difference.

The old adage "if it's too good to be true, it probably isn't true" holds for claims made on the internet.

Electronic Medical Records

As mentioned earlier, there is now a federal mandate for health-care organizations and providers to transition to EMR over the next few years. Use of EMRs is not without controversy. There has been much discussion focused on problems providers may face when using EMR systems that were developed and implemented without sufficient input from users in design, training and use. In some cases these issues have resulted in the need to uninstall the EMR, resulting in significant costs to the organization (Ash, *et al.*, 2007; Harrison, *et al.*, 2007).

"Early adopters" usually pay the price for technological innovation. In this case, however, the government mandates early adoption by every provider. Therefore, it's important that dietetics professionals be ready for the transition to EMRs in all practice settings.

What is an EMR? Paper medical records have several significant limitations that are known to be associated with some medical errors (Harrison, *et al.*, 1999).

- Handwriting may be illegible.
- Records can be lost or damaged during natural disasters (during hurricane Katrina, this became very evident).
- Paper can get lost when providers remove pages to document and then forget to return them.
- Timing of notes can be incorrectly recorded.
- When patients have names that are the same or very similar, there's always the chance that wrong information will be recorded in the wrong medical record.

Therefore, efforts to develop electronic clinical information systems in ways that minimize these occurances have been ongoing for many years. Early EMR systems simply gave health-care professionals a way to type documentation and store files on the computer. Over time, the systems have become incredibly sophisticated. EMRs now can be thought of as integrated computerized systems that contain all of an individual's health information. This information is then available to the patient and to all authorized providers regardless of the care setting.

According to the Health Information Management Systems Society (HIMSS) analytics model, there are seven stages that describe how far along a healthcare organization has come in implementing an EMR. The table on the next page describes these stages.

At this time, there are very few health-care organizations in the US that have met all of the criteria to achieve Level 7. This will obviously change as the provisions of the meaningful use regulations come into play. These regulations include financial incentives for eligible facilities and for eligible health-care providers who can demonstrate that they are "meaningfully using" EMRs.

Stages of EMR Implementation

Stage	Description
1	Major ancillary areas using clinical systems No data sharing between departments
2	Major ancillary areas sharing information from central data repository Providers have access to information System using a standardized medical terminology Basic decision support (data entry error checking)
3	Nursing documentation (vital signs, flow sheets, I/O) in use Care plan documentation in use in at least one patient care area Error checking in place
4	Computerized Provider Order Entry (CPOE) in use in at least one patient care area System has access to evidence based medicine resources
5	Electronic Medication Administration Record (eMAR) in use: system uses some method to ascertain patient identification for medication administration eMAR integrated with CPOE
6	All providers documenting care in at least one patient care area Clinical decision support for all aspects of care
7	Facility no longer uses paper documents for any aspect of patient care Clinical data warehouse used to store and manage data; data analyzed to determine patterns of care and need for improvement Clinical information rapidly available when needed Clinical information easily shared between authorized providers

HIMSS Analytics. EMR Adoption Model. 2009; http://www.himssanalytics.org/hc_providers/emr_adoption.asp Accessed September 10, 2010

Following are descriptions of some of the key components of an EMR that might be used in either inpatient or ambulatory patient care.

• **Patient demographic information**. Health-care providers and organizations must have information that allows rapid identification of patients or clients, along with their location in the health-care system. This software is known as the *Admission, Discharge, and Transfer* (ADT) system.

Because one of the most important functions of any medical record keeping system is to know who the patient is and where he or she is located, ADT functions were among the first to be moved from paper to electronic systems. ADT systems keep track of patient names, addresses, payment information, primary care providers, and medical record numbers.

Patient location is tracked through admission, discharge and transfer dates and locations. ADT systems are often closely linked to financial data that includes billing and payment information. Because each patient is linked to his/her medical information by a unique identification number, it is much less likely that information will be recorded in the wrong medical record.

• **Allied health systems**. Very rarely will one EMR vendor have available software that meets the needs of all hospital systems. A system that has outstanding clinical documentation capabilities might have major drawbacks in how lab data is tracked or how pharmacy information is managed.

Because of this, there are hundreds of smaller vendors specializing in software that meets the needs of one or a few ancillary departments. Each of these systems must be linked or "interfaced" with the EMR in order to share information. Large organizations might have hundreds of interfaces for different software used in the facility. Building and maintaining these interfaces is no easy task — each interface can take months of work and tens of thousands of dollars just for the initial build (Payne, *et al*., 2008).

• **Documentation.** Health-care professionals are responsible for documenting the care they provide. A well-designed documentation template pulls information such as lab data, patient weight, admitting diagnosis, and the attending practitioner into the chart note being written. EMRs will have basic documentation templates included. Depending on how the facility contracted with the vendor for overall software support and installation, users will have the ability to request varying levels of customization to better meet their needs.

RDs must remember that the basic EMR template for nutrition care will almost never meet their needs for documentation of nutrition care. Development of custom screen templates for clinical documentation is a difficult and complex task. All too often, RDs are asked to do this with little or no training; the results may be difficult to use and not meet the needs of RDs who must use the system.

Ideally, EMR documentation templates are designed with input from users following extensive evaluation of workflow, information needs and documentation requirements. Ideally, documentation is done using as little free text as possible; once again, the IDNT can be used to facilitate documentation in structured data fields. Quite often facilities will utilize expert consultants to help determine provider workflow and build documentation templates that support efficient documentation.

• **Computerized provider order entry.** One of the key components of any fully implemented EMR is *computerized provider order entry* or CPOE. It is widely thought that CPOE will be a major step in ensuring that medical errors are minimized (The Leapfrog Group, 2008; Simpson, 2001). When CPOE is utilized, orders are transmitted to the appropriate department as soon as they are written — there is no delay in sending the order "through channels."

Patient safety is enhanced as CPOE allows a rapid computer check of new orders in comparison to current medication and food allergies, any dose modifications needed based on the patient's clinical condition, and prescribing alerts if dosage errors are noted.

Another benefit of CPOE is implementation of order sets or "care bundles" (Hoyt, *et al*., 2008). For example, RDs can participate in creating an order set for enteral nutrition that includes tube type and location, formula, rate, initiation schedule, and indicators for monitoring. When order sets are utilized, providers have the ability to quickly implement all of the components, or to select only those components desired.

While order sets and CPOE have proven in many cases to improve care, these systems must be built and implemented with strong consideration of user needs in order to avoid negative unintended consequences (Ash, *et al*., 2007). It's well worth the time to develop CPOE systems with provider needs in mind, as this typically results in higher adoption rates and improved compliance leading to fewer medication errors (Birk, 2010; Hoonakker, *et al.*, 2010).

• **Clinical decision support systems.** Another major benefit of EMRs is the ability to provide current information to providers at the point of care. The first Clinical Decision Support Systems (CDSS) gave drug alerts and reminders. These systems would compare new medication orders to already existing orders and scan a database of drug – drug interactions, drug allergies, and dosing changes needed, then provide an alert when a discrepancy was found. These early systems were able to show some beneficial impact on decreasing medication errors, (Kaushal *et al*., 2003).

CDSS have evolved into very complex systems that utilize information from clinical guidelines and health-care knowledge to assist providers making difficult diagnostic decisions. Typically, CDSS is provided through a third-party software vendor that is either offered as a link to the EMR or interfaced directly into the EMR software itself.

Health-care providers tend to have mixed reactions to CDSS, depending on their experience with these systems (Keeffe, *et al*., 2005). Poorly built systems may detract from care by requiring clinicians to interrupt their workflow to get to the system (Sittig, *et al*., 2007). Other systems have too-frequent alerts and reminders, resulting in what has become known as "alert fatigue." When providers receive too many reminders that they consider to be for trivial reasons, there is a tendency to ignore all reminders.

Providers must have a way to silence CDSS reminders and alerts, although it is a good idea to ask for a reason the alert was silenced. This way, system builders can use the information from reasons submitted to improve the system.

One systematic review identified four key components that are critical to successful CDSS implementation (Kawamoto, *et al.*, 2005):

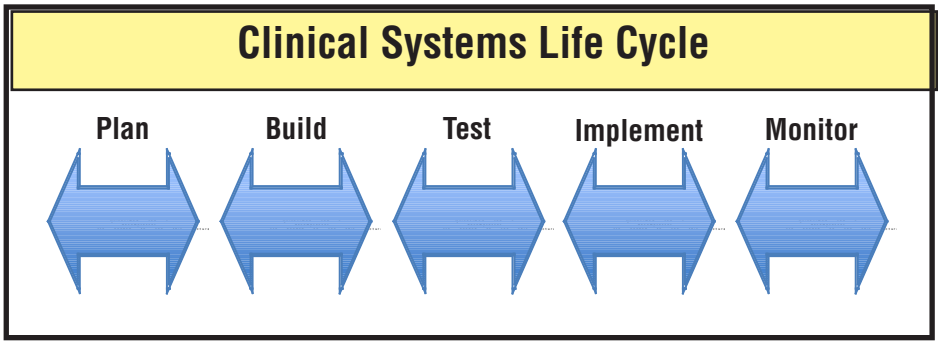
- First, CDSS was more likely to be positively viewed by clinicians, and result in improved patient outcomes, when CDSS was provided as part of clinician workflow.
- Second, successful systems gave clinicians recommendations for action instead of simply repeating assessment information.
- Third, it was important to have the CDSS integrated at the point of care.
- Finally, successful CDSS systems were those that were computer based.

When all four of these features were present, patient care was improved more than 90 percent of the time (Kawamoto, *et al.*, 2005).

Clinical system life cycle

The decision to implement EMRs is a major undertaking in all care settings (Berg, 2001). Depending on the size of the facility, these systems can cost tens of millions of dollars. In addition to the cost of the system software, costs for additional personnel to work on the build and implementation, training costs, and additional time needed for patient care during the implementation process. Because of the significant costs involved with implementation, and the serious consequences associated with system failure, informatics project management professionals are valuable members of the team (Gruber, *et al.*, 2009). In order to ensure that their system needs are considered, dietetics professionals must be involved in all phases of the "clinical system life cycle," a term often used to describe the stages included in implementing a clinical system.

The following chart illustrates the clinical system life cycle. Double arrows are often used to illustrate the point that even during each of the phases, the need exists to constantly reevaluate for the need to update current software or purchase new software, retrain users or re-evaluate purchasing decisions.



• **Planning.** There are many important decisions to be made during the first phase of the life cycle beyond simply deciding to make the transition to an EMR.

Facilities must decide which type of systems to consider — those that purport to meet all needs using one product, or several smaller systems which require them to create interfaces. In order to meet the needs of nutrition services, RDs must be ready to clearly define the options needed at this phase. Many vendors focus on the system needs for nursing and physician documentation, and thus may not have fully developed solutions for allied health needs.

An important part of the planning phase is evaluation of clinician work flow (Brokel, *et al*., 2007). Remember that provider satisfaction with clinical systems is related to how well the system supports the way the clinician works. While some change is inevitable when clinical systems are implemented, one overall goal is to make the system meet the clinician's workflow.

A complete understanding of workflow requires knowledge of how providers get their work done, where they go, whom they talk to, how they document and where they find the information needed to document. Workflow analysis takes time, which should be built into the planning phase.

As the facility's needs are articulated, those responsible for the purchase will develop a "request for proposals" (RFP), which will describe in great detail the functions that the system will need to provide. This document is the basis of the project, so RDs must ensure that their needs are included in detail.

These needs might include the ability to generate reports describing the number and type of patients seen or outcomes of nutrition interventions. Documentation screen requirements might include the need to have structured data entry fields for nutrition diagnoses. Other requirements might be to have medical diagnoses and medications automatically entered into nutrition documentation screens.

The RFP will then be sent to vendors; those vendors that are interested will then develop proposals and submit them for review. Several vendors may then be asked to provide demonstrations and more information regarding their products.

At this phase, facilities must seek out opinions from others who are using the vendor's products, as vendor sales representatives often do not have clinical experience and will be focused more on making the sale than on being totally honest about their product's capabilities. When purchasing agreements are drafted, facilities must include provisions for consultation with the vendor, assistance with training, and continued support.

Once a decision is made to purchase, a "build team" is assembled, project goals, objectives and timelines are developed, and work begun. Very rarely will a product be ready to use "out of the box." In most cases, a significant amount of customization will be needed. Again, RDs must be ready to develop custom templates with a full understanding of how they will be used and how information will flow.

While it's a good idea to see what others are using, remember that each facility is different, so there will most certainly be a need to change shared templates to ensure that the documentation needs of clinical staff are fully represented.

• **Testing.** Anytime changes are made to software, there is a need to test the complete system to ensure that bugs don't lead to downtime or failure. This phase can be very time-consuming, depending on the amount of customization required and unique circumstances of the facility.

RDs should participate in testing. Because nutrition services is so integral to functioning of any health-care facility, RDs must be ready to evaluate testing of CPOE, CDSS, documentation and other components. Nutrition documentation must be tested to ensure that information flows to the proper place in the correct format. When errors are noted, the underlying code must be revised and testing begun again!

• **Training** on the system begins towards the end of testing. As the system is closer to implementation, users must be trained. Because facilities often focus on training the major users (nurses and physicians), RDs must be assertive in ensuring that all staff are adequately trained. Strong training programs include several hours in the classroom, along with visible support on the units when patient care is being provided.

• **Implementation** begins once testing is complete. There are two schools of thought related to best practices in implementation. These are:

> *The "big bang" theory*, which basically says the best way to facilitate the change is to change the entire system at once. Although users will have initial shock, if the system is well-designed and tested, providers will adapt.

> *Phased implementation*. Here, decisions to implement might include all units implementing some components and gradually adding on, or some units implementing all components, with additional units plugging in on a planned schedule.

• **Monitoring and evaluation** is the final phase. Here, results obtained from the system are constantly monitored. Clinical informatics departments might monitor the amount of unplanned down time or glitches in interface function along with the amount of time required to keep things running. Clinicians should monitor how well the system is meeting their needs and how easy it is to make changes as new needs arise. Managers often rely on clinical systems to provide the data needed to develop reports describing work done and care outcomes. During monitoring and evaluation managers must determine if the information provided by reports is sufficient and if changes are needed.

Managing personal health information

One of the more exciting developments in clinical informatics is the use of personal health records (PHR) (American Health Information Management Association, 2010). One of the goals of ARRA and HITECH is for all Americans to have their health information stored in a PHR where it is readily available only to those who are authorized to view it.

Because of the emphasis put on PHRs by recent legislative efforts, some have the impression that PHRs are a new development. Not so; they have been around for a long time.

PHRs now range from simple paper files to complex internet-based systems that are linked to a health-care organization's EMR. Prior to implementation of clinical systems, many individuals simply maintained their health records in paper format in a binder or file. As internet access has become more widely available, commercial PHR stand-alone products have proliferated. Both Google and Microsoft offer internet-based PHRs. Some health-care organizations have contracted with on-line PHR providers so that the PHR is linked to their EMR. Other organizations have fully-integrated PHRs that are linked to their EMR as a single package (Kahn, *et al.*, 2009).

PHRs have many benefits to patients and providers alike (Tang, *et al.*, 2006). Use of secure messaging is one benefit.

Patients and providers have been using e-mail to communicate for some time. However, e-mail is not secure and should not be used to share protected health information. Integrated PHR systems often offer secure messaging. Think of it as e-mail with armor; when messages are sent within the PHR, information is encrypted and access requires a password.

PHRs also give patients access to educational materials and information that they would otherwise have to travel to a provider's office to receive (Kupchunas, 2007). RDs must seize this opportunity to ensure that nutrition information provided in their facility's PHR is factual and appropriate.

However, some caveats apply. Users of stand-alone products like Microsoft HealthVault™ and Google Health™ must be aware that HIPAA regulations for safety and security mandated by the Health Insurance Portability and Accountability Act (HIPAA) may not apply to these products. Providers must understand that some stand-alone PHRs allow patients to change or edit information. Most now have some method to alert providers when information is edited.

Safety and security

In 1996, HIPAA was enacted to ensure that an individual's health insurance information was able to be shared between health-care organizations only as needed and in a safe manner (Centers for Medicare and Medicaid Services, 2009). Subsequent "administrative simplifications" have further expanded HIPAA's reach (Chung, *et al.*, 2006).

Health-care providers and organizations must become familiar with requirements related to management of information security, documenting processes used to share information in order to demonstrate that information is kept safe and secure, determining who should have access to protected health information, and which information is to be shared (Banks, 2006).

It is important to remember that the provisions of HIPAA should never impede needed care. Using common sense in sharing patient information is a major component of HIPAA. Some common-sense guidelines include:

- Never use unsecure email to share patient information with other providers.
- Never provide detailed patient descriptions when communicating about patient care on listserves and discussions.
- Never fax protected health information unless you are sure that the receiving fax is secure.
- Never share information that is not vital to patient care.

Social networking: should you "friend" your patients?

Social networking can be thought of as a group of individuals who join together in an online forum or website for the purpose of sharing information. Users of social networking websites may or may not know each other personally, and typically become connected through their "friend" status.

Most social networking sites allow users to request others to friend them, which simply involves a link between users' information that gives more access to information and photos posted online.

Here we'll review two of the more popular social networking sites, Facebook™ and Twitter.™

• **Facebook.** Facebook is among the most popular of the social networking sites. During the late 1990s, students at Harvard University created Facebook as a sort of "online yearbook." Popularity of the site soared, prompting an initial release to other universities, which was rapidly followed by general release in 2004. Facebook now has over 500 million subscribers (Facebook, 2010).

Users register for free accounts and are then given a profile page where they can post photos, update their activities and share other information. Most of the social networking sites provide users some level of control over privacy settings, although many simply use the default settings, which may not fully protect user's information (Thompson, *et al*., 2008).

Dietetics professionals have embraced social networking as well. Though there is little information regarding patterns of usage among RDs and DTRs, it should be assumed that dietetics students would have similar knowledge of social networking as other allied health professions students. A survey study evaluated changes in behavior and opinions about social networking before and after participation in an educational session focused on "e-professionalism." Prior to the session, students did not fully understand how use of social networking sites like Facebook might be perceived by instructors and prospective employers (Cain *et al.*, 2009). After the session, most planned to change their online behaviors.

There are professional risks associated with use of online social networking that cannot be ignored. Because many users do not fully utilize privacy settings, information thought to be private may be shared outside a user's group of online "friends." Prospective employers might view an applicant's social networking profile prior to making employment offers. Educators and students may have access to personal information that goes beyond that needed in an educational setting.

Dietetics professionals must be aware of these risks and carefully consider which information they want to share. Additionally, they must be aware of their friends' activities, as others may add tags to photos or other information that makes the information more public than might be wanted.

Another concern for health-care professionals is the practice of "friending" patients. Providing access to personal information poses serious issues for both the patient and the professional. Many social networking users don't fully understand the privacy issues surrounding use of social networking (McCreary, 2008). For these reasons, Guseh, *et al. (2009)* proposed guidelines for physicians (which apply to all health professionals) who are using social networking, including:

> avoiding acceptance of invitations from patients;
> carefully evaluating any patient-specific information gleaned from online social networking sites;
> being cautious when revealing personal information on online social networking sites; and
> understanding and utilizing privacy settings at all times.

• **Twitter.** Twitter began as a method for users to become "microbloggers." Twitter allows users to post information in very brief (limited to 140 characters) "tweets."

Twitter is now used by individuals and organizations to update followers on activities and breaking news. Professional organizations use Twitter to alert meeting attendees to newly scheduled sessions or interesting events that attendees might want to know about. Public health organizations might use Twitter to alert communities regarding outbreaks of communicable disease.

However, all too often Twitter is used to simply update more day-to-day details of daily living. Initially, many couldn't quite understand the apparent fascination with lunch choices, movies seen and other mundane information. As Twitter has become more popular, however, more and more users are sharing this information. Others have found that Twitter offers support for individuals with chronic disease, who can share their daily challenges and get rapid feedback and encouragement (Hawn, 2009).

Building online "communities" through Twitter can be a way for dietetics practitioners to maximize their impact and extend their reach. Reminding clients of upcoming deadlines or program milestones — such as progress on a diet regime — can enhance and prolong counseling and promote inclusiveness among members of a group. Inviting program participants to share experiences can provide valuable feedback.

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Nutrition Care Process Assessment

Patient ID:

Date of Admission:

Patient/Client History

Personal History

Age	
Gender	
Race/Ethnicity	
ETOH	
Tobacco use	
Language spoken at home	
Education	
Role in family	
Activity level	

Social History

Employment	
Housing	
Social support	
Support for health care needs	

Patient/Family Health History

Condition	Date	Patient/Family	Comments

History of Current Illness (part of medical/health history):

Topic	Data	Definition/Significance to Nutrition
Admitting diagnosis or Chief Complaint		
Other health concerns		
Medical/Surgical history		

Nutrition Care Process Assessment *cont'd*

Patient ID:
Date of Admission:

Medical Tests, Labs, and Procedures

Lab Data

Test	Date	Result	Normal Value	Significance

Procedures and Tests

Procedure	Date	Outcome

Anthropometric Data

Parameter	Date	Outcome
Height		
Weight		
BMI		

Weight History (if known)

Date	Weight	Comment (planned or unplanned weight change, etc)

Food and Nutrition History

Previous Diet Modifications

Date	Diet Type	Knowledge, Belief, Attitude

Nutrition Care Process Assessment *con't*

Patient ID:
Date of Admission:

Food and Nutrition History *cont'd*

Foods Eaten on Typical Day Prior to Admission (if relevant)

Time	Food and Amount	kcal	Protein	Comments

Total estimated energy and protein intake:
Estimation of adequacy of micronutrient intake:
Overall adequacy of diet

Medications – Include herbal and supplements

Medication	Dose	Food/Drug Interaction
HOME		

Physical Activity and Function:
Access to Food and Food/Nutrition-Related Supplies:

Physical Exam Findings

Finding	By Whom? (MD, RN, RD)	Significance

System Specific
Nutrition Focused Physical Assessment

Body System	Nutrition Specific Evaluation	Findings
Head and Neck	• Condition of hair • Eyes; movement, color of sclera • Conjunctiva • Xanthomas • Mouth; lesions, dentition, tongue movement	
Skin	• Color, pigmentation • Integrity; presence of wounds, bruises, lesions • Quality of wound healing • Edema • Petechia • Temperature	
Chest	• Symmetry • Breath sounds • Heart sounds • Muscle wasting	
Gastrointestinal	• Ascites • Bowel sounds • Distension • Firmness to touch • Presence and quality of bowel sounds • Feeding devices and / or ostomies	
Musculoskeletal and Extremities	• Amputations • Gross and fine motor control • Gait • Muscle wasting • Strength • Symmetry • Involuntary movement • Pain on movement • Presence of edema	
Neurologic	• Level of consciousness • Coordination of movements • Aphasia • Dysphasia	
Other		

Nutrition Care Process Diagnosis

Patient ID:
Date of Admission:

Nutrition Diagnosis

Foods Eaten on Typical Day Prior to Admission (if relevant)

	Problem (Nutrition Diagnosis)	Etiology (The nutrition-related issue felt to be the most proximate cause of the nutrition diagnosis)	Sign/Symptom (must be identified from assessment information and must be directly related to the problem)
1			
2			
3			
4			

Determination of Nutrition Prescription

Estimated energy requirements	
Estimated protein requirements	
Estimated intake prior to admission	
Current diet order	
Nutrition Prescription	
Recommended changes to current diet order	

Nutrition Care Process Intervention

Patient ID:
Date of Admission:

Relevant Information:

Diagnosis:

Nutrition Prescription:

Patient Input:

Nutrition Intervention

Note the intervention planned/completed as well as the nutrition diagnosis the intervention was to treat.

Intervention	Diagnosis	Outcome Goal	Planned/Date of Completion

Nutrition Care Process
Monitoring and Evaluation

Patient ID:
Date of Admission:

Monitoring/Evaluation

Note the monitoring indicator chosen, the diagnosis that will be improved, the standard to compare the monitor and the time frame for monitoring.

Planning

Monitoring Indicator	Diagnosis	Standard for Comparison	Time Frame

Monitoring

Date	Indicator	Results	Goals Met?

Patient Feedback:

Examination

NCP10

Answer each question by checking the correct answer online or filling the circle corresponding to the correct answer on the answer sheet. There is one best answer for each question. If you want a record of your answers, photocopy the answer sheet or record your choices on another piece of paper. Do not detach the examination from the book. This exam has 40 questions.

1. Health outcomes management is not included as a distinct step of the Nutrition Care Process for which of the following reasons?
    a. It is not required that RDs participate in outcomes management
    b. Nutrition care is not considered a component of outcomes management
    c. RDs participate in outcomes management with other health professionals
    d. Other health professionals lead outcomes management projects

2. Which of the following best describes the role of the RD in completing nutrition risk screening in most care settings?
    a. RDs are often too busy to screen for nutrition risk
    b. RDs should screen patients/clients for nutrition risk in all care settings
    c. RDs should delegate responsibility for nutrition risk screening to nursing
    d. RDs should develop and oversee nutrition risk screening policies

3. RDs were familiar with three of the four components of the Nutrition Care Process when it was first introduced in 2003. Which of the four steps was new for most RDs?
    a. Nutrition Diagnosis
    b. Nutrition Intervention
    c. Nutrition Assessment
    d. Nutrition Intervention and Monitoring

4. Which of the following does the Institute of Medicine feel must be understood in order to improve health care quality in the United States?
    a. Patterns of care
    b. Health-care professional education
    c. Processes of care
    d. Cost of medications and treatments

5. According to the NCP, which of the following is not one of the five major components of the nutrition assessment?
    a. Nutrition history
    b. Anthropometrics
    c. Nutrition-focused physical exam
    d. Activity history

6. When does nutrition assessment begin?
    a. When the RD meets the patient/client for the first time
    b. When the referral for nutrition assessment is received
    c. When the RD discusses the patient/client with the referring provider
    d. When reviewing lab and medical information about the patient/client

7. What is the best way to quickly and efficiently gather a food/nutrition history in acute care?
   a. The RD simply asks the patient "What did you eat?"
   b. Having nursing complete a 24-hour recall with the patient
   c. The RD completes a 24-hour recall with the patient
   d. Having the patient complete a food frequency questionnaire

8. Which method for assessing food/nutrient intake is used most often in community settings?
   a. Food frequency questionnaires
   b. Diet records
   c. Calorie counts
   d. 24 hour recall

9. Body weight may not provide sufficient information to diagnose nutrition problems in which of the following situations?
   a. The patient has advanced cancer and is scheduled for major surgery
   b. The patient has HIV/AIDS and is taking antiretroviral medications
   c. The patient is obese and is being seen in the outpatient clinic for education on weight loss
   d. The patient has an above the knee amputation

10. When should the dietetics professional request or order laboratory testing?
   a. A standard lab panel should be requested or ordered for all patients
   b. Dietetics professionals should not request or order lab testing
   c. Lab testing should be requested or ordered based on the patient's condition
   d. Lab testing should be requested or ordered even if no action will be taken on the results

11. A patient returns to the outpatient clinic for follow-up counseling on a weight-loss diet, and states that she lost no weight in the past month even though, "I only eat 500 calories and walk 5 miles per day." What other information is needed to help determine the reason for lack of progress?
   a. Further discussion regarding types and amounts of foods eaten and duration of physical activity
   b. No further action; the patient should be referred to a metabolic specialist
   c. Measure energy expenditure and tailor diet to results
   d. No further action; the patient has reached a plateau and should be counseled to continue present course

12. Which of the following best describes the Subjective Global Assessment (SGA)?
   a. SGA is a clinically validated nutrition screening tool
   b. SGA should only be completed by dietetics professionals to determine nutrition status
   c. SGA relies on critical evaluation of information from the history and physical exam
   d. Positive SGA results should be followed by additional testing to determine nutrition status

13. Which of the following health care professionals are able to diagnose "type 2 diabetes mellitus" in an overweight 57-year-old patient who has a hemoglobin A1c of 8.9 and two fasting blood glucose levels greater than 200 mg/dL?
    a. Registered Nurse
    b. Physician
    c. Registered Dietitian
    d. Clinical Nurse Specialist

14. What are the three categories of the nutrition diagnosis area of the International Dietetics and Nutrition Terminology (IDNT)?
    a. Intake, clinical, behavioral-environmental
    b. Intake, deficiency, behavioral-environmental
    c. Clinical, Intake, growth-development
    d. Clinical, deficiency, growth-development

15. Which of the following diagnostic strategies is most often used by entry-level clinicians?
    a. Hypothetico-deductive reasoning
    b. Logical algorithms
    c. Strategy of exhaustion
    d. Pattern recognition

16. What is a "nutrition differential"?
    a. A list of signs and symptoms that indicate a particular nutrition diagnosis
    b. A list of nutrition diagnoses and their associated defining characteristics
    c. A list of nutrition diagnoses and associated medical diagnoses
    d. A list of nutrition diagnoses that might be associated with a patient's signs/symptoms

17. Nutrition diagnoses are documented using P-E-S statements. What does P-E-S stand for?
    a. Problem-etiology-signs/symptoms
    b. Prognosis-etiology-signs/symptoms
    c. Problem-epidemiology-significance
    d. Patient/group-epidemiology-signs/symptoms

18. A clinical RD is seeing a patient who was admitted to the hospital for pneumonia. The patient has a BMI of 40 and is complaining of a poor appetite. Which nutrition diagnosis might apply to this patient?
    a. Inadequate oral intake
    b. Altered GI function and obesity
    c. Inadequate oral intake and obesity
    d. Altered GI function and inadequate oral intake

19. Nutrition interventions include actions that are planned by which of the following individuals?
    a. The RD alone
    b. The RD and patient
    c. The RD, patient, and healthcare team
    d. The RD and the healthcare team

20. RDs working in acute and long-term care facilities are able to implement which types of nutrition interventions?
    a. Direct and indirect without provider order
    b. Direct and indirect following provider order
    c. Direct and indirect only if credentialed and with provider order
    d. Direct only if credentialed and with provider order

21. The facility's credentialling committee has a policy that specialty credentials are required to begin the credentialing process. Which of the following applies regardless of the care setting?
    a. The specialty credential alone can be used to justify writing orders
    b. The specialty credential provides supporting information for writing orders
    c. Specialty credentials are meaningless for justifying writing orders
    d. Justification for writing orders would depend on the organization offering the credential

22. Future health-care models may see entry-level to advanced practice beginning at which educational level?
    a. Bachelor's degree
    b. Master's degree
    c. Doctoral degree
    d. Practice specialist level

23. What are some of the skills that might be needed to practice at the clinical practice doctoral level in dietetics?
    a. MNT, leadership, evidence-based practice
    b. Collaboration, MNT, bioinformatics
    c. MNT, evidence-based practice, health care finance
    d. MNT, management, evidence-based practice

24. What are the two components of nutrition interventions?
    a. Planning and implementation
    b. Goal setting and intervention
    c. Critical thinking and implementation
    d. Discussion and action

25. A nutrition diagnosis from the intake domain ideally should be treated by an intervention from which of the following intervention domains?
    a. Education
    b. Counseling
    c. Delivery of foods
    d. Collaboration

26. What are the initial considerations involved in determining which nutrition intervention is appropriate?
    a. Prioritize the diagnoses
    b. Prioritize the interventions
    c. Determine patient wishes
    d. Collaborate with others

27. How does the nutrition prescription differ from the diet order?
    a. There is no difference between the nutrition prescription and the diet order
    b. Physicians are the only providers who can write diet orders while RDs are the only providers who can write nutrition prescriptions
    c. Nutrition prescriptions are only written when the diet order is incorrect
    d. RDs use a nutrition prescription to convey a given patient's nutrient needs
28. Which of the following is the best of the key considerations that must be included in goal setting?
    a. Patient's insurance coverage
    b. Patient's family's wishes
    c. Coordination with other providers
    d. Length of patient hospital stay

29. The RD caring for a patient in a long-term care facility decides with input from the resident to provide an extra afternoon snack in order to increase energy intake. What is the responsibility of the RD once the order for the snack has been written?
    a. To reevaluate at the next visit
    b. To determine if the order was carried out
    c. To check the patient's weight in one week
    d. To document that the order was written

30. RDs in acute care would rarely be implementing nutrition counseling interventions. Why is this?
    a. It takes time to develop a counseling relationship; inpatient length of stays are too short
    b. RDs in acute care do not have the skills to conduct nutrition counseling
    c. There is no reimbursement for inpatient nutrition counseling
    d. Inpatient RDs must have permission from credentialing committees to counsel patients

31. The three components of the monitoring and evaluation step of the Nutrition Care Process include:
    a. Outcomes, process and measurement
    b. Evaluation, monitoring and measurement
    c. Process, monitoring and evaluation
    d. Outcomes, monitoring and measurement

32. Which of the following refers to a set of numbers or measures?
    a. Data
    b. Information
    c. Knowledge
    d. Values

33. Evaluation of trends in monitoring indicators results in creation of:
    a. Knowledge
    b. Process
    c. Outcomes
    d. Information

34. Dietetics professionals working in the area of health informatics require knowledge in which of the following areas?
    a. Change management, patient care and information science
    b. Information science, computer science, and patient care
    c. Leadership, computer science and evidence-based practice
    d. Clinical practice, information science and change management

35. Provisions of the HITECH Act require that eligible providers and organizations must demonstrate "meaningful use" of certified EMR systems by which year?
    a. 2012
    b. 2013
    c. 2014
    d. 2015

36. What is the overall function of a computer's operating system (OS)?
    a. Allows users to access the Internet
    b. Used to diagnose problems causing lost data
    c. Used by programmers to help test software
    d. Coordinates interactions between hardware and software

37. Why do "simple text word" PubMed searches often result in a large number of both relevant and non-relevant citations?
    a. Users often use incorrect search terms
    b. PubMed matches search words to terms in all citation fields
    c. PubMed searches the Internet for citations matching search terms
    d. Users might misspell search terms resulting in non-relevant citations

38. What is a major limitation to use of spreadsheets for collecting and analyzing data?
    a. Spreadsheets have very limited analytical ability
    b. Results of data analysis cannot be displayed using charts and graphs
    c. Spreadsheets require that all data is kept in one file
    d. Spreadsheets are too difficult to use

39. Health care professionals and consumers are using the Internet more and more often to search for information about health conditions. Which of the following may impede access to accurate information?
    a. There are no regulations governing what can be posted on the Internet
    b. Some health-related websites don't appear in search results
    c. Users may not understand how results are ranked and presented
    d. Users may not be able to open websites with accurate information on their computer

40. Which of the following is thought to be a major benefit of using an electronic medical record (EMR)?
    a. Cost of care will be reduced
    b. Improved access to care
    c. Improved ability to manipulate and update information
    d. Improved communication among departments.
    e. c & d