CLINICAL NUTRITION EXPERT STATUS AS RELATED TO SELECTED DEMOGRAPHIC, DIAGNOSTIC THINKING, KNOWLEDGE AND MOTIVATIONAL VARIABLES

by

Ronna Lee Biesecker

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As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Ronna Lee Biesecker entitled Clinical Nutrition Expert Status as Related to Selected Demographic, Diagnostic Thinking, Knowledge and Motivational Variables.

and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy

Mary Ann Kight — 12-11-98
Mary Ann Kight — Date

Pamela G Reed — 12-11-98
Pamela Reed — Date

12-11-98
David Van Wyck — Date

Joan E Haase — 12-11-98
Joan Haase — Date

Lawrence Aleamoni — 12/11/98
Lawrence Aleamoni — Date

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

Mary Ann Kight — 12-11-98
Dissertation Director Mary Ann Kight — Date

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SIGNED: Ronna Lee Briesecker

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ABSTRACT

The purposes of this study were: (a) to examine diagnosis of nutritional problems as a representative task of clinical dietitians practicing in renal nutrition, (b) to differentiate levels of practice performance based upon scores obtained on the diagnostic thinking inventory, and (c) to define clinical nutrition expert status. A descriptive, correlational design was employed. Variables were examined in a random sample of 309 registered dietitians who were members of the Renal Practice Group of The American Dietetic Association.

Expert Status Inventory was developed to include items addressing four categories of expertise: professional characteristics, diagnostic thinking, knowledge and motivation. Professional characteristics included years of experience, professional behaviors, roles, work setting and caseload, honors and awards. Diagnostic thinking inventory from medicine was modified for use with dietitians. Knowledge variables included formal and informal knowledge sources and deliberate practice. Motivational variables included the experience of flow and involvement with second-order environments. Reliability and validity were assessed and deemed acceptable for this study, with recommendations for revisions noted.

Diagnosis of nutritional problems was acknowledged by 56.9% of the sample. Findings were that statistically significant differences exist between diagnosing and non-diagnosing dietitians at the $p = 0.01$ level using Student's t-test. Step-wise regression identified four variables predictive of the highest diagnostic scores: use of medical diagnostic codes, experience with flow, professional behaviors and dietetics

experience. Diagnosing dietitians were then separated into three groups: those using dietetic-specific nutritional diagnostic codes only, those using medical codes only and those using both classification systems. Post-hoc contrasts between groups on the regression variables revealed significant differences in experience and diagnostic scores only.

Characteristics reflecting clinical nutrition expert status identified by this study were formal diagnosis of nutritional problems, professional involvement, experience of flow and dietetics experience.

Areas recommended for future study are: qualitative analysis of dietitians' diagnostic thinking, refinement and modification of diagnostic thinking inventory for dietetic-specific use and the relationship between the study of flow and deliberate practice activities.

CHAPTER 1

STATEMENT OF THE PROBLEM

A paradox has guided the domain of clinical dietetics for the past seventy years. In the charter issue of the Journal of The American Dietetic Association, Wilder (1925) envisioned hospital dietitians as "clinical nutrition experts." However, expert status has not been attained for dietitians as evidenced by Strategic Plans of The American Dietetic Association (ADA, 1991; ADA, 1995) which state that registered dietitians *will be* recognized as "the experts in nutrition and food issues by the public and other professionals." Inter-professional and intra-professional forces appear to have sustained this paradox and a blurred image relevant to dietetics and nutrition.

Inter-professional forces include (a) dietetics' scope of practice (extent of professional overlap), (b) certification of clinical nutrition specialists by numerous agencies other than The American Dietetics Association and (c) status of licensure in dietetics. Intra-professional forces include: (a) Lack of a definition for "clinical nutrition expert," (b) lack of identified representative tasks/competencies of experts and (c) inability to differentiate levels of practice performance among dietitians (Bradley et al, 1992) or between registered dietitians and dietetic technicians (Bristol, 1993)).

As these forces cannot be addressed in entirety in this dissertation research, the focus will be on the inter-professional forces: (a) A preliminary definition of clinical nutrition expert specific to renal nutrition, (b) identification of a representative task of dietetics, i.e., diagnosis of nutritional problems and (c) differentiation of levels of practice performance renal nutrition. If these forces are not addressed, concerns regarding professional and public recognition of expert status, certification of other health professionals as clinical nutritionists and legal requirements to become recognized as a profession are inconsequential. On the other hand, if differentiated levels of practice performance do exist, examination of those registered dietitians identified at the highest level should reveal strategies and processes to inform clinical dietetics practice and education, and thus influence dietetics' scope of practice.

Overview of the Problem

Inter-professional and intra-professional forces shaping the domain of clinical dietetics are examined below.

Inter-professional Forces

"Dietetics and nutrition are viewed as interchangeable occupations by the lay public and many who work in health-medical care fields. Though separate occupations, dietetics and nutrition are closely interwoven and have been shaped by the same social forces" (Biesecker, 1995).

Scope of Practice

The search for food consumed a major portion of life for pre-historic people. After humans learned to domesticate animals and sow grains, the nomadic lifestyle changed to one of agriculture and a fixed abode (Todhunter, 1965; Biesecker, 1995). Food availability became less a concern than *diet* or *dietetics*, the interest in diet and its relationship to survival and disease. Initially comprising the entire doctrine of health and what was once referred to as hygiene, dietetics can be traced back to the early Greeks and Romans (Ibid.).

The word *nutrition* was seldom used until the early 1900's when sufficient advances occurred in physiological chemistry to make possible the development of the new science of nutrition. Nutritional science then appropriated the physiologic component of what had been considered dietetics--digestion, absorption, metabolism, utilization, functions, quantitative requirements and interrelationships of nutrients (Ibid.) while dietetics became responsible for the application of scientific nutrition principles concerning food composition, selection, preparation, habits, patterns and diet therapy.

Development of the knowledge of food values, one component of dietetics, paralleled the development of medicine and science. While science and technology quantitatively analyzed vitamin and mineral content of foods, malnutrition due to individual nutrient deficiencies became a new division of medical pathology in the early 1900's (McCollum, 1959).

Thus diet, or dietetics, once comprising the entire doctrine of health has been partitioned into nutrition, nutritional science, biochemistry, physiological chemistry, molecular biology, genetics, food science, food technology, food toxicology, food engineering, nutraceuticals and divisions of medicine, immunology and pharmacy. Dietetics' scope of practice, comprising the exclusive domain of registered dietitians, overlaps the above disciplines. In other words, dietetics' scope of practice appears to be in the public domain with many tasks and functions performed by members of other professions.

Additionally, a unique area of interest must be identified in order to legally be considered a profession. To date, only Leyse (1998) has preliminary data identifying dietitians' perceptions of their uniqueness.

Licensure/Title Protection. The law provides a regulatory framework by licensing activities performed by health professions and occupations that pose a serious threat to the health and safety of patients if performed by unqualified personnel. Licensed activities in health care include cutting beneath the dermis, injecting fluids, prescribing drugs, entering body orifices, using gases and x-rays, setting fractures, delivering babies and making diagnoses. While physicians may perform all of the licensed activities, podiatrists and dentists are limited to specific anatomical sites. Physician assistants' and some nurses' work performance must be supervised by a physician (Shimberg, 1994).

State licensing laws for registered dietitians do not include the above licensed activities and do not exclude any licensed persons from engaging in the profession or occupation for which he or she is licensed. In other words, statutory certification protects the title, "Registered Dietitian" (Ibid.) but not activities or tasks performed by dietitians.

Certification. Certification guarantees the public that specified individuals have met the standards of a credentialing organization and may legally use a specified title. The credential, "R.D.," was developed by the credentialing arm of

The American Dietetic Association in 1969 to legally protect the designation of "registered dietitian" (ADA Reports, 1990), to convey "a measure of professional qualifications and competence to consumers and employers" (Bogel, 1974 as quoted in ADA Reports, 1990). However, only entry-level competency is assured by this credential.

Numerous other agencies in addition to The Commission on Dietetic Registration certify specialists in clinical nutrition. Academic clinical nutritionists, Ph.D.'s in the biological sciences, are certified by The American Institute of Nutrition and its clinical arm, The American Society of Clinical Nutrition (Atkinson, 1995). Physicians certify medical doctors or doctors of osteopathy with postgraduate training in nutrition as specialists in clinical nutrition and have developed criteria for Physician Nutrition Specialists affiliated with medical schools (ASCN, 1995). The American Society for Parenteral and Enteral Nutrition certifies pharmacists, nurses and dietitians working in critical care as nutrition support specialists. The National Certification Board for Diabetes Educators certifies pharmacists, nurses and dietitians as diabetes educators, all certified to perform tasks and functions surrounding appropriate diabetic diets. Lastly, The American Dietetic Association certifies experienced registered dietitians as specialists in renal and pediatric nutrition and designates as Fellows of The American Dietetic Association those registered dietitians meeting specific criteria of experience and professional involvement judged by their peers.

Thus registered dietitians do not have a legally protected area of interest, do not perform licensed activities and are not the only certified clinical nutrition specialists. Only the use of the title, "Registered Dietitian," is protected. In order for other health care professionals and the public to recognize registered dietitians as *experts* in nutrition and food issues, it must be recognized that registered dietitians provide something unique from all of the overlapping professions. With that in mind, intra-professional forces will be examined for the uniqueness.

Intra-professional Forces

Forces examined within the domain of clinical dietetics will be discussed briefly in this chapter and more in depth in Chapter 2.

Definition of Expert. Decisions, or problem solving, by our ancestors was based on common sense, tradition, conferring with wise people within the community. Those wise people became known as "experts" during the latter part of the nineteenth century when the division of labor allowed sufficient numbers of people to earn a living by selling advice and specialized services (Haskell, 1984). Although experts were recognized as "very skillful; having much training and knowledge in some special field" (Webster's, 1982), articulation of the unique characteristics of experts was left unexplored until the advent of artificial intelligence in the twentieth century with it's need to codify problem-solving strategies of the best and brightest in many domains (Newell & Simon, 1977; Chi, Glaser & Farr, 1988; Ericsson & Smith, 1991).

Articulation of experts' unique characteristics requires definition of terms, i.e., descriptive, stipulative and operational (Hempel, 1966). Descriptive definitions provide a general, accurate meaning of a term. Stipulative definitions are formulated for a specific, more limited use and are only accurate within that setting or system.

Operational definitions provide specifications to measure each term within the definition for consistent, objective and reproducible results in any setting.

A descriptive definition, "specialty area" was defined in 1990 as "an area of (dietetics') practice...that has a substantial and verifiable knowledge base, an identified dimension of advanced practice, and a reasonable pool of practitioners" (ADA).

A stipulative definition of advanced-level practitioners was validated empirically in 1993 as registered dietitians with at least a master's degree and at least 8 years of practice, at least one professional award or publication or conference presentation within the last 3 years, a multiplicity of role positions and contacts, an approach to practice that complements technical elements with an in-depth, holistic, intuitive understanding, is highly adaptable and process-oriented and values innovation and self-knowledge (Bradley et al, 1992).

Operational definitions for dietitians in specialty practice are, "exclusive renal," "exclusive pediatric," and "exclusive metabolic" nutrition dietitians--registered dietitians practicing 3 years of more in dietetics with at least 10 hours or more per week in one of the specialty areas and zero hours in other specialty areas (Ibid.).

The term "clinical nutrition expert" was coined to describe Wilder's (1925) vision of the responsibilities of future hospital dietitians as "technical assistants:" organizing and directing the equipment of clinical research, teaching patients and medical students, plus directing nurses in the planning, preparation and feeding of special diets. This term was not defined during the intervening years but utilized as a marketing strategy implying a distinctive social role, visibility and income potential by The American Dietetic Association.

Representative Tasks/Responsibilities. "The central organizing reality of professional life is control of tasks" (Abbott, 1988, pg. 84) which were identified by Abbott as to classify/diagnose, to reason/infer and to take action/treat. In cognitive science, the first step in the process to capture outstanding performance was to identify a representative task or collection of tasks providing the *essence* of superior performance in a particular domain and distinguished from tasks measuring related functions or abilities—*essence* defined as core behaviors demonstrating superior performance.

Task identification was the major focus of the Role Delineation Studies in dietetics. However, tasks identified in the Role Delineation Studies did not represent the *essence* of dietetics but responsibilities for which dietitians are held accountable, not how well the tasks were performed but documenting that the tasks were performed. Tasks representing the essence of chess captured the *next best move*, not a collection of possible moves, but the *best moves* (de Groot, 1978). To extrapolate from Abbott's (1988) professional tasks, professional tasks in dietetics would include interviewing strategies leading to problem-identification (classify/diagnose), problem-solving (reason/infer) and treatment. The *essence* of dietetics then, would be captured in a collection of tasks capturing the *best diagnosis, problem-solution* or *treatment.*

Differentiate Levels of Practice Performance. The second step investigating outstanding performance in cognitive science (Ericsson & Smith, 1991) was a detailed task analysis of verbal reports and behavior, which inferred the underlying cognitive processes mediating superior performance. As the Role Delineation Studies did not identify tasks capturing the essence of dietetics, superior performance and thus differentiated levels of performance were not identified. Data consisted of frequency measures and captured movement from direct patient contact to less direct patient contact with increased experience (Bradley et al, 1992).

Purpose and Significance of the Study

The purposes of this dissertation research are (a) to examine diagnosis of nutritional problems as a representative task of clinical dietitians practicing in renal nutrition, (b) to differentiate levels of practice performance based upon scores obtained on the diagnostic thinking inventory, and (c) to define clinical nutrition expert status. The tool will be a cognitive-based survey instrument focusing on the process of diagnostic thinking, on specific demographic features associated with expertise and on motivating factors enabling the dietitian to pursue domain knowledge for an extended period of time.

Significance of the findings of this study will be multi-factorial. The Pew Health Professions Commission has challenged all health care professions to restructure the way health care is provided (Pew, 1995). The Commission further urges allied health professionals, including clinical dietitians, to assume increased responsibilities and become key players in the future health care system (Ibid.).

In addition to the challenge to the health care industry as a whole, a more specific challenge has centered around the fact that physicians and registered dietitians both claim responsibility for nutrition, yet nutritional care of patients is inadequately addressed (McLaren, 1995). It may be due to the lack of nutrition courses in medical school, lack of physicians with a nutrition interest (Ibid.) and/or reluctance of a majority of registered dietitians willing to accept new responsibilities (Schiller, Foltz & Campbell, 1993). Regardless of the reason, highly-skilled/expert professionals are required for the health care system of the future, specifically in nutrition.

Bereiter & Scardamalia (1993) comment that professions are defined by their constitutive problems, i.e., a class of endlessly complex problems where progressive problem solving never reaches an end point (pg. 97). They identify a constitutive problem of medicine as the elimination of disease (Ibid.). Constitutive problems of nutrition, then, could be achievement and/or optimization of health through dietary manipulation. It is anticipated that dietetic-specific descriptive, explanatory and predictive theories would eliminate any overlaps with other health care professional manipulations. However if dietitians claim expertise in nutritional care and all that implies regarding complex problem solving, yet are not providing it in reality, then the constitutive problems of nutrition will be claimed and solved by physicians or nurses or others willing to address these problems. *What matters is not what claims are made, but whether there is a potential sub-set of highly-skilled professionals capable of performing the professional nutrition tasks of diagnosis, inference and treatment.*

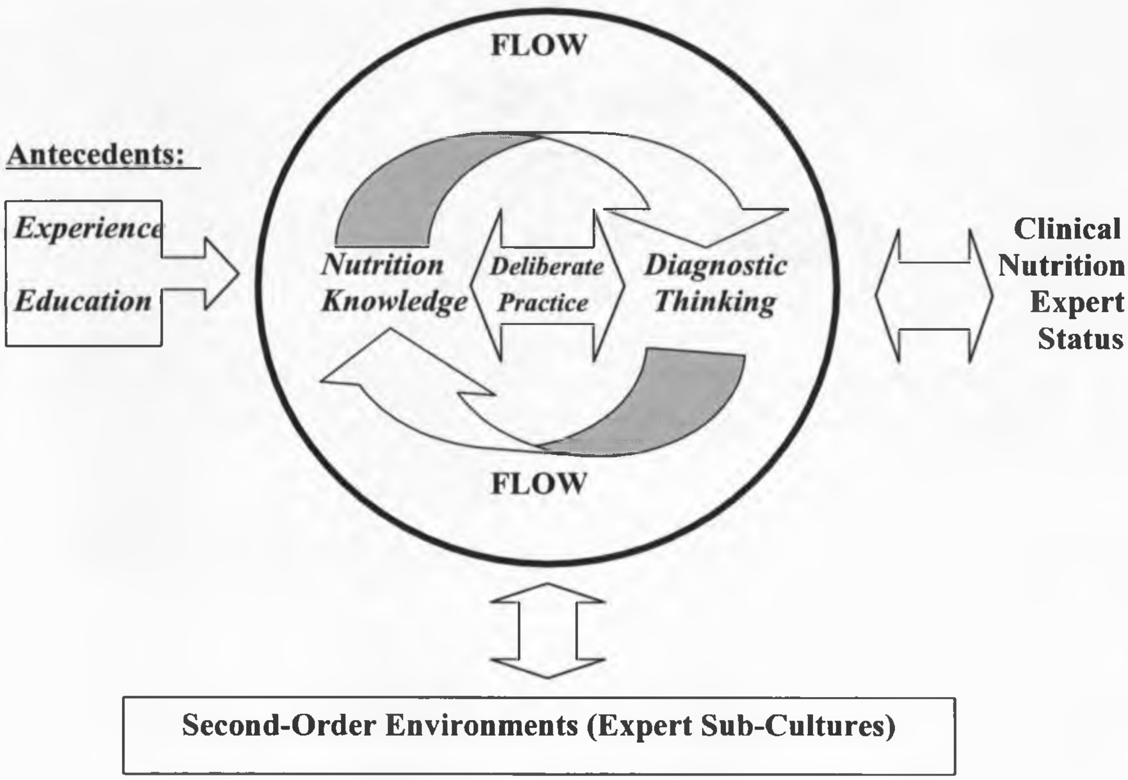
Current Conceptual Framework

Elements of theory building are: (a) to identify a concept, a mental image of a phenomenon, (b) formulate relational and non-relational statements between the concept and others and (c) using internally consistent relational statements, describe, explain, predict or control phenomenon (Walker & Avant, 1988). Strategies of concept development are analysis, synthesis and derivation (Ibid.). Concept analysis clarifies or refines an existing concept; synthesis extracts or pulls together concepts from existing data; and derivation shifts or redefines concepts from one field to another (Ibid.). As the concept of "expert" has not been developed in clinical dietetics and a paucity of data exists concerning clinical nutrition experts, concept development strategies will necessarily be synthesis of findings from this study together with redefining information (derivation) from the fields of cognitive science, medicine and nursing.

Following the above process, this author developed the conceptual framework for Clinical Nutrition Expert Status as diagrammed in Figure 1. Defining attributes or characteristics extracted from the literature are: 10 years or more experience in the domain (Ericsson & Smith, 1991), use of cognitive information-processing structures (Chi, Glaser & Farr, 1988; Ericsson & Smith, 1991), accessibility of second-order (expert) environments (Bereiter & Scardamalia, 1993), engaging a coach or mentor to improve one's performance (deliberate practice) (Ericsson, Krampe & Tesch-Römer, 1993; Ericsson, 1996), with the outcome of rigorous deliberate practice being a state of elation, or flow (Csikszentmihalyi & Csikszentmihalyi, 1988; Bereiter & Scardamalia, 1993), contributing to consistent outstanding performance in the domain by motivating dietitians to pursue clinical dietetics for the requisite number of years to attain expert status.

Antecedents, characteristics which must precede the development of expertise are: clinical patient-focused experience and in-depth education in nutritional sciences. Assumptions made in this model are that the expert has sufficient intelligence to become an expert, emotional support from family and/or significant others to pursue excellence, financial ability to pay tuition expenses and study with a mentor, internal recognition of own abilities and external recognition of potential by others and last, and most importantly, the existence of practitioners in clinical dietetics capable of providing mentoring at the expert level.

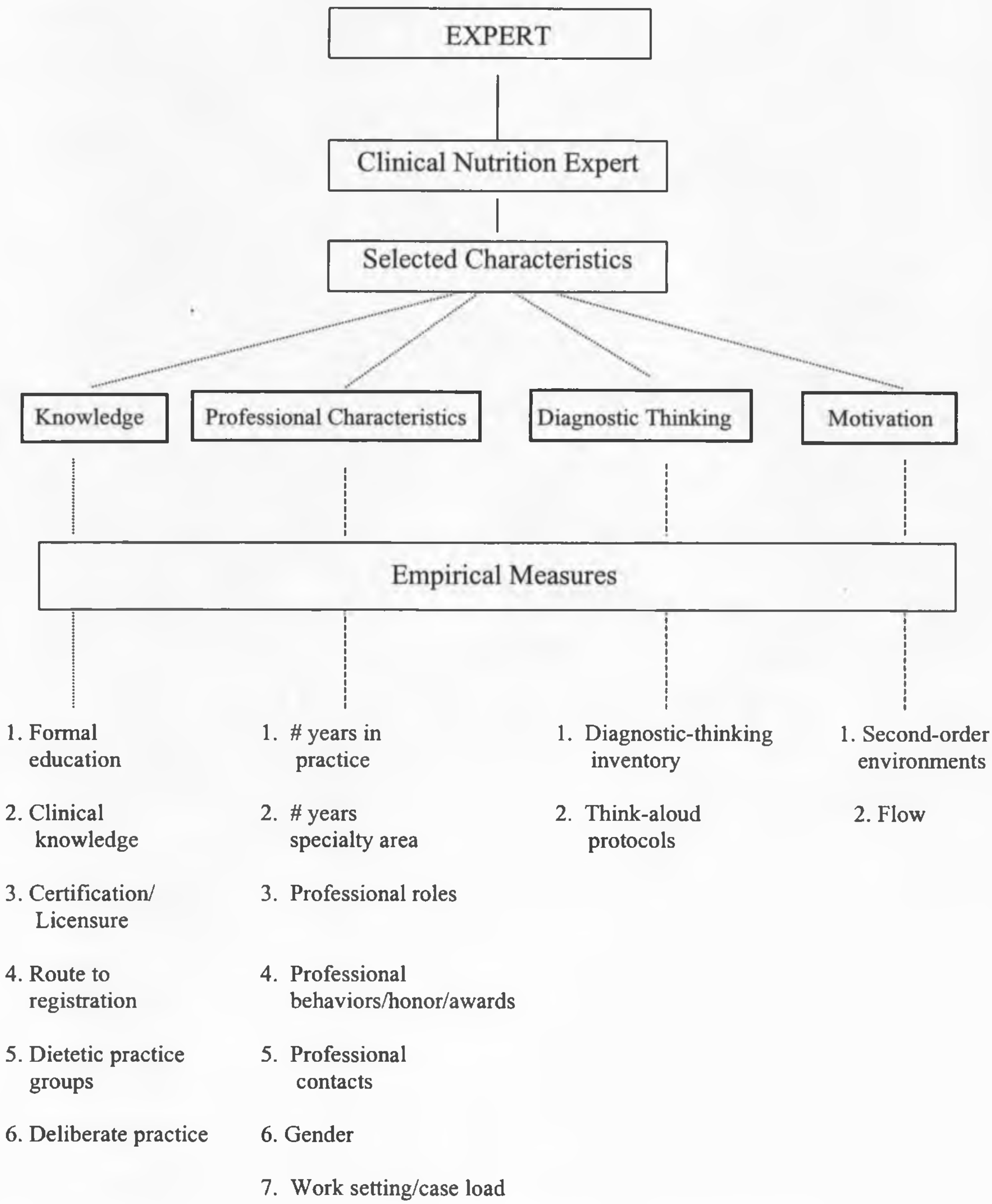
Figure 1. **Emerging Conceptual Framework**



The use of the term "status" indicates that this study will measure the condition of the domain of clinical dietetics in regards to expert-like levels of practice performance. A random sample consisting of 27% of the population of renal dietitians will by definition be representative of the entire population (Munroe & Page, 1993) and thus reflect status at the time of the survey.

The elements of the conceptual framework addressed in this study were then hierarchically organized with links to the study variables (Figure 2). Following the empiric-abstract continuum of Chinn and Kramer (1995), the concept *expert* is the most abstract level. The generic expert is defined as having "much training and knowledge in a special field" (Webster's, 1982) without specifying the field or domain, the specific skills or level of knowledge, or the method of measurement. In other words expert status is a cognitive representation, inferred from multiple direct and indirect observations. *Clinical nutrition expert* is the more specific concept, as the domain of interest is identified and boundaries are established although not directly measurable. Categories of *expert characteristics* derived from the literature selected for this study were: knowledge, selected professional characteristics (demographics), diagnostic thinking and motivation. Specific *empiric measures* for each category were selected: for the knowledge category, attained educational level, specialty certification, registration route, professional group memberships combined with indirect assessment of clinical knowledge and deliberate practice. The professional characteristics category measured years of general dietetics experience plus renal specialty experience, professional roles and contacts, professional behaviors such as writing, presentations and research. The diagnostic thinking category implies the use of specific cognitive processing structures by answering a diagnostic thinking inventory that was developed in medicine. The motivational category assesses experience with flow and with second-order (expert sub-culture) environments.

Figure 2. **Hierarchical Diagram of Clinical Nutrition Expert Status**



The two figures were condensed into a figure representing the essence of clinical nutrition expert (Figure 3). The four categories are represented as individual strings or threads, interwoven, twisting and turning together continuously. Each string is in contact with, yet remains identifiably unique. All strings are required for the ultimate strength of the thread. The strings represent facets of clinical nutrition expert status and will be described using the chakra system of archetypal depiction of individual maturation through distinct stages (Small, 1991; Myss, 1996).

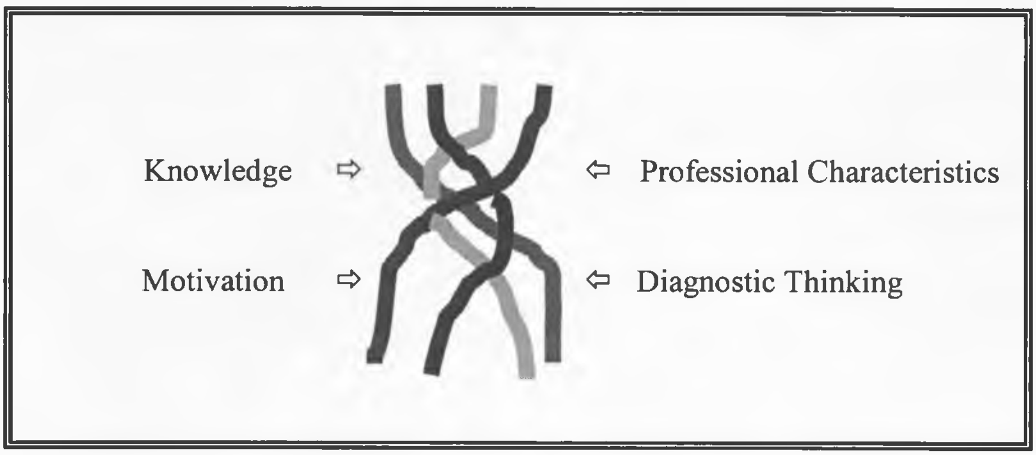
Knowledge, the underlying string, is represented by the color red. In Eastern religions, red is the color of the first chakra or energy center situated at the *base of the spine*. This provides the base or foundation of expertise and consists of formal or procedural knowledge (Bereiter & Scardamalia, 1993), informal or tacit knowledge (Polanyi, 1967, as referenced by Bereiter & Scardamalia, 1993), clinical knowledge gained through experience, learning gained through deliberate practice, assimilation of knowledge from other professions (Abbott, 1988) and self-regulatory knowledge (Bereiter & Scardamalia, 1993) often referred to as 'metaknowledge' or 'metacognition,' which controls the application of other knowledge.

Motivation, the second string, is represented by color yellow from the third chakra, *solar plexus*. The third chakra energy center is concerned about issues of self-esteem or quality and intellect. In dietetics this consists of search for quality, the gold standard, reference values, motivation to excel, to spend years in increasingly complex problem solving.

Professional characteristics are represented by the third string of green, from the fourth chakra, *heart*. This energy center is concerned about issues of fecundity or growth and in dietetics consists of experience and level of professional involvement (Ericsson & Smith, 1991).

Diagnostic Thinking is represented by the fourth string of blue, from the fifth chakra, *throat.* This energy center is concerned with "creative expression in the world and comprehension of the whole of which we are a part" (Small, 1991). In dietetics, it consists of the ability to pull all the clinical information together in order to diagnose a nutritional problem, to be thorough and use expert cognitive processing structures.

Figure 3. **Metaphor as Clinical Nutrition Expert Status**



Assumptions

Assumptions of this study are:

1. That practice of clinical dietetics in renal nutrition varies in measurable ways.
2. That cognitive methods used in expert-novice comparisons in other domains will be transferable to clinical dietitians practicing in renal nutrition.

3. That a significant number of expert-level practitioners exist within renal nutrition clinical practice.

Research Questions

Research questions posed address elements of the theory of clinical nutrition expert status in this study: (a) demographic variables consistent with cognitive science theories of expertise plus sociological roles and responsibilities, (b) expert cognitive processing structures implied in the diagnostic thinking inventory, (c) knowledge variables of formal education and certification, inferring depth and breadth of knowledge and rules pertaining to the use of knowledge in the relational formatting of diagnostic thoughts, and (d) motivational components experienced in the work setting and/or inherent in the domain.

Research Question 1: What are the professional characteristics of renal dietitians measured by a cognitive-based instrument?

Research Question 2: Is there a significant difference in diagnostic scores between diagnosing renal dietitians and non-diagnosing renal dietitians?

Research Question 3: What are the underlying cognitive dimensions of the diagnostic thinking inventory?

Research Question 4: Which study variables best explain highest diagnostic scores of renal dietitians?

Research Question 5: How do renal dietitians with the highest diagnostic scores compare with The American Dietetics Association's advanced-level dietetics practice model on the demographic measures of experience, education, professional roles, responsibilities, contacts and behaviors?

Limitations

The generalizability of the study is limited only to the particular population of renal dietitians. Findings and conclusions that are reached may not be applicable to the general population of dietitians registered by The American Dietetic Association.

Summary

This chapter contains a brief overview of the problem, the purposes of this dissertation and significance, a brief conceptualization of clinical nutrition expert status, assumptions and limitations of the study and research questions guiding the study. Emphasis has been placed on the fact that existing dietetics' research has focused on *role* versus *performance* or *process*.

CHAPTER 2

SELECTED REVIEW of the LITERATURE

This chapter initally describes the context of expert from three perspectives: cognitive science, medicine and nursing, followed by a description of the Role Delineation Studies in clinical dietetics. Essential characteristics of expertise derived from the literature are defined.

Context of Expert

Social historians describe the evolving concept of expertise while cognitive scientists focused on development of the measuring tools of outstanding performance. Social historians state that deference to experts, or authority figures, is so completely interwoven into the fabric of our daily lives that it is considered by some to be the most distinctive feature of modern culture (Abbott, 1984). Prior to industrialization, persons behaving as "experts" possessed a reputation for wisdom or healing but were not called "experts." The term, "expert," implying a social role and the prospects of earning income from that role did not come into being until the latter part of the nineteenth century (Ibid.). After industrialization, the division of labor and increasingly complex cultures, expertise became the basis for an elite authority. Institutions, especially the universities, recruited, trained and sustained expertise. The university-trained scientist became the epitome of the authoritative expert: selfless, modest, patient, vigorous, with unflinching honesty and cool self-discipline in the search for truth (Ibid., page xxvii).

Expert Versus Specialist. With the division of labor and university training, the label "specialist" has erroneously become synonymous with "expert." Specialists have a great depth of knowledge in limited, narrow roles without regard to the wider implications of what they are doing (Bereiter & Scardamalia, 1991). Whereas the expert is expected to be able to creatively, coherently deal with intersecting problems (Ibid.).

Cognitive Science

Initial attempts to discover the source for outstanding performance led Sir Francis Galton in 1869 to examine socially eminent individuals from many domains and posit that genetic predisposition was a requisite for outstanding achievements (Ericsson & Smith, 93). He argued that outstanding achievement was a blend of natural ability (genetics) and personal motivation. Subsequent studies by Galton, however, failed to produce correlations between high achievement and stable personal characteristics, such as motivation, intelligence and concentration (Ibid.).

Research of outstanding performance since Galton's time focused on (a) general inherited abilities such as high intelligence, (b) specific inherited abilities, such as musical, artistic or athletic prowess and (c) acquired abilities attributed to general knowledge acquisition (Ibid.).

The advent of artificial intelligence forced researchers to systemize analyses of domain-specific task performance of high achievers. Prior to 1966, the problem-solver was viewed as having limited information-processing capability whereas the problem space was considered massive, represented as a 'maze" (Feigenbaum, 1989).

Structure, codification and representation of knowledge were less important than the search.

A shift occurred in 1966-1976 based on Allen Newell and Herbert Simon's methodology to a knowledge-based system: the knowledge base is "large and rich with descriptions of objects, relations among them, and rules pertaining to them. The system's *inference engine* is small and simple" (Ibid., italics added, pg. 167). Thus, how knowledge in a domain is codified, the relationships, the small nuances, how knowledge is represented is the essence of an expert system as an extension of experts.

General Theory of Expertise. Ericsson & Smith (1993) extracted three steps used by Chase and Simon (1983) in their initial research exploring the cognitive processes used by chess grand masters as compared to the lower skill level of chess experts: (a) capture superior performance under standardized laboratory conditions by identifying representative tasks, (b) conduct a detailed analysis of superior performance and (c) account for acquisition of characteristics and cognitive structures mediating superior performance (Ericsson & Smith, 1993, page 12).

The first step required identification of a task or collection of tasks, which would capture the *essence* of expert performance and would measure stable processes acquired over an extensive period of time rather than learning skills. The researchers concluded that if learning or improved performance occurred during measurement of the tasks, then superior performance was not captured. Tasks were designed to capture real-life experience as much as possible. In complex domains such as medicine, a collection or population of tasks was necessary to elicit superior performance.

Step two, analysis of superior performance, was based upon observations of behavior, such as timing of eye movement, and speed and accuracy in solving memory problems. Analysis of the observations then led to inferences concerning the cognitive structures mediating the behavior. Analysis of think-aloud verbalizations were used to compare different levels of expertise, i.e., novice-expert comparisons. General types of differences between novices and experts remained consistent through a wide range of domains, such as forward reasoning versus backward reasoning, accessibility of an extensive knowledge base and relevance. In contrast to group studies, detailed studies of single subjects revealed complex coding of relevant domain information.

Mechanisms used to acquire superior performance, the third step, included effects of training, i.e., increased speed, knowledge acquisition and superior memory. An important distinction made by Ericsson and Smith (1993) was between practice and mere exposure to experience. Merely performing a task with increasing rapidity does not automatically lead to improved task performance. In addition, repeating the initial performance incorrectly may result in enhanced efficiency but not superior performance. In this instance, cognitive processing is not enhanced, merely motor skills. The key element appears to be the cognitive component of the task--evaluation, refinement, practice on the refinement, and development of deeper, more complex memory storage.

Expert Careers. Bereiter and Scardamalia (1993) expanded cognitive sciences' perspective of individual experts to expert careers, or sustained expert performance levels. Experts, or individuals surpassing what nature intended in Bereiter's perspective, were individuals from all walks of life, not exclusively professionals, but individuals who consistently surpassed their own capabilities. Potential experts were identified as individuals cognitively operating in an expert manner, without an extensive experience base.

Bereiter implicated an additional component in the development of expertise: the motivation to invest ten to twenty years pursuing the knowledge and skills required to acquire expertise in a domain. Extrinsic motivation was attributed to second-order environments, or expert sub-cultures, which insist upon and support growth, consistently acknowledge successes and provide successful career models. Intrinsic motivation was attributed to flow, a feeling of sustained pleasure when absorbed in an activity or problem which called forth all existing skills plus required additional learning to meet the challenge. Csikszentmihalyi & Csikszentmihalyi (1988) stated that there must be a balance between skills and challenges; too little produces boredom, too great a disparity creates anxiety. Or quoting Richard Mitchell, "Flow emerges in circumstances that are perceived as both problematic and soluble" (Bereiter & Scardamalia, 1993, page 100).

Bereiter & Scardamalia (1993) assigned the term flow to the aspect of expertise generating an almost addictive pleasure. However, this does not diminish the importance of rigorous practice in developing skills. A form of rigorous practice—deliberate practice—was identified as the most predictive of expert or outstanding performance (Ericsson, Krampe & Tesch-Römer, 1993). Deliberate practice is designed with a goal of improving performance, is conducted under a coach or mentor with tasks tailored to the individual skill level. Performance feedback is immediate, informative and applied to the specific task.

Medicine

Medicine shifted from the hypothetico-deductive model for research on medical diagnosis to a knowledge-based model in the early 1980's (Bordage, Grant & Marsden, 1990). The hypothetico-deductive model was concerned with "data acquisition, hypothesis generation, data interpretation and hypothesis evaluation" (Ibid., pg. 413). The knowledge-based model, on the other hand, translated advances in cognitive science into the domain of medicine by focusing on knowledge: recognition of meaningful information (pattern recognition and relevance), definition of clinical data, and access to knowledge (retrieval) (Ibid.). Personally relevant items were labeled "forceful features," recognition of which became the key to memory structures dictating interpretation(s). Interpretation was then followed by expectation of certain confirming items, modified by case specific items and individual memory structures. In other words, clinicians were theorized to have constructed richly, complex schemata's of diseases based upon their personal clinical experience, which guided the interview, interpretation and diagnosis.

The knowledge-based approach to diagnostic expertise has been analyzed in the context of (a) connecting the structure of knowledge while explaining the process of problem-solving (Groen & Patel, 1988), (b) developing schema to represent relationships of findings (Lesgold et al, 1988), (c) organizing domain knowledge representing human problem-solving methods into a computer model (NEOMYCIN) to explain the reasoning process and to teach students (Clancey et al, 1988) and (d) assessing problem-solving approaches utilized by clinicians and students and developing strategies to intervene in the educational process (Bordage, Grant & Marsden, 1990).

Diagnostic Thinking Inventory

The diagnostic thinking inventory was the result of combining the work of two groups in the United Kingdom who were investigating the process of clinical reasoning or problem-solving approaches in medicine. One group analyzed the content of videotape-recall of clinical interviews conducted by students and physicians that revealed 14 diagnostic thinking processes (Gale & Marsden, 1982; 1983; 1984). The results indicated that clinicians initially attempted to make sense of information by forming a working interpretation prior to hypothesis generation (Gale & Marsden,1982; 1983) while a combination of routine inquiry and personal interpretations directed the interview (Gale & Marsden, 1984). Subsequent research compared memory structures of novice and expert clinicians and concluded that there was no difference between groups in the breadth of thought although there were marked differences in the content and structure of thought (Grant & Marsden, 1987). The researchers described knowledge changes occurring with increased experience as beginning with a "narrow, idiosyncratic and inappropriate memory store, thorough increasing breadth and similarity to the final characteristic of a perhaps slightly narrower, useful and finely tuned primary knowledge base which has been organized to respond to the demands of clinical problems and practice" (Gale & Marsden, 1988, page 178). The researchers identified forceful features as "personally important pieces of information which act as a key to particular memory structures which in turn give rise to the clinical interpretation" (Grant & Marsden, 1987, page 92).

Bordage and others researched the breadth of knowledge (Bordage & Allen, 1982) as well as content and organization (structure in long term memory) (Bordage & Zacks, 1984). The conclusion that knowledge deficiencies did not account for diagnostic errors as much as content and organization led Bordage to explore categorization of information (Ibid.) and to relationships of stored information in weak and strong problem-solvers (Bordage & Lemieux, 1987).

Findings generated by both groups were combined into an inventory of diagnostic thinking items to assess clinicians' current thinking. Prototype examples captured the core meaning of a category (Bordage & Zacks, 1984.) and were merged with Gale-Grant & Marsden's forceful features (1987). Both were personally meaningful mental constructions around which clinical information was organized and from which interpretations were drawn.

The initial inventory was reduced to 41 stem questions followed by two opposing anchor statements separated by a 6-point interval scale and organized theoretically into two sub-scales. Anchor statements were drawn from clinician statements as they assigned meanings to symptoms and signs. Abstract associations were uncovered and related to semantic theory and thus levels of meaning. The statements were transformed into binary, oppositional semantic axes or a semantic differential scale (Bordage & Lemieux, 1991).

Items in the diagnostic thinking inventory were theoretically linked by this author to cognitive structures identified as essential attributes in the preceding section (Table 1).

Table 1. **Theoretical Linkages Between Expert Characteristics and Diagnostic Thinking Inventory** (Bordage, Grant & Marsden, 1990)

Literature	Bordage, Grant & Marsden
Flexibility	Flexibility Scale: Questions 2-6,11,15-16,23- 24,26-30,32,34-36,38,40-41
Structure of Knowledge in Memory	Structure Scale: Questions 1,7-10,12-14, 17-22,25,29,31,33,37,39
Abstraction	1) Abstraction of signs/symptoms 7) Decoding into medical terminology
Pattern recognition	3) Early interpretation 10) Forceful feature 13) Relatedness of information 17) Relatedness of diagnostic information
Relevance	2) Prioritizing 15) Irrelevance of some information 35) Active elimination
Increased constraints	5) Responsive to patient's line of thought 28) Compare and contrast diagnoses 32) Inquiry responsive to clinician's interpretation 34) Doctor-patient control of interview 40) Compare and contrast clinical information
Confidence	6) Postponement of judgement 12) Probable diagnostic ideas 27) Confidence in judgement 36) Reversibility of judgement

Table 1 Continued. **Theoretical Linkages Between Expert Characteristics and Diagnostic Thinking Inventory** (Bordage, Grant & Marsden, 1990)

Literature	**Bordage, Grant & Marsden**
Cognitive restructuring	4) Mental-set effect: one-track minded 22) Reinterpretation in light of new information 23) Reinterpretation of existing data 38) Cognitive structure
Convergent thinking	25) Specific inquiry 18) Anticipation of clinical information 33) Specific diagnostic formulations 39) Anticipation of laboratory data 21) Dispersed knowledge
Thorough, holistic	8) General inquiry 9) Recollection of previous ideas 11) Clarification before further data acquisition 24) Clarification of ambiguities 26) Recall of previous information 29) Elaborated knowledge 30) Summarize as case unfolds 31) Consideration of all information 41) Completeness of inquiry

Nursing

Benner

In the seminal work on nursing expertise, Benner (1984) interviewed 21 pairs of novice and expert nurses from 3 hospitals, plus 51 experienced nurse clinicians, 11 new nursing graduates and 5 senior nursing students. Observations and interviews were analyzed according to Dreyfus and Dreyfus' (1986) model of skill-acquisition. Five levels of proficiency were described: novice, advanced beginner, competent, proficient, and expert reflecting changes in performance. Exemplars were extracted to conform to each level with implications for teaching and learning.

Levels were described as: (a) Novice is inflexible with little experience, having been taught context-free rules. (b) The advanced beginner performs marginally, with enough prior experience to recognize globally-relevant characteristics, or aspects of a situation. (c) Competence is reached after sufficient experience and a beginning mastery of the majority of the situations encountered, with an ability to prioritize. (d) Proficiency is performance guided by maxims, constructing a normal picture of a situation with the entire web of contingencies fleshed out and prioritized. Deep understanding must be present before maxims can be used in this manner. This is similar to building a disease model based upon personal experience in medicine. In-depth analysis is by-passed by concentrating upon salient aspects—analogous to *key features* in medicine. (e) Expert level has an enormous amount of experience, an intuitive grasp of each situation, does not waste time on irrelevancies, actions are automatic. Benner (1984) defines "intuition" as apprehension of a problem based up deep background understanding and broad base of knowledge and experience without need to build an entire scenario.

Bereiter & Scardamalia (1993) criticize this model by arguing that actions happening automatically or by second nature may also produce mindless menaces rather than experts. The metaphor used is that of the experienced driver reaching the state of driving effortlessly, yet badly, because the driver did not consciously and consistently pursue skill improvement and the attendant global perspective of expert driving—deep knowledge of road conditions, technology advances, vehicles, fuel, etc.

Bereiter & Scardamalia (1993) also criticize the Dreyfus & Dreyfus model as being linear—that one progresses carefully through each step to emerge as an expert. In this model, everyone progresses to the expert level. However, development of human expertise does not progress so uniformly and predictably.

Additionally, the methodology used by Dreyfus and Dreyfus to examine skill acquisition may be appropriate in perceptual fields, but not in verbally-complex fields such as medicine and nursing. Comprehensive ability measured by analysis of semantic units or verbal chunking may be more appropriate in fields such as medicine, nursing and this study in dietetics.

Thompson

Thompson (1992) investigated the organization of nursing knowledge in 42 nursing expert/non-expert pairs plus 40 novice nurses. Novices were defined as having less than 6 months experience, experts as those recognized by their peers as having "the ability to perform appropriate actions rapidly, after recognizing a minimal number of situational cues" (Thompson, 1990). Non-experts were the remainder of the sample.

Cognitive maps were created from dissimilarity pairs of nursing terms used in hospital units admitting congestive heart patients. Links were defined as the shortest path between concepts. Paths were weighted and numbered. Coherence, degree of internal consistency within the network, was calculated.

Thompson's found that experts' cognitive structures were organized around fewer links with greater coherence than novices, consistent with the cognitive science theory that expertise develops efficiency in coding, storage and retrieval of information by storing meaningful patterns as chunks. Thompson also extracted a professional factor that included experience, education, and professional activities/behaviors. A second factor included cognitive structure and peer perception of expertise.

Criticism of this study is that the task represented a component of nursing tasks surrounding the care of the congestive heart patient, but not the *essence* of nursing. The expert processes of pattern recognition, forward-reasoning, etc. could only be partially captured in this manner. Semantic units would need to be analyzed to identify specific information processing strategies.

Another criticism is that the "10-year rule of preparation" proposed by Ericsson (1996) was not considered (read section on essential characteristics). A sample of nurses with at least 10 years' experience with congestive heart patients may produce significantly different findings than Thompson's study.

Role Delineation Studies in Clinical Dietetics

Although studies on expertise in clinical dietetics have not been conducted to date, Role Delineation studies were initiated by The American Dietetic Association in

1979 under contract to the Division of Associated Health Professions, Bureau of Health Professions, U.S. Department of Health and Human Services to delineate the "appropriate" role of the entry-level clinical dietitian (ADA Reports, 1981). Responsibilities for which the clinical dietitian was held accountable, skills and knowledge that must be demonstrated by dietetic practitioners were identified as a basis for constructing "appropriate" roles (Ibid.). Entry-level dietetic positions in community nutrition (ADA, 1983a), foodservice management (ADA, 1983b) and clinical dietetics (ADA, 1984), plus advanced and specialty practice (Bradley et al, 1992) were examined.

Although performance was not measured and significant differences between advanced and specialty practice were not measured, tasks, roles and responsibilities were identified at each entry-level position and a sociological profile of the advanced-level practitioner was validated (Ibid.). The tasks of entry-level registered dietetic technicians and registered dietitians, beyond entry-level, advanced-level and specialty dietitians (ADA, 1981; 1983a; 1983b; 1984; Kane et al, 1990; Bradley et al, 1992) were identified as types of activities performed (ADA 1983a; 1983b; 1984) plus the level of involvement or responsibility for various types of activities. Involvement was indicated by the four roles of "policy-setting," "advising," "supervising" and "doing" (Kane et al, 1990). The 1991 study utilized the same roles of "doing," "supervising" and "consulting" adding dietitians' perceptions of entry-level or beyond entry-level knowledge required to perform in the identified roles and the level of criticality required for each role in three designated specialty areas.

Several criticisms of the Role Delineation Studies follow. Although the cognitive processes which mediate outstanding/superior performance were acknowledged as the underlying dimension of the 1991 Role Delineation Study (Bradley et al, 1992), measurement of performance utilizing those cognitive parameters was considered too time-consuming. Instead, actual practice behavior was measured through two components of the instrument: a section labeled "psycho-social capabilities" and a section labeled "practice situations." The psycho-social scale examined personal values, and the respondents identified as advanced-level practitioners indicated that they were intuitive and valued innovation and self-knowledge. In real life however, decisions become very complex and actual behavior may contradict cherished personal values (Labow, 1982). Additionally, the practice situations targeted formal knowledge by asking for the "right answer.' The *process* of problem-solving to find the right answer was not addressed although it is considered the key to differentiating levels of practice using expert-novice comparisons (Newell & Simon, 1972; Chi, Glaser & Farr, 1988; Ericsson & Smith, 1991).

Propositions guiding the 1991 Role Delineation Study focused on sociological parameters of role and status derived from roles. Multiplicity of roles and contacts were addressed by Propositions 1 and 3. Proposition 1 stated that "the greater the scope and complexity of the domains of professional role structure, the greater the probability a dietitian is practicing at an advanced-level" and Proposition 3, "the greater the scope and complexity of professional role structure, the higher the probability that a dietitian possesses effective interpersonal, group-process, and/or managerial skills."

Both propositions assume that complexity of roles and contacts is the antecedent of advanced-level practice rather than an individual's intrinsic motivation to search for the complexity and organize knowledge systematically in order to efficiently retrieve complex relationships.

Proposition 2 in the 1991 Role Delineation Study stated that "the greater the number of role relationships held with social actors occupying any single social position (e.g., patient or client), the lower the probability a dietitian is practicing at an advanced-level" (Bradley et al, 1992). That proposition addressed the *status* of a dietitian, not practice performance. According to social historians, those persons working within a purely professional environment dealing exclusively with professional knowledge have higher status than those working mainly with clients/patients, e.g., professional regression (Abbott, 1988).

In summary, the only studies in clinical dietetics which attempted to measure practice performance and differentiate levels of practice focused on *what* was being done rather than *how.* Cognitive science addresses *how* experts process information.

Essential Characteristics of Expertise

A discussion of the selected essential attributes or characteristics, which are consistent across domains, follows. Selected attributes are: experience, deliberate practice, cognitive processing structures, knowledge, and motivation.

Experience

Chase & Simon (1973) and Hayes (1985) estimate that it takes 10,000 to 20,000 hours to become an expert after studying experts in chess and many other fields. To understand that figure, if an individual spent 40 hours per week, 50 weeks per year, it would take 5 to 10 years to become an expert providing that every hour of experience each week was at maximum concentration and intensity. However, it is not possible to maintain that level of intensity for more than 4 hours per day without experiencing "burn-out" in a short period of time (Ericsson, 1996). Therefore, Ericsson (Ibid.) promotes the "10-year rule of necessary preparation" to attain international-level performance gleaned from studies in such diverse fields as chess, music, sports, evaluating livestock (Ericsson, Krampe & Tesch-Römer, 1993), arts and sciences. Ericsson (1996.) states that this is consistent with Galton's claim that "motivation and perseverance are necessary for attainment of eminent performance" (pg. 366). Ericsson further stresses that increases in maximal performance over historical time have been so consistently observed in all domains to suggest that boundaries for optimal performance are unknown (Ibid).

Deliberate Practice

Deliberate practice was identified (Ericsson, Krampe & Tesch-Römer, 1993; Ericsson, 1996) as the type of learning most closely associated with outstanding performance. Deliberate practice requires: a well-defined task at an appropriate level for the individual, informative feedback, and opportunities for repetition and correction of errors (Ericsson, 1996, pg. 20-21). Based upon reviews of 100 years' worth of laboratory studies in addition to testing their theory, the criterion above differentiated playful interaction and competitions from deliberate practice (Ericsson, Krampe & Tesch-Römer, 1993). Three phases of development were proposed based on Bloom's (1985) work: play, practice with a teacher/coach/mentor and then full-time involvement (Ericsson, 1996). Deliberate practice would be introduced in phase two and intensified in phase 3 if the individual desired to be internationally competitive.

Two to four hours a day of deliberate practice were considered the maximum amount of time an individual could tolerate without loss of motivation (Ibid). Initially, the daily time would be short with increases as the individual became more adept at handling the intensity (Ibid). The recommended optimum times of day for deliberate practice were morning for mental activities and afternoons for physical activities (Ibid.).

Cognitive Structures

Cognitive structures were identified using real-life expertise (deGroot, 1978), domain-specific memory performance (Chase & Simon, 1973; Ericsson & Smith, 1991) novice-expert comparisons (Ericsson & Smith, 1991; Patel & Groen, 1991) and extensive case studies (de Groot, 1973; Ericsson & Smith, 1991). In order to be relevant, domain-specific tasks needed to be standardized, yet replicate "real life" (Ericsson & Smith, 1991). Comparisons were then made against "control" groups of individuals experiencing similar opportunities to make contributions (Ibid.). Cognitive structures appeared to be consistent across domains (Ibid.). Structures of interest to this study are: pattern recognition of chunks of information, "best-fit" strategy, forward-reasoning, ability to determine relevance, flexibility, ability to handle large number of constraints and abstract information, thoroughness and cognitive restructuring.

Superior Pattern Recognition is described as linking meaningfully-related configurations of information, or chunks, into clusters and stored in short-term (Posner, 1988) or long-term memory (Ericsson, Krampe & Heizmann, 1993). Chunks are relatively small groupings of information, the maximum being 3 or 4 symbols or chunks (Staszewski, 1988), which may be grouped into higher level chunks and organized or encoded, indicating relationships (Posner, 1988). A specific piece of information may belong to more than one chunk so that the relationships or encodings may vary directionally (Ibid). The chunks are acquired through years of practice, new information is encoded according to existing knowledge and stored as mnemonic codes (Staszewski, 1988).

Pattern recognition was initially demonstrated empirically by asking chess experts to reproduce game positions on a board while they verbalized their thoughts (Chase and Simon, 1973). Experts formed more elaborate chunks in short-term memory and effortlessly recognized patterns of high significance to chess. Randomly-placed pieces were not recognized as patterns, nor was the memory of experts greater in non-chess tasks.

Staszewski's review (1988) raised the issue of retrieval structures of experts. He proposes that: (a) experts have the capacity to store long sequences in memory in serial order and (b) the ability to access information quickly and accurately. The sequences stored were redundant patterns observed in the domain; in other words redundancies (patterns) were exploited by replacing computation or problem-solving with retrieval of patterns, thus generating results more rapidly.

Chi, Glaser & Farr (1988) emphasize that the ability to recognize meaningful patterns is not superior perceptual ability but reflects a specific organization of the knowledge base (pg. xvii). Groen & Patel (1988) argue that pattern recognition chess (perceptual ability) is analogous to comprehensive ability in medicine—a verbally-complex domain. They further explore a method of verbal analysis that decomposes underlying units of meaning, called propositions, as a form of verbal chunking.

<u>Best-fit strategy</u> was coined by Bereiter & Scardamalia (1993) for the non-expert strategy of pattern recognition. "Best fit" strategy relies upon a limited number of symptom patterns or quickly settles upon an interpretation rather than allowing the inconsistencies to lead to problem-solving or increased depth of knowledge.

<u>Forward-reasoning</u> or convergent thinking was defined as moving from a deduced fact to a new fact (Groen & Patel, 1988). Forward reasoning was not identified in medicine initially, as the verbally complex domain did not lend itself to mathematical or pictorial solution paths (Ibid.). However after propositions or semantic networks became the unit of analysis, analogous to "chunking" as the unit

of analysis in cognitive science research, forward reasoning was observed in physicians generating medical diagnoses. The steps of medical forward reasoning were identified as first noting significant signs and symptoms, reasoning, and then converging upon a diagnosis (Patel & Groen, 1991). Backward reasoning was observed in medical students and physicians in an area other than their specialty (Patel, Arocha and Groen, 1986). Backward reasoning consisted of selecting a candidate diagnosis and then attempting to find signs and symptoms to support or contradict that diagnosis (Ibid.).

<u>Relevance.</u> As stated above, only meaningful or relevant patterns and information linked to problem-solving strategies specific to the domain were encoded and stored by experts (Staszewski, 1988). Bereiter & Scardamalia (1993) stress that relevant patterns must be recognized at the right time as well as recognizing which irrelevancies must be discarded or ignored. Relevant information is the base of inferences for medical experts, while novices infer from less relevant information (Groen & Patel, 1986; Paten & Groen, 1991). Expert medical diagnosticians also attend to relevant symptoms rather than wasting time on less plausible ones (Bereiter & Scardamalia, 1993). In other words, experts appear to selectively screen out irrelevant information, thus reducing the number of problem constraints.

<u>Flexibility</u> was demonstrated in studies of computation; subjects modified their coding and retrieval strategies upon recognition of pattern or problem variances (Staszewski, 1988). Inflexibility was demonstrated with "automaticity," defined as practice of a strategy until it becomes habitual leading to loss of conscious access to

the strategy (Staszewski, 1988; Bereiter & Scardamalia, 1993). Bereiter also cites physiological evidence from studies with monkeys which demonstrated that flexibility to tackle new problems leads to a corresponding rise in anti-aging hormonal levels.

Constraints are restrictions placed on a problem. Complexity is the number of constraints that must be taken into account during problem solving. Experts appear to circumvent human limitations of memory capacity, i.e., cope with increased complexity, by encoding data, chunking and storing meaningful links as constraints (Bereiter & Scardamalia, 1993; Ericsson & Smith, 1991; Chi, Glaser & Farr, 1988). Analogous to a programming problem, adding constraints as coded chunks to an economic problem reduced the search space (Chi, Glaser & Farr, 1988). Practice increases the efficiency of storage and retrieval of information for any individual. The ability to plan, reason or evaluate based upon the constraints of the problem appears to be a crucial part in the development of expertise (Ericsson & Smith, 1991).

Abstraction. Experts represent problems at a deeper, more-principled level than novices (Chi, Glaser & Farr, 1988) based on research of physics problems and computer programming. Both groups categorized problems, but novices on the basis of applications and experts on the basis of solution algorithms. Expert physicians made more use of scientific principles to justify their diagnosis than did non-experts (Boshuizen and Schmidt, 1992)

Thoroughness. All relevant elements of a problem are accounted for with diagnosis or solution. As experts recognize 95% of the extensive number of problems that they encounter (Abbott, 1988; Bereiter & Scardamalia, 1993), attention is focused and problem-solving is required for the irregularities of the problems (Staszewski, 1988; Bereiter & Scardamalia, 1993). Again, strategies are modified by a mixture of factoring and retrieval to accommodate irregular data and redundant patterns (Staszewski, 1988).

Cognitive Restructuring, or synectics, involves viewing the problem from another perspective or "making the strange familiar *and* making the familiar strange" (Gordon, 1961). Making the strange familiar attempts to "normalize" the unfamiliar, making room for the unfamiliar. Making the familiar strange distorts, inverts or transposes the familiar world into analogies to creatively solve problems, using personal, direct, symbolic or fantasy analogies (Ibid). Gale & Marsden (1983) compare structuring and restructuring of clinical information to the classical psychological theory of productive problem solving as a "creative and inventive process relying on the individual's capacity to restructure the problem in different progressive ways in order to perceive the inner structure" (page 124).

Knowledge

That experts possess an extensive knowledge base is a universally accepted fact. The type of knowledge and the ways knowledge is used differs between experts and non-experts. Formal knowledge consists of stable facts and principles found in textbooks, plus educational programs leading to undergraduate and graduate degrees. "Declarative" knowledge, another term for formal knowledge used by psychologists (Bereiter & Scardamalia, 1993), is easy to test, and thus forms the basis of licensing and certification tests. Formal knowledge is more static than informal knowledge due to the rigorous process of justification, criticism and argument and thus becomes a "negotiable" quantity (Ibid.). Formal knowledge is the foundation for communicating the essence of a domain and becomes the platform to launch expert and non-expert careers.

Informal Knowledge. Informal knowledge is acquired as one or more skills, is manifested as performance and is accumulated through personal and work experiences. Learning, remembering, perceiving and understanding are situational (Ibid.), not linear or orderly. Experience makes you what you are; knowledge is one aspect of what you use. Informal knowledge does not appear in text books, but is the self-developed creation of patterns and connections formed by a lifetime of experience, or "educated common sense" (Ibid.). It has been the most difficult aspect of expert knowledge to program into computer models due to its situational nature. Artificial intelligence researchers have used "think-aloud" protocols with numerous experts to discover the relationships and situations encountered in real life (van Someren, 1994).

Another form of informal knowledge, crystallized expertise, is defined as "intact procedures, well-learned through previous experience, that can be brought forth and applied to familiar kinds of tasks" (Bereiter & Scardamalia, 1993). Fluid expertise is defined as new assemblies or reassembly of processes to adapt to novel situations (Ibid.). Artificial intelligence systems and lectures are labeled crystallized intelligence (Ibid). Mental processes active at the moment and captured by think-aloud protocols are examples of fluid intelligence (Ibid). Crystallized and fluid intelligence continually interact.

Motivation

In addition to cognitive structures identified through standardized tasks, expert characteristics are acquired through a process. This process includes the number of years to acquire skills plus the motivation to commit to those years of intensive study. Different researchers have attributed motivation to either personal pleasure obtained from optimal experiences (Csikszentmihalyi & Csikszentmihalyi, 1988) or the social aspect of surrounding oneself with second-order environments (Bereiter & Scardamalia, 1993). Either way, expertise is acquired.

Flow, the name given to optimal experience, is a common experience reported as rewarding in and of itself, providing intrinsic motivation (Csikszentmihalyi & Csikszentmihalyi, 1988; Bereiter & Scardamalia, 1993). People who "experience flow in activities that are rich in challenge tend to develop increasingly complex personalities....which in turn leads to gradual increments in skill...."(Csikszentmihalyi & Csikszentmihalyi, 1988, pg. 205). Experience of flow has been validated in retired persons, working persons, traditional and contemporary societies, sports activities, professional artists and dancers, anthropology of play, mystical and religious contexts, Eastern and Western cultures, mountain climbers and has been explored for implications in sociocultural evolution (Ibid.).

Csikszentmihalyi (1988) first noticed that the intense concentration of artists during the creative process of painting was lost rapidly when the painting was completed. It appeared that the motivating factor was the sheer enjoyment of the process. In this context, interest was lost more rapidly if monetary rewards were received (Ibid. pg 6). Interviews were conducted with individuals strenuously involved in activities for which they received little money to determine the subjective experience of the activity when it was going well. It was found to be an "*autotelic* experience, or rewarding in and of itself" (Ibid., pg. 8). Any activity could be constructed to generate these rewards, work, play, sports and creative endeavors. However, "flow is possible only when real, meaningful, fateful outcomes are dependent upon the volitional action of participants" (Ibid., pg. 54).

Frequency of flow was initially measured asking respondents to read three quotations describing the flow experience and then if they had ever experienced that and during what activities. Quotation A, labeled by Csikszentmihalyi (1975) "merging of action and awareness" and the clearest sign of the flow experience, was a dancer's description of a performance going well. Quotation B, was labeled "merging of action and awareness," and described a chess player's focus on game strategy (Ibid.). Quotation C, labeled "centering of attention," described a modern music composer's narrowing of consciousness that made the merger of action and consciousness possible (Ibid.).

The measurement of quotations evolved into the Experience Sampling Method or self-reports (Csikszentmihalyi & Larson, 1987). Respondents were provided with an electronic pager and questionnaire booklet. Investigators would activate the pagers six to eight times per day for one week according to a random schedule and asked the respondents to fill out questions in the booklet each time the pager signaled. Questions included activities involved in when the pager was activated, persons involved with, and feelings at the time based on a list of adjectives in semantic differential format.

Various combinations represent the subjective experience, from low challenge: low skill = apathy, moderate challenge: low skill = worry, moderate challenge: high skill = control to high challenge: high skill = flow (Table 2). Flow is described as the most positive experience and when reported, respondents concentrated more significantly than usual, felt "in control, happy, strong, active, involved, creative, free, excited, open, clear, satisfied, and wishing to be doing the activity at hand" (Massimini & Carli, 1988, page 271).

Table 2. **Eight Combinations of Challenges and Skills with Corresponding Motivational Level** (Massimini & Carli, 1988)

Combination	**Individual State**
Low challenges and low skills	Apathy
Low challenges and average skills	Relaxation
Low challenges and high skills	Boredom
Average challenges and low skills	Worry
Average challenges and high skills	Control
High challenges and low skills	Anxiety
High challenges and average skills	Arousal
High challenges and high skills	Flow

<u>Second-Order Environments (Expert Sub-Cultures).</u> Second-order environments providing extrinsic motivation are social environments or subcultures that support the expert process by directing its development and recognizing its successes (Bereiter & Scardamalia, 1993). Criterions are: help and cooperation toward

professional growth, consistent recognition of each member's successes and successful career models (Ibid.) A distinction between second-order environments and supportive environments is that to belong, one is required to contribute and become increasingly more competent, not just stabilize at a particular level. Research groups are an example of second-order environments, while the general work setting would be considered a first-order environment. Thus stressing once again, that certain types of experiences and certain types of associations are crucial to the development of expertise.

Summary

Essential attributes of expertise addressed in this study were examined from the cognitive science, medical and nursing perspectives. During the time cognitive science developed and refined the tools of expert systems, medicine examined diagnostic strategies and constructed a knowledge base for consulting and tutoring (Clancey, 1988). Benner initiated the cognitive perspective of expertise in nursing a decade later. Thus, the essential attributes of experts are more fully defined in medicine than in nursing.

Essential characteristics or attributes of expertise consist of structured and unstructured components. Demographic items consisted of the "10-year rule of necessary preparation" to attain international-level performance as identified across domains by cognitive science (Ericsson, 1996). This attribute is incorporated into the training of physicians through medical school, residency, specialty fellowship and beyond but is less defined in nursing. Speed and accuracy of skill performance rather than length and quality of experience dominated nursing expertise research initially, although Thompson (1992) approached a cognitive component in her dissertation.

Rigorous, structured practice with immediate feedback, or deliberate practice, provides a supportive environment in which to develop expertise. The hospital and group practice environments have the potential to provide a rigorous, structured environment in medicine and nursing although it must be intentionally structured. Private practice generally does not provide the necessary immediate feedback for skill development.

Cognitive processing structures identified by cognitive science, such as pattern recognition, forward reasoning, relevance, abstraction, thoroughness, flexibility; accessibility of knowledge in memory—were identified in medicine after the unit of measure became semantic networks instead of memory chunks used in perceptual fields. Nursing research revealed significant differences in novice-expert cognitive maps linking clinical concepts, although the cognitive maps were not linked to specific cognitive processing structures.

Formal knowledge is more easily quantified; however, relationships or linkages of informal knowledge in memory structures have been the most productive focus of cognitive science, medical and nursing research.

Csikszentmihalyi & Csikszentmihalyi (1988) labeled the exhilarating feeling of performing at the peak of abilities to meet a solvable challenge, "flow". The desire to re-experience that feeling appears to provide the intrinsic motivation underlying development of expertise as flow is only experienced the first time a particular challenge is met at a particular skill level. Neither medicine or nursing have investigated the subjective experience of outstanding performance although the psychology and cognitive science literature reported extensive experience in diverse age groups, cultures, work and leisure activities (Ibid.). Second-order environments also provided support to individuals progressing toward expertise and are demonstrated in many research and professional groups in medicine and nursing.

The essential attributes are incorporated into the survey instrument while specific cognitive structures are linked to items in the diagnostic thinking inventory.

CHAPTER 3

METHODS AND PROCEDURES

This chapter describes the research methods used in this study. Descriptions of the research design, sample and setting, instrument development, reliability and validity, data collection and management are presented.

Research Design

A descriptive, correlational design was used to collect data investigating the research questions posed in this study. Descriptive statistics were appropriately used in this study to characterize the population as paucity of information exists regarding the topic of clinical nutrition experts among clinical dietitians (Burns & Grove, 1987).

Factor analysis was used to identify cognitive sub-scales linked to items in the diagnostic thinking inventory (Kline, 1986; 1993; 1994), in addition to validating the medical sub-scales of flexibility and structure of knowledge with clinical dietitians.

Predictive statistics were selected to identify study variables related to highest diagnostic scores, which was selected as a representative task of the population. Step-wise regression evaluated the effect of each independent variable on the dependent variable of diagnostic thinking, through a forward-selection and backward-removal process (SAS) and is useful in "exploratory or descriptive studies designed to develop theory" (Burns & Grove, 1987).

Specific Objectives

Specific aims of this study were: (a) to examine diagnosis of nutritional problems as a representative task of clinical dietitians practicing in renal nutrition, (b) to differentiate levels of practice performance based upon scores obtained on the diagnostic thinking inventory, and (c) to propose a preliminary definition of clinical nutrition expert status.

Research Questions

Research questions addressed in this study are restated below:

Research Question 1: What are the professional characteristics of renal dietitians measured by a cognitive-based instrument?

Research Question 2: Is there a significant difference in diagnostic scores between diagnosing renal dietitians and non-diagnosing renal dietitians?

Research Question 3: What are the underlying cognitive dimensions of the diagnostic thinking inventory?

Research Question 4: Which study variables best explain highest diagnostic scores of renal dietitians?

Research Question 5: How do renal dietitians with the highest diagnostic scores compare with The American Dietetic Association's advanced-level dietetics practice model on the demographic measures of experience, education, professional roles, responsibilities, contact and behaviors?

Definitions

Descriptive definitions of study terms are as follows:

Clinical nutrition expert (prior to the study): registered dietitian actively practicing in clinical nutrition with greater than 10 years' experience in dietetics, formal training in addition to a Bachelor's degree and internship, possessing extensive clinical knowledge and skills developed through deliberate practice, with the ability to diagnose nutritional problems by accessing expert cognitive structures and motivated by expert subcultures and flow.

Cognitive-based instrument: in this study, a survey instrument which contains descriptions of behaviors mediated by human mental information-processing strategies.

Cognitive dimensions: in this study, human mental information-processing strategies such as forward-reasoning, abstraction, cognitive restructuring, and mental flexibility.

Diagnosing dietitians: registered dietitians who formally diagnose nutritional problems.

Diagnostic score: summed numerical score obtained on the diagnostic thinking inventory.

Diagnostic thinking inventory: medical survey instrument modified for use with dietitians. Items were derived from descriptors of physicians' diagnostic thinking patterns. Cognitive processing structures were theoretically linked to selected inventory items.

Motivational variables: in this study, impetus to consistently pursue goal of expertise; intrinsic motivational variable is flow and extrinsic motivational variable is second-order /expert environments.

Professional characteristics (demographics): study variables such as, years of dietetics' experience, years of experience in renal nutrition, educational level attained, work setting and case load, deliberate practice, gender, professional roles and behaviors.

Renal Dietitians: registered dietitians specializing in renal nutrition and members of The American Dietetic Association Renal Practice Group.

Study Variables

The dependent variable, diagnostic score, was obtained by summing items in the diagnostic thinking inventory. Independent variables were: years of experience in dietetics and renal nutrition, total hours worked per week in dietetics and renal nutrition, specialization in renal, renal specialty certification, work setting and case load, educational level, route of entry into dietetics, gender, professional honors and awards, professional roles and contacts, the professional behaviors of writing, presentations and research, experience with deliberate practice, flow and second-order environments, practicing diagnostician and diagnostic classification system(s) utilized.

Instrument Development and Testing

The instrument developed for this study, Expert Status Inventory, measured four selected categories under the concept of clinical nutrition expert status: professional characteristics (demographics), diagnostic thinking, knowledge and motivation. Development, testing and pilot-test results of the cognitive-based instrument will be described by category.

Professional Characteristics (Demographic) Inventory

To descriptively compare findings from this study with the advanced-level practice model, permission was obtained to use selected demographic information from the 1991 Role Delineation Study Questionnaire for Section 1 of the instrument (Appendix C).

Reliability and Validity of Advanced-Level Practice Model. The 1991 Role Delineation Study sampled 8,012 dietitians registered prior to 1988 who were members of at least one practice group in a stratified random sample (Ibid.). Two randomly selected groups of 1,000 dietitians each served as controls—group 1 was composed of entry-level dietitians and group 2 was composed of dietitians who were not members of any dietetic practice group (Ibid.). Validity of the model was established by discriminant analysis, which successfully classified group membership, while split-half analysis and an independent sample measured reliability of the discriminant function.

Item Selection. Questions selected from the 1991 Role Delineation Study for use in this study included: "years of dietetics practice" and "hours worked in typical week." Although not included in the model of clinical nutrition expert, "professional roles," "major role," "frequency of contact with individuals and committees/organizations," "honors and awards" and "professional activities" were selected to descriptively compare findings with the 1991 Role Delineation Study (Bradley et al, 1992).

Demographic questions added by this investigator to substantiate renal experience were: "years practicing in renal," "specialization, if not renal" and "typical hours per week in renal" and "certified renal specialist." "Gender" was added based upon Leyse's findings of significantly different responses between genders (1998).

Pilot Testing. Results of the pilot test with a convenience sample of 6 renal dietitians revealed the following demographic data (Tables 3 and 4). Reliability coefficients were not determined due to the small sample size and non-parallel items. Face validity was established by the subjects and content judged relevant for use with clinical dietitians through an item-by-item analysis (Table 5).

Years of experience in dietetics and renal varied significantly as subjects clustered into three groups, 1, 2-4 and 5-6. Subjects 1-3 performed in a greater number of roles. Subject 2 reported a wider variety and number of contacts while subjects 1 and 2 reported significantly greater number of professional behaviors and research activities (Table 4).

Revisions. The cover letter and instructions (Appendix A) were revised to reflect comments of pilot subjects. One suggestion incorporated into the study was to offer an incentive to improve the response rate. Revisions to the demographic section based upon the pilot were: to add "work setting" and "case load" in order to investigate relationship between diagnostic ability and caseload; and to add "residents/fellows" to professional contacts, question 12.

Table 3. **Pilot Data: Demographics** (n = 6)

Individual	**Experience In Dietetics In Years**	**Experience In Renal**	**Number of Roles**	**Number of Contacts**
1	19	15-19 years	12	1.96
2	22	15-19 years	12	2.58
3	12	10-14 years	11	1.93
4	16	10-14 years	3	1.82
5	2	12-35 months	2	1.76
6	5	3-6 years	5	1.64
Mean Scores	12.7	7-10 years	7.5	1.95
Range of Scores	0 – 45	0-20+ years	0 – 24	0 – 4

Table 4. **Pilot Data: Demographics** (n = 6)

Individual	**Number of Honors/Awards**	**Professional Behaviors**	**Research Activities**
1	2	35+	5+
2	2	23+	11+
3	1	1	4+
4	2	4	0
5	2	0	1
6	0	0	0
Mean Scores	1.5	10.5	3.5
Range of Scores	0 –2+	0-40+	0-16+

Table 5. **Pilot Results: Percent Agreement Among Pilot Subjects; Rating on Clarity of Questionnaire Items** (n = 6)

Item	Percent Agreement	Item	Percent Agreement
Section 1--Demographics			
Actively employed	100%	Professional Roles	67%*
Years in Dietetics	100%	Major role	100%
Years in Renal	100%	Professional contacts	83%*
Specialization	83%	Educational level	100%
Hours/week in dietetics	100%	Honors/awards	100%
Hours/week in renal	100%	Professional activities	100%
Council on Renal Nutrition	100%	Professional presentations	100%
		Research activities	100%

*Revised Item

Diagnostic Thinking Inventory

Medicine's diagnostic thinking inventory (Bordage, Grant & Marsden, 1990) was selected to measure dietitians' diagnostic thinking. Permission was obtained for the use of the diagnostic thinking inventory (Appendix C).

Reliability and Validity with Physicians. Nine groups of thirty physicians and medical students each were recruited in the United Kingdom by Bordage, Grant & Marsden (1990) to validate the diagnostic thinking inventory as a new instrument. Each group represented "a distinct phase of medical education and clinical practice…first-year clinical medical students, third-year clinical medical students, house officers, senior house officers, registrars, senior registrars, consultants, trainees in general practice, and general practitioners…The first seven groups…from general (internal) medicine…The latter two groups.. representative of the research populations" (Ibid., pg. 415). Fifty-six items were administered and analyzed. Four items were dropped due to negative discriminant indices, ten additional dropped because of synonymous formulations with other items, leaving 41 items.

The inventory was administered a second time with the remaining 41 items. Overall reliability was $\alpha = 0.83$, with 0.72 and 0.74 for flexibility and structure sub-scales respectively. Total and sub-scale scores were significantly different between groups ($p = 0.0001$). First- and third-year clinical medical students were significantly different from the remaining seven groups, and only senior house officers were significantly different from the registrars in the remaining seven groups.

Pre-Pilot Testing. A panel of 9 clinical and academic dietitians determined relevance of the diagnostic thinking inventory to clinical dietetics (Gammon, 1993), prior to instrument development in this study. Verbal consensus was achieved after group administration and discussion of the inventory. Results after administration of the diagnostic thinking inventory without modification for dietitians appear in Table 6.

Modification. This investigator modified the stem questions and anchor statements for use with registered dietitians as follows: "nutritional problem" replaced "medical problem or disorder," nutrition examples replaced medical examples in parentheses, "nutritional diagnosis" was substituted randomly for "diagnosis." Only double-barreled sentences containing the word *and* were rewritten, for example "I move on *and* gather new information to trigger new ideas" became "I gather new information to trigger new ideas." "I move on to get new information *and* a new perspective" became "I move on to get new information in order to get a new perspective." "Signs *and* symptoms" was left unchanged. Although the two comprise objective and subjective evidence of disease, they are grouped together when reporting clinical findings.

Table 6. **Individual Scores and Means for Responding Clinical Dietitians and Educators** (adapted from Gammon, 1993)

Individual Clinical Dietitians/Educators (n=8)	**Total Score*** (41 variables)	**Thinking†** (21 variables)	**Structure‡** (20 variables)	**Experience in Years**	**Role**
1	161	82	79	20	Educator
2	165	85	80	8	Clinician
3	167	87	87	-	Educator
4	177	87	90	20	Educator
5	180	92	88	23	Clinician
6	184	95	89	20	Clinician
7	184	98	86	11	Clinician
8	191	93	98	20	Clinician
9	196	101	95	18	Clinician
Mean Scores	177.2	91.1	88	17.5	

* Total Score in ascending order = Flexibility in Thinking + Structure in Memory
Possible Score = 41-246
† Flexibility in Thinking; Possible Score = 21-126
‡ Evidence for Structure in Memory; Possible Score = 20-120

Secondly, to accurately interpret findings, a labeled, interval scale for each anchor statement was considered. The anchor statements were separated, numbered and followed by a labeled, interval scale. Several scales were tested in this manner with groups of dietitians in Tucson, Arizona and a questionnaire development class at The University of Arizona. Scales tested were: (a) a 4-point Likert-like (Likert, 1932) scale of "strongly disagree," "disagree," "agree" and "strongly agree," (b) a 5-point

Likert-like scale of "strongly agree," "agree," "disagree," "strongly disagree" with "neither agree nor disagree" in the middle position and "no opinion" to the right side, and (c) a 6-point scale measuring frequency of behavior using the intervals of "never," "rarely," "infrequently," "frequently," "almost always," and "all of the time." In the last instance, stem questions and anchor statements were rewritten to remove qualifiers, such as "often," "rarely," etc.

Lastly, the order of item appearance was changed to separate similar items. One synonymous item was dropped from the scale leaving a total of 40 items.

Two versions of the instrument were tested prior to this study by asking dietitian volunteers during two separate conferences in 1995 and 1996 to review relevance of scales to items, flow of questions and length of instrument. Minor adjustments were made to the questionnaire after each administration.

Pilot Testing. The purpose of the pilot test was to determine preference for either Bordage, Grant & Marsden's (1990) published format or the separated anchor statements followed by labeled, interval scales of frequencies. The formats were randomly placed in in the questionnaire booklet to reduce bias.

Reliability and Validity of Pilot. Reliability coefficients were not determined as previously discussed. The clarity of each item pertaining to its use with renal dietitians was rated by each subject (Table 7), plus written or verbal comments to this investigator.

Pilot testing of the diagnostic thinking inventory revealed a significant difference between subject 1 and the remainder of the subjects based upon total diagnostic scores using Student's t-test at $p \doteq 0.01$ (Table 8).

Format preference for the diagnostic thinking inventory was evenly divided among the pilot subjects. One subject commented that the Likert-like scale continued to have double-barreled items, which in reality were double negatives and incorrect word choices requiring further revision. For example if the first anchor statement of item 28 were read with each frequency choice, the sentences would read, "I am *never* not capable of ruling out most of my ideas," "I am *rarely* not capable of ruling out most of my ideas," "I am *infrequently* not capable…," "I am *frequently* not capable….," "I am *almost always* not capable…," "I am *always* not capable…."

Table 7. **Pilot Results: Percent Agreement Among Pilot Subjects Regarding Clarity Of Diagnostic Thinking Inventory Items** (n = 6)

Item	Percent Agreement	Item	Percent Agreement
Section 2—Diagnostic Thinking Inventory			
1	100%	21	100%
2	83%	22	100%
3	100%	23	100%
4	100%	24	100%
5	100%	25	100%
6	100%	26	100%
7	100%	27	100%
8	100%	28	100%
9	100%	29	100%
10	100%	30	100%
11	100%	31	100%
12	100%	32	83%
13	100%	33	100%
14	100%	34	100%
15	100%	35	100%
16	100%	36	100%
17	83%	37	100%
18	100%	38	100%
19	100%	39	100%
20	100%	40	100%

This investigator, in consultation with graduate committee members, decided to use the published semantic differential format rather than revise the inventory and interval scale.

Table 8. **Pilot Data: Diagnostic Thinking Inventory** (n = 6)

Subjects	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**
Diagnostic Scores	215*	175	168	178	176	162	179

* Significant at $p = 0.01$ using Student's t-test
Range = 40-240

Revisions. Revisions to Diagnostic Thinking Inventory were: (a) Change instructions to read "patients/clients" instead of "individuals" and add "indicate problem-solving strategies used if you do not diagnose." (b) Rewrite definition of "diagnosis" to be consistent with other publications on nutritional diagnosis. (c) Combine "nutrition" with "diagnosis" more frequently to differentiate nutritional from medical diagnosis. (d) Re-insert item 41.

Knowledge Inventory

Formal knowledge variables included educational level (formal degree attained or working towards) and certification as a Renal Nutrition Specialist. Educational level ranged from bachelor's degree to doctoral degree with separate categories to indicate progress toward the next degree.

Informal knowledge was measured indirectly, as actual performance behavior was not observed. However, dietitians' perceptions of their behavior were recorded as responses to the diagnostic thinking inventory.

Deliberate practice criteria were listed, and the respondents were asked to indicate if they had experienced it, how frequently and to describe the experience. Pilot results follow (Table 9).

Reliability and Validity. Reliability coefficients were not determined as previously discussed. The pilot subjects (Table 10) rated relevance and clarity of the items.

All subjects were highly educated, while subjects 1 and 3 described greater involvement with deliberate practice than the remaining subjects.

Table 9. **Pilot Data: Knowledge and Deliberate Practice** (n = 6)

Subjects	1	2	3	4	5	6	Mean/Mode
Educational level	MS	PhD	MS	MS	BS	MS	MS
Certified Renal Specialist	0	0	0	0	0	0	0
Practice Groups	2	5	1	1	2	1	2
Deliberate Practice	4+	0	3	0	1	0	1.3

Table 10. **Pilot Results: Percent Agreement Among Pilot Subjects Regarding Clarity of Knowledge Items** (n=6)

Item	Percent Agreement
Knowledge Variables	
Educational level	100%
Certified Renal Specialist	100%
ADA Practice Groups	83%*
Deliberate Practice	100%*

* Revised item

Revisions. A line was added to question 18 asking, "if you have not experienced deliberate practice, would you care to?" Question 8 was revised to read, "are you a member of ADA practice groups *other than renal*?" A question regarding route to registration was added based upon Leyse's (1998) findings.

Motivation Inventory

Experience with flow in professional activities was included in order to determine if dietetics practice was structured to elicit flow and to identify potential roles eliciting flow. Permission was granted to use the three quotations that described the flow experience (Csikszentmihalyi, 1975; Han, 1988) (Appendix C). For the pilot, the quotations were labeled A, B and C and followed by roles extracted from the 1989 Role Delineation Study (Kane et al, 1990a) plus activities such as diagnostic work and reflective thinking/theorizing. Respondents were invited to describe one or more flow experience for each role or activity using the quotations as triggers. The descriptions of flow were compared with published reports of flow experiences (Csikszentmihalyi & Csikszentmihalyi, 1988). Although the quotations were labeled separately, quotation scores were not calculated. However, the number of roles or activities eliciting flow was tabulated.

Second-order environment criteria were described, various professional groups were listed as possible supportive environments and space allotted to describe "other" groups. Group selections were summed. Frequency data for motivational variables are displayed in Table 11. Subjects 1, 2 and 3 demonstrated greater involvement with flow than other subjects.

Reliability and Validity. Reliability coefficients were not determined. Clarity and relevance of items to clinical dietetics were rated and is shown in Table 12.

Table 11. **Pilot Data: Flow and Second-Order Environments** (n = 6)

	Range	Subjects 1	2	3	4	5	6	Mean
Flow & number of roles	(0-10)	5	2	5	1	2	0	2.5
Second-order environments	(0-9)	5	4	1	1	0	4	2.5

Table 12. **Pilot Results: Percent Agreement among Pilot Subjects Regarding Clarity Of Motivational Items** (n = 6)

Item	**Percent Agreement**
Section 3—Motivational Variables	
Flow quotations	100%
Flow and roles	100%
Second-order environment	100%

Revisions. Flow quotations were formatted to calculate number of flow experiences by quotation in addition to summing the number of roles and activities.

Study Sample and Setting

The study consisted of a sample of registered dietitians, actively practicing in renal nutrition in the United States. The pilot sample of 6 subjects was identified using a convenience-sampling technique; the dissertation sample consisted of 500 randomly selected subjects (Table 13). One of the pilot subjects was also included in the random sample purchased from The American Dietetic Association List Rental Service sorted by dietetic practice group.

Criterion for selection included: (a) registered dietitians who are members of The American Dietetic Association and The American Dietetic Association Renal Practice Group, (b) currently employed in dietetics practice defined as working any number of hours per month in clinical, administration, education and/or research, (c) residing in the United States. Gender was requested as demographic information, age and race were not.

Table 13. **Description of the Sample Used Indicating Purpose and Number of Subjects**

Sample	**Purpose**	***n***
Dissertation--Quantitative	a) To obtain instrument reliabilities	500
	b) To provide quantitative data supporting the use of cognitive measures to assess practice performance	
	c) To assess characteristics of subjects using cognitive measures	
	d) To provide a "pool" of potential subjects for future qualitative data collection	

Setting

All questionnaire mailings originated from Tucson, Arizona. Telephone interviews were conducted from Desert Dialysis Center, Tucson, Arizona.

Protection of Human Subjects

This study was approved by The University of Arizona Human Subjects Committee and declared to be an exempt project (Appendix D). In order to be declared an exempt project, the phrase, "you are under no obligation to participate," was included as part of the cover letter. In addition, the cover page of the questionnaire included the statement, "Participation in this survey is completely voluntary; completion and return of the survey signifies your consent to participate."

Confidentiality of respondents was maintained by numerically coding questionnaires, and data were immediately scanned into the computer identified by code numbers. Raw data are maintained in a locked file cabinet accessed only by this investigator. If future studies are conducted with the identified pool of potential experts, written permission from each respondent will be obtained by this investigator prior to release of individual names.

Data Collection and Management

Data collection and management procedures are discussed in this section.

Expert Status Inventory Survey Instrument

A survey containing the Professional Characteristics Inventory, Diagnostic Thinking Inventory, Knowledge Inventory and Motivational Inventory was mailed to each subject (Appendix B). Ten pages of the questionnaire were printed on double-sided scanning paper by Mark Reflex © /AIM by National Computer Systems, Inc. to allow for more accurate data entry and reduce mailing and questionnaire costs. This investigator, in addition to hand collation and stapling, photocopied the cover page and final page.

Data Collection Procedure

Quantitative data were collected from February to June 1998 by mailing questionnaires to respondents homes using a modified Salant & Dillman's method

(1994). Salant & Dillman's basic survey procedure recommends four mailings to increase response rate. The initial mailing is a personalized, advance-notice letter to the entire sample explaining that they have been selected for the survey and will be receiving a questionnaire. One week later, a more detailed letter plus the questionnaire and stamped return envelope are mailed to all respondents. Four to eight days later a postcard reminder is sent to all respondents to thank them and serve as a reminder to the non-respondents. Three weeks later, a new personalized letter and replacement questionnaire are sent to non-respondents.

The mailing procedure was modified as follows. First mailing to every respondent consisted of a packet containing a non-personalized cover letter (Appendix B) stating that they had been randomly selected for the survey and explaining the purpose of the study, the 13-page questionnaire and a stamped, return envelope ($0.78 postage delivery and return). Pressure sensitive, bar-coded labels purchased from The American Dietetic Association were utilized as address labels.

Second mailing consisted of post cards (hot pink card stock photocopied four to a page and cut to size by this investigator) mailed as reminders to the non-respondents four weeks after the initial mailing. Initial heavy response rate (ten to twenty responses a day for two weeks) prompted a lengthened interval between the initial mailing and the first step in the follow-up sequence.

A second questionnaire with a new cover letter and stamped, return envelope was mailed to non-respondents eight weeks after the post card reminders as third mailing. An unanticipated delay occurred due to problems printing the double-sided scanning paper. Subsequently, one side of each page was photocopied rather than printed necessitating data entry by hand for responses to that mailing.

Each respondent was asked to complete and return the enclosed questionnaire within two weeks after receiving the packet. All respondents were requested to respond whether they were employed in dietetics or not, the first two spaces were provided to indicate active or inactive employment. Telephone number and address of the investigator were included for questions. An expression of appreciation for their participation was included in the cover letter and questionnaire.

A raffle prize of 1 one-year membership to either the Council on Renal Nutrition of the National Kidney Foundation or the Renal Practice Group of The American Dietetic Association was offered as an incentive to respond.

Data Management

Subjects were assigned a code number sequentially by zip code, which was then placed in the upper right hand corner of the questionnaire cover page.

Coding of the scanned responses proceeded as follows: Dichotomous variables were coded as "0" and "1." Zero also indicated that an item was selected in questions with multiple responses. Range for question 3, Section 1 was "0 to 8;" range in questions 15 and 16, Section 1 was "0 to 4." Frequency of activities in questions 19 to 22 and route of entry into dietetics, question 23, ranged from "0 to 4." Range for questions 1 through 41 in Section 2 was "1 to 6;" with coding reversed on questions

2,3,8,11,12,15-19,21-23,27-31,33,35,36,38-40 (See Table 14 for key). Questions with multiple responses were entered and summed as frequencies.

Missing data were handled in the following ways: the group mean for each individual question was inserted for factor analysis, missing cases were dropped prior to step-wise regression and missing items were dropped prior to post-hoc analysis. Data were scanned for computer entry into a mainframe VAX 11 at The University of Arizona Center for Computer Information and Technology, saved as a Microsoft Excel file, analyzed using Statistical Applications for Science with narrative data entered as a separate Microsoft Word file. Data were scanned for accuracy and edited by this investigator.

Summary

This chapter discussed research methodology, survey instrument development and testing, reliability and validity of the Expert Status Inventory, plus data management strategies. The Expert Status Inventory consisted of 4 separate inventories: the Professional Characteristics (Demographic) Inventory, Diagnostic Thinking Inventory, Knowledge Inventory and Motivation Inventory. A pilot test with a convenience sample of 6 renal dietitians was conducted to determine the format for the Diagnostic Thinking Inventory. Additionally, ease of administration and validity of items for clinical dietitians were assessed.

Three levels of respondents were theorized based upon all study variables in the pilot test, indicating that a potential pool of experts might be identified.

Table 14. **Diagnostic Thinking Inventory Key**

Biesecker Items	Bordage Items	Direction of Preferred Response*	Flexibility (F) or Structure (S)
1	1	R	S
2	2	L	F
3	3	L	F
4	4	R	F
5	5	R	F
6	7	R	S
7	8	R	S
8	10	L	S
9	11	R	F
10	12	R	S
11	13	L	S
12	14	L	S
13	15	R	F
14	16	R	F
15	17	L	S
16	18	L	S
17	19	L	S
18	22	L	S
19	23	L	F
20	24	R	F
21	25	L	S
22	26	L	F
23	27	L	F
24	28	R	F
25	30	R	F
26	32	R	F
27	33	L	S
28	35	L	F
29	36	L	F
30	37	L	S
31	38	L	F
32	39	R	S
33	6	L	F
34	9	R	S
35	21	L	S
36	29	L	S
37	31	R	S
38	34	L	F
39	40	L	F
40	41	L	F
41	20	R	S

* R = Right response preferred
L = Left response is preferred

Chapter 4

DATA ANALYSIS AND RESULTS

This chapter presents sample response rate, instrument reliability and validity and followed by data analysis procedures and results presented in order of each corresponding research question.

Sample Response Rate

Study subjects were a random sample of 500 registered dietitians, members of The American Dietetic Association Renal Practice Group. Two hundred eleven (42.2%) responded to the first questionnaire mailing, 31 (6.2%) to the postcard reminder and 67 (13.4%) to the second mailing of the entire packet for total response of 309 (61.8%). Thirty-six (11.7%) returned the questionnaire unanswered: 29 (9.4%) were no longer actively employed in dietetics, 5 (1.6%) declined to participate, and 2 (0.6%) questionnaires were undeliverable. The sample represented 43 states plus Washington D.C. (Table 15, Appendix E).

Expert Status Inventory Reliability and Validity

Reliability and validity of the newly developed Expert Status Inventory were evaluated for internal consistency reliability, stability reliability, and content and construct validity with the 309 respondents of this study.

Reliability

Internal consistency reliability of Section 2, diagnostic thinking inventory, was estimated using coefficient alpha, appropriate for multiple response item scales (Cronbach, 1951; Kline, 1986). Criterion level for alpha was set at 0.70, given that this study is the first attempt to validate the construct of diagnostic thinking in the domain of clinical dietetics and that $\alpha=0.70$ provides modest reliability (Nunnally, 1994). Internal consistency reliability was evaluated on all 41 items, plus each of the two sub-scales specified by Bordage, Grant and Marsden (1990)—flexibility and structure.

Overall reliability was acceptable with coefficient alpha of 0.80 for all items and 0.78 for the structure subscale. However, "early interpretation" and "active elimination," items #3 and #28, respectively were negatively correlated with the total scale. Coefficient alpha of 0.54 for the flexibility sub-scale indicates that some items need to be dropped or revised. Specifically, items #3, #28 and #9, "clarification." Item-to-total correlation of raw variables ranged from -0.38 to + 0.60. Thirty items were correlated greater than the .20 criterion to retain items (Kline, 1986). Items # 1, 2, 3, 9, 12, 13, 14, 20, 24, 28, and 32 demonstrated low correlations. These items were not dropped prior to factor analysis in this study, but would need to be revised prior to another administration of this inventory to clinical dietitians.

The standardized variable correlation was 0.83 for all items, 0.54 for flexibility subscale and 0.81 for structure subscale. Item-to-total correlations of standardized variables ranged from -0.38 to + 0.61 with 31 items greater than 0.20 criterion. All items, regardless of correlation, were retained to compare findings with physicians' diagnostic thinking (Bordage, Grant & Marsden, 1990). Item statistics are listed in Appendix E.

Stability reliability can be evaluated using test-retest (DeVellis, 1991; Nunnally, 1994). Test-retest, or temporal reliability, is evaluated by administering the same test to one group of respondents on two separate occasions, then correlating the results. However, only two respondents were re-tested. One pilot subject was included in the random study sample and received the study instrument six months after the pilot. A respondent in the study sample was re-tested after two months. Both listed more roles in their first questionnaire for question 13, Section 1, and Section 3, questions 2 and 3. The pilot subject responded identically on the diagnostic thinking inventory on both the pilot test and study. However, item 41 was added after the pilot test so the net difference in diagnostic scores was +4. The second respondent scored a net difference of –7 on the diagnostic thinking inventory due to varied responses on 20 questions. Error-proneness of the instrument was insufficiently evaluated.

Thus the total instrument demonstrated internal reliability for use with clinical dietitians although selected items require revision for future administration. Given that the theoretical subscales were reliable when administered to physicians but that this study is guided by a different theory linking expert cognitive structures to the same items, Cronbach's alpha of 0.80 was deemed acceptable.

Validity

Content validity is difficult to determine in tests where the material or domain is not clearly defined (Carmines & Zeller, '79; Kline, '86). Specific procedures used to determine content validity were based upon Kline (1986): (a) specify the population for whom the test is designed, (b) specify the skills to be tested, (c) ask experts in the field to review for omissions, (d) convert skill items to test items, (e) resubmit test items to experts and (f) apply rigorous test-construction procedures.

The specific population was registered dietitians, members of The American Dietetic Association Renal Practice Group. The skill, or representative task, was diagnostic ability. Experts did not review diagnostic thinking inventory for omissions, but rather reviewed the inventory for relevance for use with renal dietitians as little data exists regarding dietitians' diagnostic thinking. New test questions were not developed, but rather existing questions were revised and reviewed by an expert panel of renal dietitians and academic dietitians with diagnostic training. Rigorous test-construction methods were used.

Construct validity was estimated by principal factors analysis (Nunnally, 1994) of interval data in the diagnostic thinking inventory. Factors extracted were determined by an eigenvalue of greater than 1.00. Factor loadings of .30 or greater was the criterion for retaining items on a given factor (Kline, 1994). Comrey (1988) recommends a sample size of 200 for a 40-item factor analysis in order to be generalizable (5:1 ratio) while Kline (1991) states that a ratio of 2 subjects per scale item is sufficient. The total sample answering the Diagnostic Thinking Inventory ranged from 237 respondents answering question 32 to 253 respondents answering 9 other separate questions. Forty-one items comprised the scale items, with 106 non-diagnosing respondents (2.59:1 ratio), 140 diagnosing respondents (3.4:1 ratio) and 253 all respondents (6.2:1 ratio).

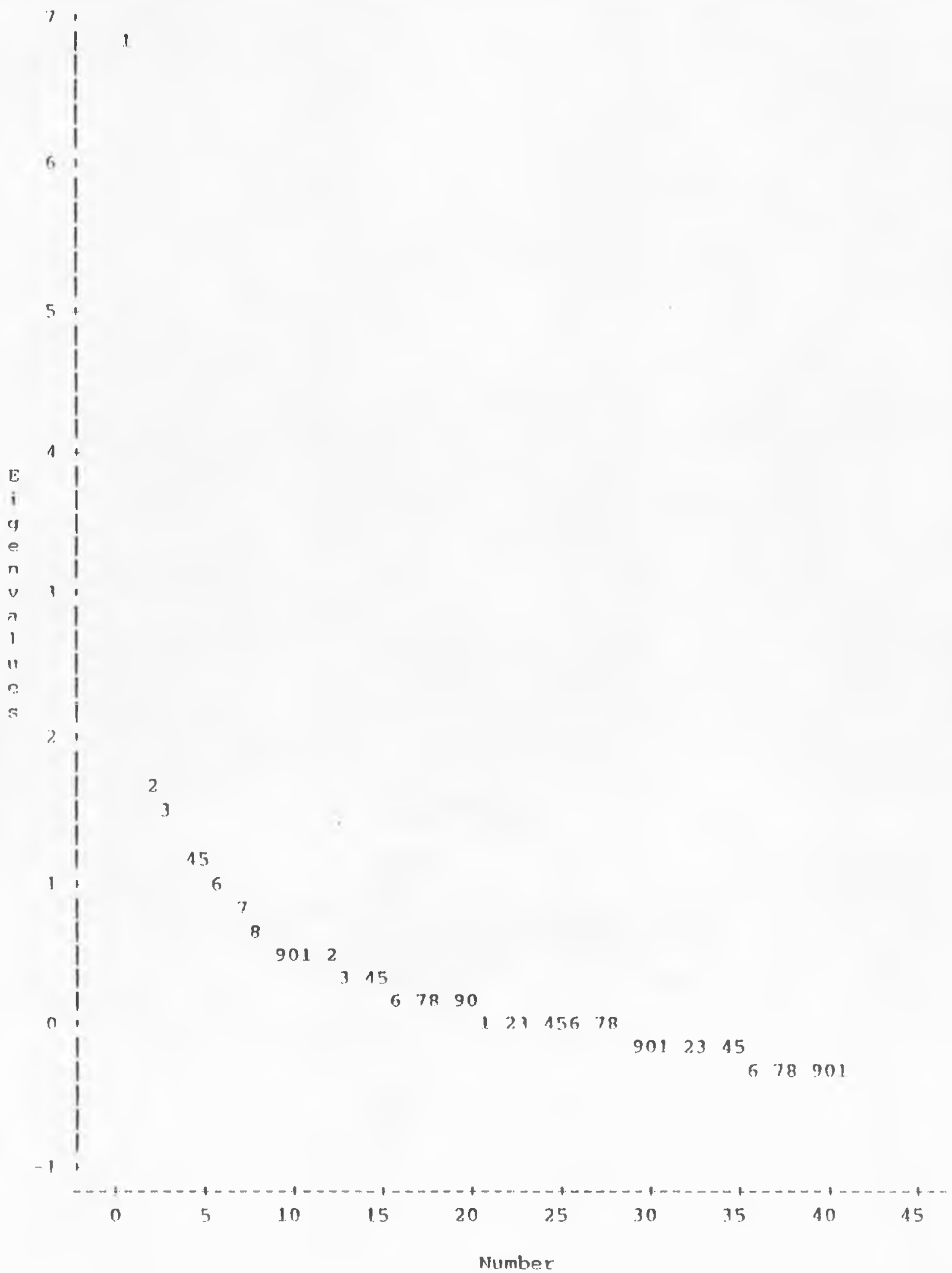
Principal factors analysis of all respondents revealed five factors with eigenvalues greater than 1.00 accounting for 40.26% of the variance (Table 16), a poor fit of the model (Nunnally & Bernstein, 1994). The scree plot supported this conclusion (Kline, 1991; see Figure 4). Regardless of the model fit, orthogonal rotation of factors and factor loadings were examined using previously described criterion. This procedure identified several items that did not load sufficiently on any one factor. Item #13, "irrelevant information," item #20, "clarify ambiguities," item #28, "active elimination," and item #39, "compare clinical information."

Alpha reliability coefficients were calculated for standardized and unstandardized items for each of the five factors extracted from all respondents by including all factor loadings greater than .30 and setting the criterion at α=0.70. The calculation for unstandardized items is "equivalent to using the correlation-based alpha formula" (DeVellis, 1991, p.105).. Cronbach's alpha for factor 1 was 0.84, for factor 2-- 0.84 and for factor 3-- 0.55. Factor 4 and factor 5 had negative values, -0.01 and –0.05, respectively (Table 12) due to rounding error, indicating zero correlation of variables on that factor. Factors 4 and 5 were thus discarded due to spurious results.

Table 16. All Respondents Factor Matrices (n=253)

Variables	Orthogonally Rotated Factor Loadings (Varimax)				
	1	2	3	4	5
1. Abstracting signs and symptoms			.57		
2. Prioritization					.38
3. Early interpretation					.40
4. Mental-set effect		.45			-.35
5. Responsive to patient	.43	.37			
6. Decode patient information			.59		
7. General inquiry	.57				
8. Forceful features	.32	.41			.36
9. Clarification					-.34
10.Probable diagnostic ideas	.51	.33			
11.Related information	.64	.31			
12.Diagnostic error				-.34	
13.Irrelevant information					
14.Data interpretation			.31		
15.Related diagnostic ideas	.30	.34			
16.Anticipate clinical		.50			
17.Little knowledge	.39			-.39	
18.Reinterpret new information		.62			
19.Reinterpret existing information		.50			
20.Clarify ambiguities					
21.Specific inquiry	.47				
22.Recall information		.62			
23.Confidence in judgement	.62	.37			
24.Compare & contrast diagnoses				.41	
25.Summarize as go along		.36			
26.Responsive to interpretations			.33		
27.Specific diagnostic formulations	.53				
28.Active elimination					
29.Reverse judgement		-.48			
30.Diagnose whole case		.49			
31.Cognitive restructure	.36	.31			
32.Anticipate lab information				.30	
33.Postpone judgement		.38			
34.Recall previous info	.48				
35.Dispersed knowledge	.39	.50			
36.Elaborated knowledge		.45			
37.Consider all information	.56				
38.Patient-RD control		.39			
39.Compare clinical information					
40.Complete inquiry	.63				
41.Opposing formulations			.41		
Eigenvalue	4.2	4.15	1.56	1.23	1.22
Percent Total Variance	17.6	17.2	2.4	1.5	1.5
Coefficient alpha	0.84	0.84	0.55	-0.01	-0.05

Figure 4. **Principal Factors Analysis of All Respondents: Scree Plot of Eigenvalues**



To summarize, the Expert Status Inventory consisted of a Professional Characteristics Inventory, Diagnostic Thinking Inventory, Knowledge Inventory and Motivational Inventory and was considered reliable for first time use with renal dietitians, although individual items require revision prior to another administration to a similar population.

Research Questions and Results

Research Question 1: What are the professional characteristics of renal dietitians measured by a cognitive-based instrument?

Respondents were all female with the exception of one questionnaire with missing data (99.6%). Educational level was bimodal: 134 with bachelors' degrees (49.3%) and 117 with master's degrees (43.0%). Seventeen (6.3%) were working on master's degrees, 2 (0.7%) working on a Ph.D. Of the total sample, 55.6% held a bachelors' degree, 43.7% a master's degree and 2 (0.7%) a Ph.D. (Table 17).

Route of entry into dietetics was primarily through internships (n=139, 51.7%), with other routes evenly distributed between coordinated undergraduate programs (n=47, 17.5%), experience (n=41, 15.2%) and "other" (n=40, 14.9%) (Table 18).

Table 17. **Gender and Educational Level of Respondents** (n = 273)

Respondents	**n (%)**
Female	272 (99.6)
Non-response	1 (0.4)
Bachelor's degree	134 (49.3)
Working on master's degree	17 (6.3)
Master's degree	117 (43.0)
Working on Ph.D.	2 (0.7)
Ph.D.	2 (0.7)

Table 18. **Route of Entry into Dietetics** (n = 254)

Route	n (%)
Internship	139 (51.7)
CUP*	47 (17.5)
Experience	41 (15.2)
AP4†	2 (0.7)
Other‡	40 (14.9)

* Coordinated undergraduate program
† Approved pre-practice program
‡ Master's plus experience, traineeship, coordinated internship plus master's, experience plus AP4, experience plus AP4 plus master's

The sample consisted of highly experienced practitioners. Mean number of years practicing as a dietitian was 21.4 years (n=271, s.d.=6.69); mean number of years as a renal dietitian was in the range of 3-6 years, with 40% practicing in renal 10 years or more. Data are condensed and displayed as ranges in Table 19.

Table 19. **Experience in Dietetics and Renal Nutrition** (n = 271)

	Years as Dietitian n (%)	**Years in Renal** n (%)
Less than 1 year	1 (0.4)	6 (2.2)
1-3 years	-	22 (8.1)
3-6 years	-	54 (19.9)
7-9 years	6 (1.9)	46 (17.0)
10-14 years	33 (12.2)	50 (18.5)
15-19 years	64 (23.6)	35 (12.5)
>20 years	-	24 (8.9)
20-24 years	84 (30.9)	
25-30 years	64 (23.6)	
31-42 years	19 (7.0)	
Do not practice in renal	-	34 (12.5)
Mean	*21.4 years*	*3-6 years*

Mean number of hours practicing dietetics in a typical week was 36.5 (s.d.=9.9) with a mode of 40 hours per week (45%). Mean number of hours practicing renal nutrition in a typical week was 23.9 (n=269, s.d.=16.4), with a mode of 40 hours per week (26%).

Mean number of hours practicing dietetics in a typical week was 36.5 (s.d.=9.9) with a mode of 40 hours per week (45%). Mean number of hours practicing renal nutrition in a typical week was 23.9 (n=269, s.d.=16.4), with a mode of 40 hours per week (26%). Seventeen (6.2%) subjects indicated they were not actively involved in clinical practice and 34 (12.5%) did not practice in renal. (Table 20).

Table 20. **Total Hours Worked in Dietetics and Renal Nutrition Per Week**

	Total Hours Worked/Week (n=271) n (%)	**Total Hours in Renal/Week (n=269)** n (%)
Zero hours	-	31 (11.5)
1-10	4 (1.5)	49 (18.2)
11-20	22 (8.1)	44 (16.4)
21-30	40 (14.8)	36 (13.4)
31-39	34 (12.5)	25 (9.3)
40	122 (45.0)	70 (26.0)
41+	47 (17.3)	16 (5.9)
Mean	*36.5 hours*	*23.9 hours*
Mode	*40 hours*	*40 hours*

Although a majority of the respondents specialized in renal (74.7%), 21 areas were listed as "area of specialization" other than renal, with 12 respondents indicating more than one area of specialization (Table 21, Appendix E). In three instances, similar areas were collapsed into one, i.e., critical care and nutrition support, sub-acute and rehabilitation, sports and wellness. Of the remainder, those respondents listing more than three areas of specialization were coded as generalists rather than specialists. Fifteen subjects clearly indicated their specialty as "generalist."

A majority of the respondents (54.4%) indicated that they were members of dietetic practice groups in addition to the renal practice group. The mean number of practice groups per respondent was 1.89. Frequencies of practice group memberships are displayed in Table 22, Appendix E, with diabetes and nutrition support the most frequently listed. One hundred seventy-five (65.1%) were members of the Council on Renal Nutrition of the National Kidney Foundation in addition to the Renal Practice Group. Thirty-nine (14.4%) respondents were Certified Specialists in Renal.

Question 10 asked respondents to list one or more of the following work settings: hospital, freestanding clinic, physician's office, Health Maintenance Organization (HMO) and other (Table 23). The largest percentage practiced in freestanding clinics (52%) and hospitals (45.4%).

The total caseload per week ranged from 50 to 100 (29.2%) and 101 to 150 (29.9%) with renal caseload in the same range: 50 to 100 (25.7%) and 101 to 150 (23.8%) (Table 24).

Table 23. **Work Setting by Percentage** (n = 273)

Work Setting	n (%)
Free-Standing Clinic	142 (52.0)
Hospital	124 (45.4)
Other	44 (16.!)
Physician's Office	16 (5.9)
HMO*	1 (0.4)

* Health Maintenance Organization

Table 24. **Total Case Load and Renal Case Load by Percentage** (n = 264)

	Total Case Load n (%)	**Renal Case Load n (%)**
<50	43 (16.3)	95 (35.8)
50–100	77 (29.2)	68 (25.7)
101-150	79 (29.9)	63 (23.8)
151-200	31 (11.7)	23 (8.7)
>200	34 (12.9)	16 (6.0)

In order to compare characteristics with the empirical model of advanced-level dietetics practice validated by the 1991 Role Delineation Study (Bradley et al, 1993), information regarding professional roles, activities, contacts, honors and awards was requested. The majority of respondents indicated that their primary role was clinical (n=216, 82%) with a small number indicating some form of supervision as their major role: manager (n=17, 6.4%) and supervisor (n=5, 1.9%) (Tables 25 and 26).

Table 25. **Major Roles by Frequency** (n = 266)

Major roles	**n (%)**
Clinician	218 (82.0)
Manager	17 (6.4)
Consultant	6 (2.3)
Supervisor	5 (1.9)
Teacher and "Other"	4 (1.5)
Researcher and Advisor	2 (0.8)
ADA state office, job-related committee, ADA national committee and member of other professional associations	1 (0.4) each

Table 26. **Role Positions by Frequency** (n = 273)

Roles	**n (%)**
Clinician	256 (93.8)
Member of other professional association(s)	185 (67.8)
Advisor	131 (48.0)
Preceptor	126 (46.2)
Consultant	95 (34.8)
Job-related committee member	81 (29.7)
Writer	78 (28.6)
Teacher	75 (27.5)
Supervisor	65 (23.8)
Committee member, other professional association(s)	50 (18.3)
Researcher	50 (18.3)
Evaluator	44 (16.1)
Referee	39 (14.3)
Manager	34 (12.5)
"Other" roles	30 (11.0)
Author	24 (8.8)
Creator/Developer	24 (8.5)
ADA local office holder	18 (6.6)
ADA state office holder	15 (5.5)
ADA local committee member	10 (3.9)
ADA national committee member	8 (2.9)
ADA national office holder	4 (1.5)

Table 27 indicates that respondents were most frequently in contact with individuals: health care professionals (87.1%), staff (83%) and patients (79%). Less frequent contact was made with institutional, business or media committees/ organizations but frequency of contact did not extend into the geographical location of contacts..

Frequency of professional behaviors, such as presentations, writing, editing and research are detailed in Table 28. A majority were invited to make professional presentations (n=184, 67.6%), 32 (11.9%) were invited to submit an abstract and make a conference presentation. A small percentage of the total indicated involvement in the remaining behaviors: 64 (23.4%) authored peer-reviewed journal articles, 38 (14%) reviewed book chapters and 14 (5.2%) reviewed books. Seven (2.6%) edited journals and 16 (5.9%) edited books. Respondents contributed to research (38%), rather than serving as a principal (11%) or co-investigator (15%). Seventy-eight (29.4%) listed professional honors and awards (Table 29, Appendix E).

Table 27. **Frequency of Professional Contacts by Percentage**

Type of contact	n	0*	L†	M‡	W¶	D**
INDIVIDUALS						
Patients	271	1.5%	1.8%	4.4%	13.3%	79.0%
RD colleagues	262	0.4	8.4	18.3	26.3	46.6
Health Professionals	271	0.4	1.5	2.6	8.5	87.1
Non-health Professionals	247	9.3	10.9	12.1	18.2	49.4
Staff	265	2.3	0.4	2.6	11.7	83.0
Management	254	2.4	4.3	8.3	33.5	51.6
Student	259	23.9	42.1	8.9	15.1	10.0
Residents	252	56.0	13.1	4.4	12.7	13.9
Volunteers	249	47.8	18.5	8.0	15.3	10.4
COMMITTEES						
Job-related	243	5.8%	19.3%	42.8%	27.6%	4.5%
Department	235	13.2	11.5	40.9	26.4	8.1
Institutional	228	30.7	28.9	28.1	8.8	3.5
Government	230	64.3	23.0	9.1	2.2	1.3
ADA	236	75.4	17.4	5.9	0.8	0.4
Professional	237	43.5	36.7	16.5	3.4	-
Media	235	80.0	18.7	1.3	-	-
Business	234	62.0	23.9	9.0	4.7	0.4
Volunteers	238	60.1	19.3	10.5	7.1	2.9

* No contact
† Less than monthly contact
‡ Monthly contact
¶ Weekly contact
** Daily contact

Table 28. **Frequency of Professional Behaviors**

Behavior	**Frequency** n(%)
Authored Peer-Reviewed Journal Articles	64 (23.4%)
1 to 3	43 (15.8)
4 to 9	15 (5.5)
10 to 19	5 (1.8)
>20	1 (0.4)
Authored Book Chapters	38 (14%)
1 to 3	35 (12.8)
4 to 7	3 (1.1)
Authored Books	14 (5.2%)
1 to 3	13 (4.8)
4 to 7	1 (0.4)
Editor of Professional Journals	6 (2.6%)
1 to 3	5 (1.8)
4 to 9	1 (0.4)
Editor of Books	16 (5.9%)
1 to 3	16 (5.9)
Professional Presentations	180 (67.6%)
1	44 (16.1)
2 to 3	88 (32.2)
>4	48 (17.6)
Conference Presentations	33 (11.9%)
1	16 (5.9)
2 to 3	12 (4.4)
>4	5 (1.8)
Research, Principal Investigator	31 (11%)
1	19 (7.0)
2 to 3	8 (2.9)
>4	4 (1.5)

Table 28 Continued. **Frequency of Professional Behaviors**

Professional Behaviors Continued	**Frequency** n (%)
Research, Co-investigator	42 (15%)
1	18 (6.6)
2 to 3	20 (7.3)
>4	4 (1.5)
Research, Contributed to	102 (38%)
1	45 (16.5)
2 to 3	46 (16.8)
>4	11 (4.0)

Thirty-nine (14.5%) indicated that they had experienced deliberate practice, as defined in the questionnaire, while 112 (50.7%) indicated that they would like to have the experience. Fourteen (5.2%) experienced deliberate practice at least once, 15 (5.5%) 2 to 3 times and 8 (2.9%) 4 times or more (Table 30). Examples of deliberate practice are in Table 31.

Table 30. **Experience with Deliberate Practice**

Deliberate Practice	n	**Frequencies**
Yes, have experienced	269	39 (14.5%)
1 time		14 (5.2)
2 to 3 times		15 (5.5)
> 4 times		8 (2.9)
Have not, but would like to	221	112 (50.7)

Table 31. **Examples of Deliberate Practice**

Annual employee reviews
Teaching evaluations
Master's thesis work with feedback
Internship
3-year traineeship
Graduate school
Grant applications with mentor
Work site professional development with mentor, early in career and continuing
Working with peers
Nutrition physical examinations
Author and editor of peer-reviewed journal articles

Research Question 2: Is there a significant difference in diagnostic scores between diagnosing renal dietitians and non-diagnosing renal dietitians?

Possible range of diagnostic scores was 0 to 246. Diagnostic scores in this study ranged from 121 to 219 with 253 (92.6%) of the sample completing at least a portion of the diagnostic thinking inventory. Distribution was bimodal (181, n=11, 4.0% and 173, n=10, 4.0%) with a mean total score of 174.7.

Of 253 responses to the Diagnostic Thinking Inventory in Section 2, 145 (56.9%) respondents indicated that they *do* diagnose nutritional problems. Respondents were asked to list all diagnostic classification systems utilized—medicine, nursing and dietetic-specific. Eighty-two of those diagnosing (n=145, 56.6%) indicated that they used medical diagnostic codes, 6 (4%) used Nursing Categories and 70 (48.3%) used Dietetic-Specific Nutritional Diagnostic Codes. Twenty-four of the 82 selecting medical diagnostic codes (16.6%) also indicated that they used dietetic-specific nutritional diagnostic codes (Table 32). Eighteen (12.4%)

respondents stating that they diagnose nutrition problems did not indicate the classification system used.

Table 32. **Do You Diagnose Nutritional Problems?** (n = 255)

Responses (answer one or more categories)	**n** (%)
Yes	**145 (56.9)**
Medical Diagnostic Codes	82 (56.6)
Nursing Categories	6 (4.0)
Dietetic-Specific Nutritional Diagnostic Codes	70 (48.3)
Both Medical and Nutritional Codes	24 (16.6)
Did not indicate classification system	18 (12.4)
Do Not Diagnose	110 (43.1)

Respondents' comments concerning the question "Do you diagnose nutritional problems?" were: "We use a more general nutritional assessment of risk factors: weight, lab values, diet, disease states." "Not formally; but I do informally, and I discuss this with the health care team & physician." "Indirectly—not by codes but in my documentation." "Not for actual medical coding." "Not coding, just charting by nutrition problems."

Diagnostic Thinking Inventory scores were summed and mean item scores calculated for each respondent. Next, the sample was separated into two groups: Group 1, respondents indicating that they diagnosed nutritional problems and Group 2, respondents indicating that they did not diagnose nutritional problems but answered the inventory according to their individual problem-solving strategies.

Mean total score and mean item scores for each group were determined. Mean total score was the summed response on each of the 41 items comprising the

Diagnostic Thinking Inventory. Bordage, Grant & Marsden (1990) assigned numerical values to each axis of the semantic differential scales with range of 1 to 6 points.

Group 1 mean total score was 177.5 (s.d.=17.2; SE=1.45) with 171.85 (s.d.=17.46; SE=1.695) for Group 2. Responses for each respondent were summed prior to calculating the mean of the summed scores for each group. There was no substitution for missing data.

Mean item totals for Groups 1 and 2 were 4.376 and 4.22, respectively, and calculated by substituting the item mean across individuals for missing data. Student's t-Test was significant between mean item totals of the two groups at the $P = 0.005$ level, and between mean total scores at the $P = 0.05$ level (Table 33) indicating differences between the two groups based upon diagnostic strategies.

Table 33. **Student's t-test Results Between Diagnosing and Non-Diagnosing Respondents.**

Group	**n**	**Mean Total Score** (No mean substitution)	**Mean Item Total** (Item mean substitution)
Diagnosing Respondents only	140	177.51*	4.38†
Non-Diagnosing Respondents	106	171.86	4.22

* significant at $P = 0.05$ (0.012)
† significant at $P = 0.005$ (0.0029)

Review of individual items reveals that more variance appears in the responses from the non-diagnosing group to account for the difference in scores. The diagnosing group responses cluster at the high end of the scale. For example item 23 reads, "concerning the diagnosis I eventually make, I usually have very few doubts" or "I often feel too uncertain for my own comfort." The diagnostic group indicates more confidence in their diagnostic ability or their knowledge base.

Table 34. **Item 23 Score Variance, Diagnostic Thinking Inventory** (n=251)

	Non-Diagnosing		**Diagnosing**	
Score	**n**	**%**	**n**	**%**
1	3	2.3	0	0
2	8	6.3	1	0.8
3	20	15.6	10	8.0
4	37	28.9	24	19.2
5	43	33.6	61	48.8
6	17	13.3	27	21.6

Ten respondents commented on item 32, "when I order laboratory tests," that they do not order laboratory tests, only request. Of those 10, 6 indicated that they diagnose nutritional problems. Three respondents answered to both strategies on item 32. Three respondents wrote that they keep "copious notes" rather than keep track of information in their mind for item 34. Comments on item 1 and 41 regarding use of patient's terms versus translation into medical or nutritional terms, 4 respondents wrote that they focus on meaning the patient attaches to the term, rather than the translation into nutritional terminology.

In summary, two groups of clinical dietitians practicing in renal nutrition were differentiated based upon scores achieved on diagnostic thinking inventory and indication that they formally diagnosed nutritional problems.

Research Question 3: What are the underlying cognitive dimensions of the diagnostic thinking inventory?

A two-factor solution on diagnosing respondents initially explored whether Bordage, Grant & Marsden's (1990) two theoretical subscales were viable in the domain of clinical dietetics (Table 35). Only 37% (36.4%) of the variance was accounted for by the two factors with each factor containing a mixture of the two theoretical subscales. Using greater than 0.30 as a salient loading (Kline, 1996), Factor 1 contained 13 items from the flexibility sub-scale and 11 from the structure sub-scale. Factor 2 contained 3 flexibility items and 10 structure items. Twelve items loaded on both factors, when factor loadings were rounded up to 0.30. Thus the 2 pre-determined sub-scales were not validated in this population.

As described earlier, all diagnostic thinking inventories were analyzed, regardless of diagnostic orientation. Five factors were extracted and orthogonally rotated, although only 3 were retained.

Next, a principal factors analysis with orthogonal rotation of 142 diagnosing respondents was conducted using the same eigenvalue of greater than 1.0 and factor loadings of .30 or greater. A seven-factor solution accounted for only 39.54% of the variance (Table 36 and Figure 5, Scree Plot). Two items did not load on any factor: item #28, "active elimination" and item #38, "patient-dietitian control of interview." Ten items loaded on 2 factors: #3 "early interpretation," #4 "mental-set effect," #7 "general inquiry," #10 "probable diagnostic ideas," #11 "related information," #14 "data interpretation," #18 "reinterpreting new information," #19 "reinterpret existing

Table 35. **Pre-Selected Two Factor Solution to Diagnostic Thinking Inventory**

Item	Scale	Factor 1	Factor 2
1. Abstracting signs & symptoms	S		*.39*
2. Prioritization	F		
3. Early interpretation	F		
4. Mental-set effect	F	*.51*	
5. Responsive to patient	F	*.45*	.26
6. Decode patient information	S		*.43*
7. General inquiry	S		*.42*
8. Forceful features	S	*.34*	.29
9. Clarification	F	*.44*	
10. Probable diagnostic ideas	S	*.44*	*.49*
11. Related information	S	*.42*	*.58*
12. Diagnostic error	F		
13. Irrelevant information	F		*.35*
14. Data interpretation	F		
15. Related diagnostic ideas	S	*.30*	.29
16. Anticipate clinical information	S	*.42*	
17. Little knowledge	S	.28	*.38*
18. Reinterpret with new information	S	*.57*	
19. Reinterpret existing information	F	*.52*	
20. Clarify ambiguities	F		
21. Specific inquiry	S		*.36*
22. Recall information	F	*.60*	
23. Confidence in judgement	F	*.52*	*.49*
24. Compare and contrast diagnosis	F		
25. Summarize as go along	F	*.34*	
26. Responsive to interpretation	F		
27. Specific diagnostic formulations	S	*.34*	*.56*
28. Active elimination	F	*-.35*	
29. Reverse judgement	F	*.49*	
30. Diagnose whole case	S	*.53*	
31. Cognitive restructure	F	*.52*	.28
32. Anticipate lab information	S		
33. Postpone judgement	F	*.45*	
34. Recall previous information	S	.26	*.39*
35. Dispersed knowledge	S	*.54*	.28
36. Elaborated knowledge	S	*.42*	
37. Consider all information	S	*.30*	*.42*
38. Patient-RD control	F	*.34*	
39. Compare clinical information	F	*.34*	
40. Complete inquiry	F		*.51*
41. Opposing formulations	S		
Eigenvalues		5.01	3.36
Percent Total Variance		25.1	11.3

information," #23 "confidence in judgement" and #39 "compare clinical information."

Two items loaded on 3 factors: #2 and #27, "prioritization" and "specific diagnostic formulations," respectively. Factor structures were determined based upon unique factor loadings.

Coefficient alpha again was calculated for each factor using items with factor loading of .30 or greater (item statistics in Appendix F). Items with factor loadings greater than 0.30 on factors 6 and 7 did not correspond with items remaining in the factor space when calculating Cronbach's alpha.

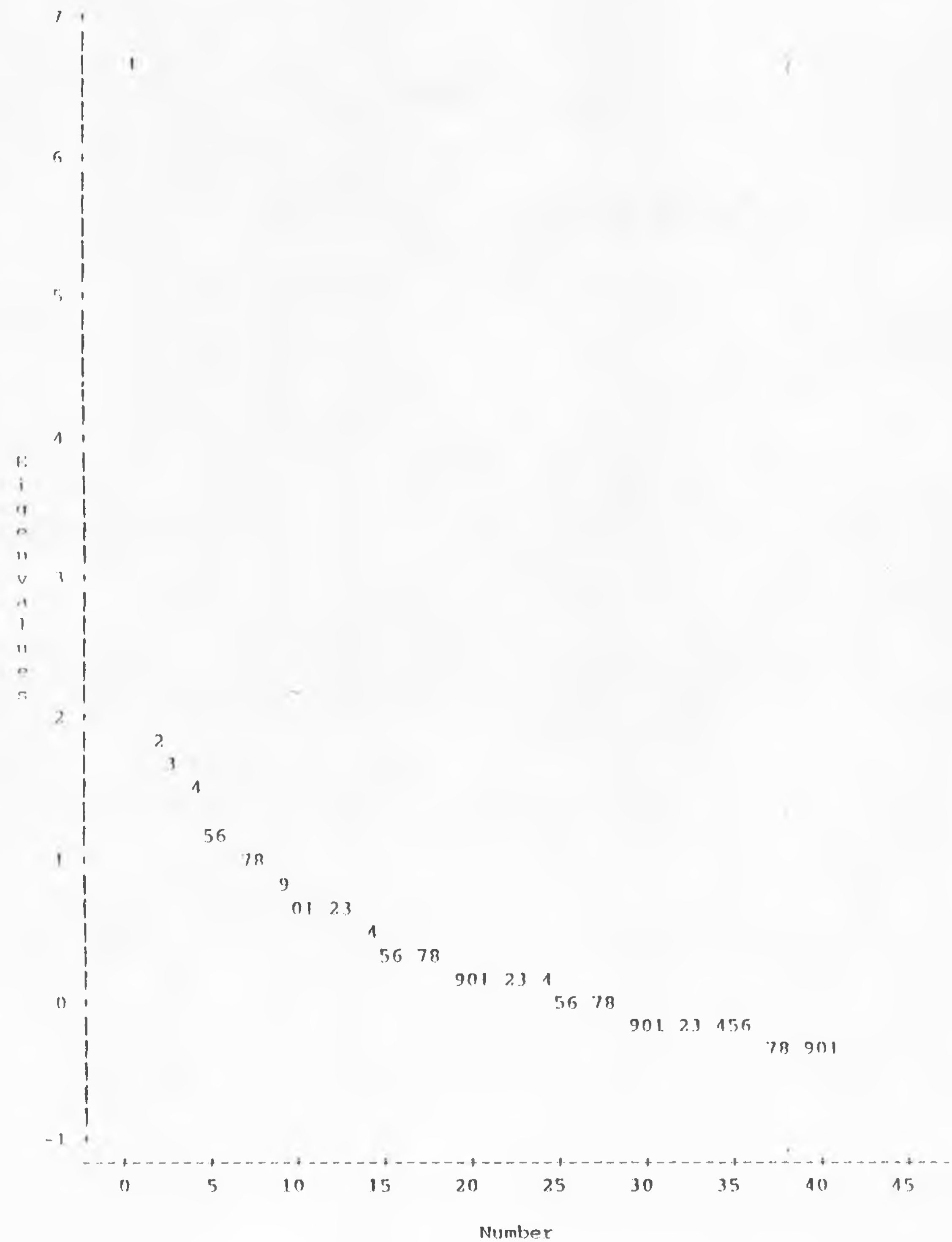
Promax nonorthogonal rotation of factors extracted from all respondents and diagnosing respondents was also conducted to verify appropriate factor structure and orthogonal nature of factors (Tables 37 and 38, Appendix E). Inter-factor correlations matrix revealed negative correlations of each factor with at least one other extracted factor indicating that the appropriate rotation for the data was orthogonal (Tables 39 & 40, Appendix E).

Each factor extracted from diagnosing respondents was labeled. The 3 factors extracted from non-diagnosing respondents were also labeled. Interpretation of the factor structures is found in Chapter 5. Factor descriptions follow.

Table 36. **Results of Principal Factor Analysis, Varimax Rotation, on Diagnosing Respondents; Factor Loading Values (> .30), Eigenvalues, Percent Explained Variance and Coefficient Alpha (n=140)**

Items **Factors**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Abstracting s/s					.66		
2. Prioritization	.37				-.32	.33	
3. Early interpretation			-.39	.44			
4. Mental-set effect			.47				.33
5. Responsive to patient		.42	.35				
6. Decode patient information					.70		
7. General inquiry		.50		.34			
8. Forceful features	.57						
9. Clarification							-.38
10.Probable diagnostic ideas	.38	.53					
11.Related information	.42	.59					
12.Diagnostic error							-.37
13.Irrelevant information			-.43				
14.Data interpretation				.31	.32		
15.Related diagnostic ideas	.48						
16.Anticipate clinical information	.53						
17.Little knowledge				.49			
18.Reinterpret new information	.40		.44				
19.Reinterpret existing information	.36			.39			
20.Clarify ambiguities						.40	
21.Specific inquiry		.46					
22.Recall information	.67						
23.Confidence in judgement	.48	.51					
24.Compare & contrast diagnoses						.52	
25.Summarize as go along							.45
26.Responsive to interpretation							.33
27.Specific diagnostic formulation	.41	.35		.41			
28.Active elimination							
29.Reverse judgement							.50
30.Diagnose whole case	.53						
31.Cognitive restructuring			.43				
32.Anticipate lab information						.36	
33.Postpone judgement			.51				
34.Recall previous information		.52					
35.Dispersed knowledge	.57						
36.Elaborated knowledge			.42				
37.Consider all information		.48					
38.Patient-RD control							
39.Compare clinical information			.33	.31			
40.Complete inquiry		.68					
41.Opposing formulations				.33			
Eigenvalue	3.81	3.38	2.31	1.62	1.55	1.28	1.26
Percent Variance	14.5	11.4	5.3	2.6	2.4	1.6	1.6
Coefficient alpha	0.78	0.70	0.48	0.39	0.56		

Figure 5. **Principal Factors Analysis of Diagnosing Respondents Only: Scree Plot of Eigenvalues**



Factor 1 of diagnosing respondents was labeled "convergence" or "forward-reasoning" (Table 41).

Table 41. **Factor 1 Extracted From Diagnosing Respondents: "Convergence" Coefficient Alpha = 0.78** (n=140)

Item	Descriptor	Factor Loadings
22	Recall information	0.67261
35	Dispersed knowledge	0.57311
8	Forceful features	0.56555
16	Anticipate clinical information	0.53011
30	Diagnose based on whole case	0.52520
15	Related diagnostic ideas	0.47963

Factor 2 was labeled "thoroughness" (Table 42) with coefficient alpha of 0.70.

Table 42. **Factor 2 Extracted From Diagnosing Respondents: "Thoroughness" Coefficient Alpha = 0.70** (n=140)

Item	Descriptor	Factor Loadings
40	Complete inquiry	0.68094
10	Probable diagnostic ideas	0.53071
34	Recall previous information	0.52445
37	Consider all information	0.48052
21	Specific inquiry	0.46319

Factor 3 was labeled "cognitive restructuring" (Table 43) with coefficient alpha of 0.48.

Table 43 . **Factor 3 Extracted From Diagnosing Respondents: "Cognitive Restructuring," Coefficient Alpha = 0.48** (n=140)

Item	Descriptor	Factor Loadings
33	Postpone judgement	0.51121
31	Cognitive restructure	0.42704
36	Elaborated knowledge	0.42014

Factor 4 was labeled "knowledge" (Table 44) with coefficient alpha of 0.39.

Table 44. **Factor 4 Extracted From Diagnosing Respondents: "Knowledge" Coefficient Alpha = 0.39** (n=140)

Item	Descriptor	Factor Loadings
17	Little or no knowledge	0.49279
41	Opposing formulations	0.32529

Factor 5 was labeled "abstraction" (Table 45) with coefficient alpha of 0.56

Table 45. **Factor 5 Extracted From Diagnosing Respondents: "Abstraction" Coefficient Alpha = 0.56** (n=140)

Item	Descriptor	Factor Loadings
6	Decode patient information	0.70299
1	Abstracting signs and symptoms	0.66398

Factor 6 was labeled "relevance" (Table 46).

Table 46. **Factor 6 Extracted From Diagnosing Respondents: "Relevance"** (n=140)

Item	Descriptor	Factor Loadings
24	Compare and contrast diagnoses	0.52380
20	Clarify ambiguities	0.40038
32	Anticipate laboratory information	0.36499

Factor 7 was labeled "constraints" (Table 47).

Table 47. **Factor 7 Extracted From Diagnosing Respondents: "Constraints"** (n=140)

Item	Descriptor	Factor Loadings
29	Reverse judgement	0.50330
25	Summarize as go along	0.45484
26	Responsive to interpretation	0.32644
12	Diagnostic error	-0.36750
9	Clarification	-0.37770

The 3 factors extracted from all respondents are contained in Tables 48-50 with item descriptors and factor loadings. Factor 1 extracted from all respondents "thoroughness" (Table 48) is similar to Table 42.

Table 48. **Factor 1 Extracted From All Respondents: "Thoroughness" Coefficient Alpha 0.84 "(n=246)**

Item	Descriptor	Factor Loadings
40	Complete inquiry	0.62970
7	General inquiry	0.56947
37	Consider all information	0.55590
27	Specific diagnostic formulations	0.52844
34	Recall previous information	0.47561
21	Specific inquiry	0.46929

Factor 2 extracted from all respondents' data is similar to Factor 3 "cognitive restructuring" from diagnosing respondents (Table 43).

Table 49. **Factor 2 Extracted From All Respondents: "Cognitive Restructuring" Coefficient Alpha = 0.84** (n=246)

Item	Descriptor	Factor Loadings
22	Recall information	0.62411
18	Reinterpret with new information	0.61929
19	Reinterpret existing information	0.50012
16	Anticipate clinical information	0.49921
30	Diagnose case as a whole	0.48557
29	Reverse judgement	0.48223
36	Elaborated knowledge	0.45472
38	Patient-RD control of interview	0.38997
33	Postpone judgement	0.37800
25	Summarize as go along	0.35883

Factor 3 "abstraction" extracted from all respondents is similar to Table 45.

Table 50. **Factor 3 Extracted From All Respondents: "Abstraction"**
Coefficient Alpha 0.55 (n=246)

Item	Descriptor	Factor Loadings
6	Decode patient information	0.59149
1	Abstracting signs and symptoms	0.56974
41	Opposing formulations	0.41385
26	Responsive to interpretation	0.33348
14	Data interpretation	0.30664

In summary, factors extracted from diagnosing respondents indicated existence of cognitive subscales embedded in the diagnostic thinking inventory. Similar items loaded on factors extracted from all respondents. Only the first 2 factors from each group demonstrated acceptable correlations and internal consistency. The remaining factors in the diagnosing group and factor 3 in all respondents will be labeled.

Because significant differences were found between diagnosing and non-diagnosing respondents based upon diagnostic scores, the factor structure extracted from diagnosing respondents will be retained as most valid to explain cognitive structures underlying the diagnostic thinking inventory although a low percentage of variance was explained.

Research Question 4: Which study variables best explain highest diagnostic scores of renal dietitians?

Descriptive analysis of motivational variables was conducted prior to selecting variables to explain highest diagnostic scores obtained on the Diagnostic Thinking Inventory.

Flow. Although 78 respondents (28.6%) reported an absence of the flow experience, 175 (64%) respondents recognized at least one quotation. Seven and

4/10% did not respond to the question. Csikszentmihalyi's (1985) research with adult American workers yields a higher recognition of flow (86.7%) while research with retired Korean elderly (Han, 1988) indicated less frequent flow (33%). Of the 297 total reports of the flow experience in this study, 35.5% of the responses were to quotation A, 47.6% to quotation B (A and B describe the merger of action and consciousness) and 25.6% to quotation C (describing centering of attention). Approximately 11% indicated that they had experienced all three quotations (Table 51).

Rather than describe their experience, several respondents indicated they had experienced a specific quotation in a specific role. Both quotations B and C were selected for the role of author, all three quotations for clinician, manager and reflective thinking; A and B for diagnostic work and preceptor, B only for creator-developer and C only for researcher. Frequencies are displayed in Table 52.

As most respondents indicated their major role was clinician, flow was found to be experienced most often in the clinician role (n=148, 54.2%), but also frequently as creator/developer (n=32, 11.7%), during diagnostic work (n=41, 15%) and the activity of reflective thinking (n=52, 19%) (Table 51). Few experienced flow working with The American Dietetic Association (n=9, 3.3%).

Table 51. **Frequency of Flow** (n = 273)

Quotation	**n (%)**	**Frequency**	**n (%)**
Quotation A	97 (35.5)	0 quotations selected	93 (34.1)
Quotation B	130 (47.6)	1 quotation	95 (34.8)
Quotation C	70 (25.6)	2 quotations	56 (20.5)
Zero Flow	78 (28.6)	3 quotations	29 (10.6)

Frequency of Flow by Role or Activity	**n (%)**
Clinician	148 (54.2)
Reflective thinking	52 (19.0)
Diagnostic work	41 (15.0)
Creator/Developer	32 (11.7)
Manager	30 (11.0)
Preceptor	27 (9.9)
Other	26 (9.5)
Researcher	19 (7.0)
Author	12 (4.4)
ADA Participation	9 (3.3)

Table 52. **Specified Flow Experience by Role or Activity**

Role or Activity	**Frequency in Raw Scores**		
	A	B	C
Author		1	1
Clinician	2	4	1
Creator/Developer		2	
Diagnostic work	3	1	
Manager	1	1	1
Preceptor	4	1	
Reflective thinking	3	2	1
Researcher			1

<u>Second-order Environments.</u> Second-order environments or expert sub-cultures provided significant motivation, support and role models for 172 (64.4%) respondents. Ranked in order of greatest frequency: Council on Renal Nutrition, American Dietetic Association, interdisciplinary team participation, medical nutrition

patient rounds and "others" (Table 53). "Other" groups specified by the respondents were the National Kidney Foundation, groups of registered dietitians, and other organizations such as American Diabetes Association and groups of co-workers (see entire list in Table 54, Appendix E).

Table 53. **Expert Subculture Participation by Frequency** (n = 267)

Expert Subcultures	**n (%)**
Council on Renal Nutrition	119 (43.6)
American Dietetic Association	100 (36.6)
Interdisciplinary team participation	95 (34.8)
Medical nutrition patient rounds	49 (17.9)
"Other"	33 (12.1)
Public speaking with critique	18 (6.6)
Collaborative research	17 (6.2)
Authoring peer-reviewed journal articles	7 (2.6)
Group facilitator	4 (1.5)

Explanation of highest diagnostic scores. Step-wise regression of the entire group revealed four variables predictive of highest scores on the diagnostic thinking inventory: (a) use of medical diagnostic codes (ICD 9, 10), (b) involvement in the domain of dietetics through the professional behaviors of writing, presentations and research, (c) experience with flow and (d) years of renal experience (Table 55). Number of roles in which flow was experienced was the second variable extracted, but was then removed when experience of flow via selection of one or more narratives was added.

Table 55. **Summary of Step-Wise Procedure for Dependent Variable, Mean Diagnostic Item Score, Significant at $P = 0.05$—All Respondents**

Variable	n	Order	R^2	F
Medical Diagnostic Codes	246	1	0.1002	27.2843
# Roles Experiencing Flow		2	0.1430	12.1923
Professional Behaviors		3	0.1736	8.9866
Flow		4	0.1855	3.5439
# Roles Experiencing Flow—removed		3	0.1791	1.9208
Years of Renal Experience		4	0.1889	2.9518
Total Variance Explained			*0.1889*	

A second step-wise regression on diagnosing respondents revealed similar predictive variables: (a) use of medical diagnostic codes, (b) professional behaviors, (c) experience with flow although the fourth predictor was years of experience in dietetics versus years of renal experience (Table 56).

Table 56. **Summary of Step-Wise Procedure for Dependent Variable, Mean Diagnostic Item Score, Significant at $P = 0.05$—Diagnosing Respondents Only**

Variable	n	Order	R^2	F
Medical Diagnostic Codes	106	1	0.1033	12.1022
Professional Behaviors		2	0.1796	9.6707
Flow		3	0.2206	5.4133
Years of Dietetics Experience		4	0.2508	4.1144
Total Variance Explained			*0.2508*	

Use of medical diagnostic codes as the principal predictive variable for high diagnostic scores was unexpected, as dietitians cannot legally use medical diagnostic codes including nutrition-related codes. Thus the decision was made to examine diagnosing dietitians according to diagnostic classification system(s) utilized by running contrasts on the four predictive variables identified in the regression analysis. Group 1 contained respondents using both medical and nutritional diagnostic codes, Group 2 the respondents indicating that they used only the medical diagnostic codes and Group 3 the respondents using only the dietetic-specific nutritional diagnostic codes. Means for the four independent variables are listed below in Table 57.

Table 57. **Mean Scores on Step-Wise Predictive Variables of Diagnosing Respondents Only by Classification System**

Group	n	Mean Dx Item Score	n	Professional Behaviors	n	Flow	n	Years Experience
Both	24	4.4936	24	0.2307	24	0.8333	23	22.3043
Medical (ICDs)	56	4.4822	57	0.1973	57	0.7719	57	20.1930
Nutritional	43	4.2498	44	0.2043	44	0.6591	43	23.6279

Tukey's post-hoc analyses of the 3 diagnostic groups (Tables 58-59) revealed differences in contrasts between the group using only nutritional diagnostic codes, medical codes or both classification systems. The group using only nutritional diagnostic codes had the lowest mean item total on the diagnostic thinking inventory contrasted with the other two groups.

Contrasts of the predictive variables of professional behaviors and experience with flow were not significant. Contrasts between groups on years of experience indicated a significant difference between the use of medical versus nutritional diagnostic codes (Table 59) in that the group using only nutritional codes was more experienced than the group using only medical diagnostic codes.

Table 58. **Summary of Post-Hoc Comparisons (Tukey) of Mean Diagnostic Scores Between Respondents Using Medical, Nutritional and Both Diagnostic Classification Systems**

Source	**Degrees of Freedom**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**P**
Between Groups	2	1.5566	0.7783	5.37	0.0058
Within Groups	120	17.3945	0.14495		
Corrected Total	122	18.9512			

Contrast	**Classification System**	**Difference Between Means**	
1	Both – Medical	0.01139	NS
2	Both – Nutritional	0.24373*	
3	Medical – Nutritional	0.23234*	

NS = Not significant
* Significant at the 0.05 level

Table 59. **Summary of Post-Hoc Comparisons (Tukey) of Years of Experience Between Respondents Using Medical, Nutritional and Both Diagnostic Classification Systems**

Source	**Degrees of Freedom**	**Sum of Squares**	**Mean Squares**	**F Ratio**	**P**
Between Groups	2	296.7108	148.3554	3.23	0.0429
Within Groups	120	5505.7933	45.8816		
Corrected Total	122	5802.5041			

Contrast	**Classification System**	**Difference Between Means**	
1	Both – Medical	2.111	NS
2	Both – Nutritional	1.324	NS
3	Medical – Nutritional	3.435*	

NS = Not significant
* significant at the 0.05 level

Next, members of each diagnostic group were individually examined for participation levels by each regression variable. Many of the respondents did not experience flow, list professional behaviors, practice in renal, complete the diagnostic thinking inventory or a combination of the above. Thus screens were instituted using a modified format of the 1991 Role Delineation Study, inclusion criteria were (a) that respondents must have completed the diagnostic thinking inventory, (b) indicated minimal experience with flow (choice of one quotation and/or one role), (c) listed involvement in the domain of dietetics by choosing at least one instance of writing, research and/or professional presentations and (d) currently practicing in renal. Respondents with missing data on any of those variables were excluded in that screen. Description of missing data by criteria is described in Table 60.

Table 60. **Summary of Missing Data by Regression Variable and Diagnostic Group**

Variable	**Both** n=24	**Medical** n=57	**Nutritional** n=44
Missing Data			
Diagnostic Score	0	1	1
Flow	4	14	13
Professional Behaviors	3	7	5
Flow & Behaviors	2	2	4
Current Renal Practice	0	3	2
Completed surveys: n =	15	30	19

Post-hoc analysis contrasted each group again on each of the 4 regression variables (Table 61). Group assignment was based upon use of diagnostic classification systems: (a) both medical and nutritional diagnostic codes, (b) use of only medical diagnostic codes and (c) use of only nutritional diagnostic codes. Significant differences were noted in the contrast between the group using nutritional diagnostic codes only when contrasted against the group using both classification systems on total diagnostic scores (Table 62).

Table 61. **Mean Scores on Step-Wise Predictive Variables of Screened Diagnosing Respondents by Classification System**

Group	n	Mean Dx Total Score	Professional Behaviors	Flow	Renal Experience*
Both	15	185.7	0.2882	2.7333	5.87
Medical (ICDs)	30	181.2	0.2392	2.5667	5.13
Nutritional	19	173.2	0.2493	2.3158	5.53

*5 = coded for 7-9 years

Table 62. **Summary of Post-Hoc Comparisons (Tukey) of Total Diagnostic Scores Between Respondents Using Medical, Nutritional and Both Diagnostic Classification Systems**

Source	Degrees of Freedom	Sum of Squares	Mean Squares	F Ratio	P
Between Groups	2	1424.74	712.37	4.506	0.015
Within Groups	61	9644.26	158.10		
Corrected Total	63	11069.00			

Contrast	Classification System	Difference Between Means	
1	Both – Medical	4.533	NS
2	Both – Nutritional	12.575*	
3	Medical – Nutritional	8.042	NS

* significant at $P = 0.05$
NS = Not significant

Means and percentages of the remaining study variables were calculated to describe the three diagnostic groups (Tables 63 to 64).

In summary, use of medical diagnostic codes, higher number of professional behaviors, experience of flow and greater number of years of experience either in dietetics or renal nutrition were the variables predictive of the highest diagnostic scores in this study. Level of education was not predictive although a greater number of respondents using only medical diagnostic codes had master's degrees than the other 2 groups. This finding is consistent with the 1991 Role Delineation Study which identified the lack of a master's degree as the primary reason renal dietitian specialists did not pass through all the screens in the advanced-level practice model (Bradley et al, 1992). Additionally, the group using only nutritional diagnostic codes experienced flow more frequently than the other two groups.

Table 63. **Comparison of Diagnostic Classification Systems by Selected Study Variables**

		Means (Modes)		
Study Variable	**Study Mean**	**Both** n=15	**Medical** n=30	**Nutritional** n=19
Years Renal Experience*	4.65	5.87 (6)	5.13 (4)	5.53 (8)
Total hours/week	36.47	37.33 (40)	37.67 (40)	41.32 (40)
Total hours renal/week	23.94	31.27 (40)	27.17 (40)	30.42 (40)
Total case load†	1.76	2.07	1.62	1.70
Renal case load†	1.23	1.64	1.27	1.35
Roles	0.22	0.30	0.34	0.28
Contacts	1.94	1.97	1.96	1.76

* 4 = 3 to 6 years, 5 = 7 to 9 years, 6 = 10 to 14 years, 8 = greater than 20 years
† 1 = 50 to 100 patients, 2 = 101 to 150 patients, 3 = 151 to 200 patients

Table 64. **Comparisons of Diagnostic Groups by Study Variable Percentages**

Variable	**Both** n=15	*Percentages* **Medical** n=30	**Nutritional** n=19
Education			
Bachelor's Degree	53.3%	40.0%	63.2%
Working on Masters	6.7	3.3	5.3
Masters Degree	40.0	50.0	36.8
Working on PhD	0	6.7	0
Route to Registration			
Internship	60.0	40.0	63.2
CUP	0	23.3	15.8
Experience	20.0	26.7	10.5
AP4	6.7	0	0
Other	13.3	10.0	21.1
Other Demographics			
Involved in other practice groups	53.3	43.3	63.2
Certified Renal Specialist	20.0	20.0	31.6
Member of CRN	86.7	73.3	78.9
Honors/Awards	53.3	43.3	31.6
Deliberate practice experience	13.3	36.7	5.3
Would like the experience	46.7	43.3	57.9
Motivational Variables			
Flow experience A	53.3	53.3	52.6
B	73.3	73.3	84.2
C	53.3	26.7	52.6
All 3 flow experiences	33.3	10.0	31.6
2 of 3 flow experiences	20.0	33.3	10.5
Expert sub-cultures	80.0	66.7	73.7

Research Question 5: How do renal dietitians with the highest diagnostic scores compare with The American Dietetic Association's advanced-level dietetics practice model on the demographic measures of experience, education, professional roles, responsibilities, contacts and behaviors?

Characteristics of the highest level of this study, diagnosing dietitians using both medical and nutritional classification systems, were compared with characteristics of the model of advanced-level practice as follows:

1. Education and experience. A master's degree and at least 8 year's experience were validated by 1991 Role Delineation Study (Bradley et al). Highest level of this study had a greater percentage of clinicians holding bachelors degrees, at least 8 years of renal experience and 21 years' experience in dietetics.
2. Professional achievement. The 1991 Role Delineation study validated at least one professional achievement. In this study, professional achievements were labeled "professional behaviors" and were predictive of the highest diagnostic scores. Mean number of professional behaviors of the highest level in this study was 2.5.
3. Approach to practice. This characteristic was not addressed by this study.
4. Multiplicity of role positions. The 1991 Role Delineation study validated multiplicity of role positions that were complex and diverse. The highest level in this study performed in at least 2 role positions, all but one indicating clinician role as the major role.
5. Multiplicity of professional role contacts. This was validated by Bradley et al (1992) as a rich network of contacts, which were professionally and geographically diverse. The highest level of this study demonstrated a multiplicity of individual contacts but not committee/organizational

contacts. Based upon Proposition 2, respondents of this study would not be classified as advanced-level due to frequency of contact with a single social level—patients. Geographic locations were not examined.

Summary

This chapter presented sample characteristics, data analysis procedures and results by the corresponding research question. There was a statistically significant difference between dietitians who formally diagnose nutritional problems and those not diagnosing. To predict highest diagnostic scores, step-wise multiple regression revealed four variables significant at p=0.05: use of medical diagnostic codes, experience with flow, professional behaviors and years of experience. Post-hoc analysis of 3 groups of dietitians separated by use of medical codes, nutritional codes or both classification systems and contrasted on the 4 regression variables, indicated that those using only nutritional diagnostic codes scored lower on the diagnostic thinking inventory than the other two groups and were more experienced in dietetics than those using medical diagnostic codes.

CHAPTER 5

DISCUSSION

The purposes of this study were to (a) examine diagnosis of nutritional problems as a representative task of clinical dietitians practicing in renal nutrition, (b) to differentiate levels of practice performance based upon scores obtained on the diagnostic thinking inventory, and (c) to define clinical nutrition expert status in renal nutrition. This chápter will discuss the purposes of the study through an examination of the research questions. A synthesis of the findings as related to the conceptual elements will precede implications for clinical dietetics practice and recommendations for future research.

Research Question 1: Professional Characteristics of the Sample

Professional characteristics addressed by this question were gender, experience, deliberate practice, work setting and caseload.

Gender and Experience

Female respondents (99.6%) were highly experienced in dietetics (mean 21.4 years) and renal (40% had practiced in renal 10 years or longer). Compared with a recent survey of the entire population of 1,800+ renal dietitians in the United States (Franco & Harem, 1998), a smaller percentage of the 548 respondents were as experienced in renal (31.7% had 11 years or more renal experience) although total dietetics experience was not documented. Thus this study appears to be composed of a more experienced subset of the renal nutritionist population with 40% of the sample meeting the initial "10-year necessary preparation" criterion which is prerequisite to the development of expertise (Ericsson, 1996).

Non-responders to the survey must be considered at this point. The only criteria for membership in the renal practice group are registration by The American Dietetic Association and payment of a minimal annual membership fee ($20). Respondents to the survey stated various reasons for membership—they were specialists in renal, had a personal or professional interest in kidney disease, desired information, enjoyed the newsletter and acknowledged the networking potential. It cannot be assumed that non-respondents would list similar or entirely different reasons, were more or less experienced, or more or less interested or skilled in diagnostic thinking. Therefore, the findings of the study cannot be generalized to the entire renal practice group membership, or to the entire membership of The American Dietetic Association.

<u>Deliberate Practice</u>

Although the criterion of years was met, the qualitative aspect of experience must be considered. Ericsson & Smith (1991) stated that the amount of time required to acquire knowledge is estimated to be around 3,000 hours, multiplied by 10 in order to organize knowledge sufficiently to perform at the international level. However, the number of hours is secondary to the quality of *practice*.

Practice was first proposed by Chase & Simon (1973) and later by Ericsson (Ericsson & Smith, 1991: Ericsson, Krampe & Tesch-Römer, 1993; Ericsson, 1996) as the major independent variable in the acquisition of skill, with performance monotonically related to the amount of time spent in deliberate practice. Deliberate practice was defined as goal-directed, rigorous practice with immediate feedback from a mentor or coach.

It has been estimated that only 2-4 hours per day can be spent in intense deliberate practice (Ericsson, Krampe & Tesch-Römer, 1993). To calculate, 2-4 hours a day times 5 days a week multiplied by 50 weeks a year times 10 years equals 5,000-10,000 hours in deliberate practice if the individual has consciously chosen to practice in that manner and has secured the assistance of a mentor/coach. This would be sufficient time to acquire knowledge according to Ericsson, but insufficient time to organize knowledge to perform internationally.

Only 14.5% of the respondents in this study reported deliberate practice experience and only 8.4% more than one time. Ten respondents described ongoing professional work development experiences with verbal, written and peer reviews which has potential for deliberate practice structure. Two respondents described numerous grant applications, collaborative research projects and publishing in professional journals, in other words, an ongoing process. Therefore, the majority of those experiencing deliberate practice did not appear to have repeated exposures—10 during graduate work with thesis, 3 during internships or traineeships (training), 3 at entry-level and 2 requested one-time mentoring for specific skill improvement. Although Abbot (1988) estimates that only 5% in any domain will reach expert status, there did not appear to be a concerted effort to consistently *practice* in the manner leading to international-level or expert performance.

Work Setting and Caseload

Work setting and caseload may create more or less time to engage in deliberate practice. Kelly et al (1987) concluded that 30+ dietitian minutes per dialysis patient per week correlated with decreased patient hospitalizations. Thirty minutes per patient per week (or a caseload of 80 patients) would allow sufficient time for in-depth assessment and examination, presenting opportunities for deliberate practice. Thirty-five percent of the sample indicated that their renal caseload equaled 50 patients or less. Providing that the total caseload is less than 80 patients, sufficient time is available to engage in deliberate practice. However, this may not be the reality in a hospital-based dialysis unit as two respondents wrote that they did not have sufficient time to cover even the routine history.

In summary, the sample represented dietitians with sufficient experience to develop expertise. The quality of the experience cannot be determined although 8.4% of the sample reported deliberate practice experience more than one time. As Abbott (1988) estimates that 5% of a domain are experts, a pool of potential experts may exist.

Research Question 2: Differentiation by Diagnostic Scores

At least a portion of the diagnostic thinking inventory was completed by 81.6% of the respondents, with 145 (56.9%) respondents indicating that they diagnose nutritional problems. The remainder answered the diagnostic thinking inventory according to individual problem–solving strategies. Statistically significant differences between the two groups exist, however, it is not known how clinically significant the difference between a score of 171 and a score of 177 is in terms of clinical problem-solving. The responses are based upon perceptions of the way respondents conduct clinical interviews, not direct observations or think-aloud protocols.

Written comments indicate that qualitative differences in information processing strategies may exist among dietitians and between dietitians and physicians. As scoring of the inventory items was based upon research with physicians, qualitative differences among dietitians may be masked. Additionally, goals directing the clinical interview are different for physicians than for and dietitians which directs strategies used.

In summary, two groups of dietitians were differentiated based upon diagnostic scores although qualitative differences between the identified groups were not explored in this study.

<u>Research Question 3:</u> Cognitive Dimensions of Diagnostic Thinking Inventory

Theoretical linkages between the diagnostic thinking inventory and expert characteristics were detailed in Chapter 2, Table 1. The theoretical linkages were partially supported by the factor structures although Cronbach's alpha was acceptable for only the first two factors. Factor 1 "convergence" contained three of the theoretically-linked items: #16 "anticipate clinical information," #27 "specific diagnostic formulations," and #35 "dispersed knowledge." As Bordage, Gale and Marsden (1990) explain their model, recognition of a forceful feature (item 8) keys into a particular memory structure (items 15 and 22) which in turn dictates the interpretations(s). The diagnosis would be based upon the entire case (item 30).

Factor 2 "thoroughness" contained four theoretically-linked items: #7 "general inquiry," #34 "recall previous information," #37 "consider all information" and #40 "complete inquiry." Additional items support a thorough inquiry, i.e., working interpretations (items 10 and 11), responsive to patient (item 5), concentrating upon a specific interpretation (item 21) and confidence (item 23).

Factor 3 "cognitive restructuring" contained three theoretically-linked items: # 4 "mental-set effect," the shift occurring after recognition of a new forceful feature, #18 "reinterpret with new information" and #31 "cognitive restructure." Reconfiguring information would also require a postponement of judgment (item 33) and elaborated knowledge (item 36), richly organized with abstract properties (Ibid.).

Factor 5 "abstraction" contained two theoretically-linked items: #1 "abstracting signs and symptoms" and #6 "decode patient information." The remaining factors did not support the theoretical linkages. Although it appears that cognitive processing structures were supported as the underlying dimension of the diagnostic thinking inventory, the variance explained by the factor structures was lower than recommended for a good fit to the model.

Sub-scale assignment suggested by the extracted factors (Table 65) includes only unique items for each potential sub-scale. A larger sample size is recommended to determine stronger, unambiguous loadings and to be able to generalize to all dietitians.

Table 65. **Potential Sub-scales Extracted from the Diagnostic Thinking Inventory**

"Convergence"

Item	**Descriptor**
8	Forceful features
15	Related diagnostic ideas
16	Anticipate clinical information
22	Recall information
30	Diagnose based on whole case
35	Dispersed knowledge

"Thoroughness"

Item	**Descriptor**
10	Probable diagnostic ideas
21	Specific inquiry
34	Recall previous information
37	Consider all information
40	Complete inquiry

"Cognitive Restructuring"

Item	**Descriptor**
31	Cognitive restructure
33	Postpone judgement
36	Elaborated knowledge

"Knowledge"

Item	**Descriptor**
17	Little or no knowledge
41	Opposing formulations

"Abstraction"

Item	**Descriptor**
1	Abstracting signs & symptoms
6	Decode patient information

In summary, potential underlying cognitive structures were identified with factor analysis and 5 potential sub-scales were identified although the explained variance in the factor structures was too low to validate the cognitive structures embedded in the diagnostic thinking inventory.

Additionally, the diagnostic thinking inventory items violated rigorous item construction methods by containing double-barreled statements. Intervals between the semantic differential anchors were not labeled and thus responses were not directly interpretable. Qualitative research with dietitians could identify levels of meaning that dietitians assigned to the semantic structures in the existing inventory (Bordage, Grant and Marsden, 1990) and provide a rich data base of semantic structures for dietetic-specific instruments.

Research Question 4: Variables Predicting Diagnostic Scores

Of the four variables predictive of highest diagnostic scores, use of medical diagnostic codes, experience with flow and professional behaviors are discussed under this question. Experience was discussed under research question 1.

Medical Diagnostic Codes

A majority of the diagnosing respondents (n=82, 56.6%) indicated that they used medical diagnostic codes. Two indications for use or non-use were: (a) "Medical diagnostic codes are used on the Medicare billing records, but more specific coding is not done. There is no billing based on nutrition diagnosis." And, (b) medical diagnostic codes are used "unofficially since NOT legally accepted in my state."

Brief telephone interviews were conducted with a convenience sample of 4 respondents (telephone numbers were readily available) to ask how they "used" medical diagnostic codes. Three indicated that they use medical codes primarily for billing purposes. For example in order to receive third-party reimbursement, a medical diagnostic code is required on the billing requisition for laboratory tests, office visits and counseling appointments. Physician-assigned medical diagnoses were indicated for primary morbidity in order to receive reimbursement for medical-nutrition therapy intervention or treatment. One respondent stated that nutrition-related medical codes were listed as co-morbidities.

One stated that she occasionally "made" a medical diagnosis, three that the medical codes were used along with the clinical reasoning process—one sharpened her clinical reasoning process by considering either an appropriate complimentary medical or nutritional diagnosis to the one proffered by the physician during hospital rounds while one began her clinical reasoning process by recognizing the nutritional indicators in the medical diagnostic codes.

The study question asked which diagnostic classification system(s) was "used" versus asking if the respondents were "making" a diagnosis. "Use" is defined by Webster's (1982) as "to apply for a given purpose" while "making" is defined as "to bring into being." Application of medical diagnostic codes for the purpose of reimbursement would constitute a "use", but would not be considered shaping or constructing a diagnosis through clinical reasoning skills. Two are teaching the clinical reasoning process to student dietitians.

Nutritional diagnostic codes were used in assessments and charting the nutritional problems although not for reimbursement by the sample of four.

Flow

At least one quotation of the flow experience was recognized by 64% of the respondents. One respondent appeared to have captured the essence of flow as a clinician,

> Typically I feel this way as I gather data from the patient, the medical record, lab and pharmacy reports, reading from articles and textbooks and try to fit all the pieces together into identification of pertinent nutrition problems and development of appropriate care plans. I am more likely to develop this focus when assessing high acuity patients with multiple nutritional issues.

Another respondent writes,

> I can get totally involved and sustain that involvement until I get "the first squeeze" out writing, or my first thought about what is happening nutritionally. If this heightened awareness continues for a long period

> of time (i.e., over the life of a grant), I sometimes need to take a break to get new perspectives.

These responses also appear to capture the elements of challenge and skills (Csikszentmihalyi, 1985)--as multiple nutritional problems indicate a complex challenge requiring a high level of skill. Descriptions of activities eliciting flow were categorized and are listed in Appendix F with taxonomies of flow responses according to apparent understanding of the concept.

Professional Behaviors

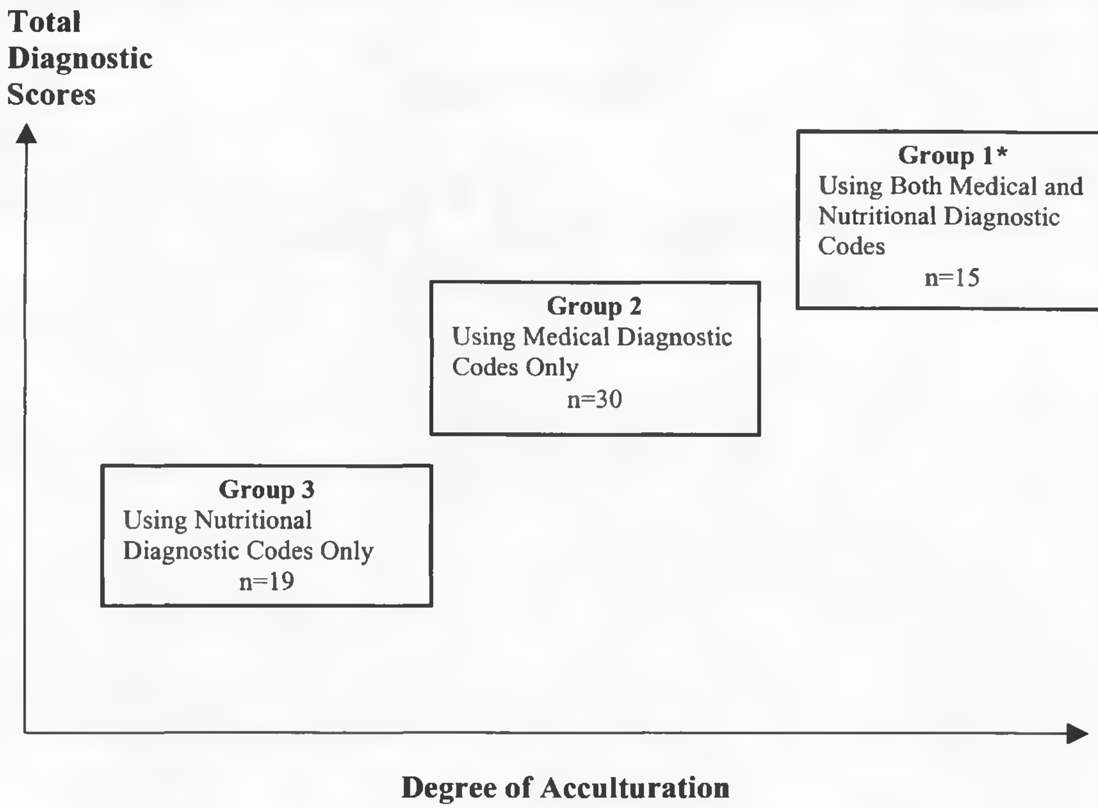
Involvement in the profession through professional presentations, publications and research was a predictor of highest diagnostic scores in this study as well as being validated as a component of advanced-level practice in the Role Delineation Study (Bradley et al, 1990).

Synthesis

Figure 6 places the three groups of respondents screened by diagnostic classification system into the acculturation model of Forcier and Kight (1977) and Thomson, Kight and Longstreth (1990). The dependent variable, diagnostic scores, is placed on the y-axis, with degree of acculturation on the x-axis.

Use of both classification systems appears to enhance diagnostic ability. The nutritional implication of the medical diagnosis of "macrocytic anemia" would be folate deficiency, a possible nutritional diagnostic statement would be, "Altered body composition related to macrocytic anemia."

Figure 6. **Differentiated Levels of Diagnostic Thinking in Renal Dietitians** (n=64)



* Significant differences based on contrasts between diagnostic scores and experience at $p=0.05$.

To summarize, four variables predicted highest diagnostic scores: use of medical diagnostic codes, flow, professional behaviors and experience. Further screening to exclude respondents with missing data on one or more of those variables and grouping respondents by classification systems utilized revealed significant differences between those using both medical and nutritional diagnostic codes and those using only nutritional codes in contrasts between total diagnostic scores and experience. The group using both classification systems was assigned the highest level in this study.

However, it is not known if either medical or nutritional diagnostic codes are being "used" or applied or if cognitive processes are accessed to "make" a diagnosis. Written indications from a small number of respondents indicate that medical codes are being applied for reimbursement. Telephone interviews revealed clinical reasoning processes in dietitians.

Research Question 5: Descriptive Comparison with Advanced-Level Practice Model

This question was discussed in depth in Chapter 4. To summarize group 1, which used both medical and nutritional diagnostic codes, was compared with the characteristics of the advanced-level practice model validated by the 1991 Role Delineation Study.

1. Education and experience. The highest level in this study was less educated with 60% holding bachelors' degrees (versus master's degree) and more experienced in dietetics (21 years versus 8 years).
2. Professional achievements was one predictor of highest diagnostic scores in this study.
3. Approach to practice was not discussed.
4. Multiplicity of role positions. a) Respondents held at least 2 role positions with the major role in clinical (82%). The advanced-level practice model proposed that increased management participation indicated advanced practice. This study theorized that immersing oneself in clinical reasoning or information processing was necessary to develop expertise. b) As increased status is awarded those further away from the "front lines" of

patient care (Abbott, 1988), the Role Delineation Study validated a model emphasizing *status* over *performance.* The expertise research approach has been, and is, intensely focused on cognitive processing, the relationships of knowledge structures in long-term memory of experts as inferred through observations of behavior and analyzed in think-aloud and recall protocols. In other words, expertise research is concerned about *performance,* not *status*.

Synthesis

Conceptual elements addressed by this study are discussed in this section. Antecedents were identified as experience and education. Experience was identified as one predictor of highest diagnostic scores. Entry-level educational requirements were met with bachelor's degrees and registration. In the groups screened by diagnostic classification system, a higher percentage of respondents with master's degrees and doctorates used medical diagnostic codes only, another predictor of highest diagnostic scores.

Flow, another predictor of highest diagnostic scores, appeared to be experienced at all levels of practice. Deliberate practice was identified by only a small percentage of respondents, although by a high percentage of those using only medical diagnostic codes. A greater percentage of the group using both medical and nutritional codes revealed support and motivation from second-order environments compared with the other two groups. Nutrition knowledge was not examined, although it was inferred through attainment of educational degrees, certification, registration route and experience.

Strength of associations between conceptual elements of the model was not calculated as the purposes of this study were to explore the various conceptual elements.

Implications

One finding of this study indicates that a high percentage of renal dietitians formally diagnose nutritional problems. Although this process is not included in curriculums in undergraduate programs or internships, it may be an example of "workplace assimilation" (Abbott, 1988) in that co-workers assimilate information from other disciplines, in this instance assimilating physicians' diagnostic strategies and language. Or many may have attended workshops on diagnostic thinking and nutritional diagnostic charting.

However, written comments on the pilot-test before this study indicated that dietitians may have incorporated more educational and counseling strategies into their diagnostic thinking processes and that an inventory developed in medicine may not be totally relevant to dietitians. Dietitians appear to use strategies such as "active listening' more readily than physicians. For example item 20 reads, "When the patient uses imprecise or ambiguous expressions, I let him/her go on to maintain the flow of the interview," or "I make the patient clarify precisely what is meant before going on." The second response is the preferred answer based upon physician strategies.

However using counseling techniques, the first choice may be more appropriate. One respondent commented that vital information may be lost if the patient is interrupted.

Several levels of practice performance are suggested for renal nutrition practice based upon cognitive processes inherent in diagnostic thinking. However written competency examinations test only formal, crystallized knowledge, not the fluid cognitive processing structures which access the rich networks of informal knowledge utilized in diagnostic thinking.

Flow appears to be an integral part of the dietetics work environment and may be the vehicle to motivate expertise development if the workplace and domain could be restructured to promote expert careers. Bereiter & Scardamalia's (1993) work could direct educators and dietetics professionals in this endeavor.

Another implication is that mentors willing and capable of structuring deliberate practice activities in dietetics be identified, their expertise documented as the beginning of an expert database in clinical dietetics.

Recommendations for Future Research

1. Qualitative analysis of diagnostic thinking processes, either analysis of think-aloud protocols with case studies or written responses to case studies with varying levels of difficulties. Subjects could be selected from the three groups identified in this study using structural semantic analysis based upon Bordage and Lemieux (1987; 1991; Lemieux & Bordage, 1992) as an external validation of the differentiated levels.

2. Redesign the diagnostic thinking inventory for use with dietitians. Ask dietitians identified as the highest level in this study to participate in think-aloud analyses of the diagnostic thinking inventory items using Bordage's (Ibid.) structural semantic analysis protocol.
3. Compare physician and dietitian thinking patterns. Articulate similarities and differences. An abundance of literature is available documenting physician diagnostic thinking processes, but the goals of the clinical interviews differ when conducted by physician or dietitian. Articulation of both processes would illustrate the complimentary nature of classification systems and interviewing processes and ultimately lead to more holistic patient care.
4. Assess flow experience in clinical dietetics using the Experience Sampling Method of Csikszentmihalyi.
5. Examine deliberate practice activities in clinical dietetics as promoting expertise development.

Summary

A large number of renal dietitians report that they diagnose nutritional problems. A pool of potential experts was identified using diagnosis as a representative task. Underlying cognitive structures were revealed in the diagnostic thinking inventory although it is recommended that inventory items be revised to more accurately reflect dietitians' thinking patterns. Clinical nutrition expert does appear to be related to selected professional, diagnostic, knowledge and motivational variables, although future studies are recommended to clarify the relationships.

APPENDIX A

COVER LETTER AND PILOT TEST QUESTIONNAIRE

Department of Nutritional Sciences
The University of Arizona
Tucson, Arizona

P.O. Box 40936
Tucson, Arizona 85717

June 19, 1997

Dear Fellow Dietitian,

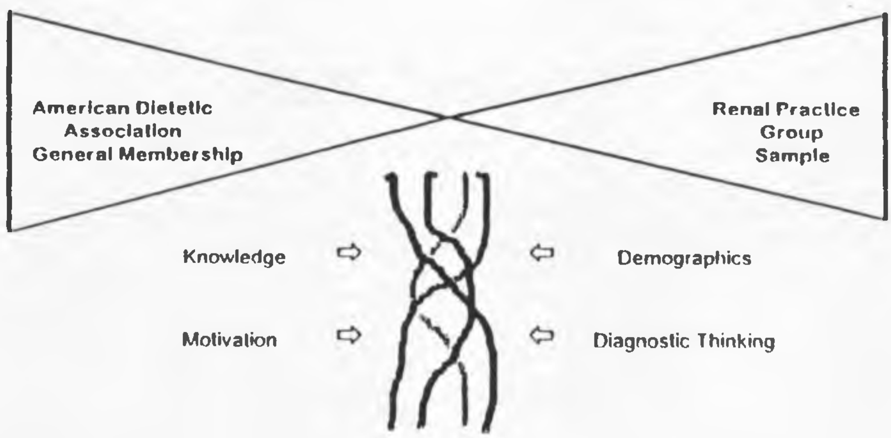
I am examining one aspect of advanced-level practice--specifically, attempting to measure selected thinking patterns of renal dietitians. This study is in partial fulfillment of the requirements for the Ph.D. in Nutritional Sciences form The University of Arizona under the research direction of Dr. Mary Ann Kight and Dr. Pamela Reed.

I have enclosed a questionnaire asking about your dietetics' experience, education and perceptions about how frequently you use certain thinking patterns to solve nutritional problems. There are no right or wrong answers and you are under no obligation to participate. However, I would certainly appreciate your input.

Our profession, like other health care professions, is undergoing tremendous change. Therefore, now is the time to measure what our status is relevant to being THE CLINICAL NUTRITION EXPERTS.

Sincerely,

Ronna Biesecker, MS, RD
Doctoral Candidate
Renal Nutritionist, Desert Dialysis Center



Clinical Nutrition Expert Status
Professional Performance Survey

▲ This survey is being conducted in partial fulfillment of the requirements for a Ph.D. in Nutritional Sciences at The University of Arizona.

▲ You have been selected to participate in this survey as a representative member of The American Dietetic Association. Participation in this survey is completely voluntary; completion and return of the survey signifies your consent to participate.

▲ Your response is important to assist in the development of a model for clinical practice.

▲ If you are not employed in dietetic practice in any capacity, there is no need to complete the survey. Simply blacken the circle below and return the survey in the postpaid envelope. It is important that we have a reply from everyone.

▲ Employment is defined as working any number of hours per month. Dietetic practice includes clinical, administration, education and research.

◯ I am not currently employed in dietetics.
(Please return in the postpaid envelope.)

GENERAL INSTRUCTIONS

1. Use a # 2 pencil to complete this survey. Blacken the circle for the alternative that best represents your professional practice in dietetics. Responses will be confidential and will not affect your job in any way. Where you are invited to write your responses, please write or print legibly.

2. Please answer all questions unless instructed otherwise.

3. "Specialty" or "area of specialization" refers to an area of practice within dietetics that has a substantial and verifiable knowledge base, an identified dimension of advanced practice, and reasonable pool of practitioners (ADA). Two specialty areas of dietetic practice offer credentialing: pediatric and renal.

4. This survey is designed to compare data with the 1991 Role Delineation Study, so you may recognize some questions. Please answer questions as you currently practice dietetics. Section 1 asks about your current practice and/or specialization, about professional roles and actions, about professional achievements and activities; Section 2 asks about how you reason when encountering nutrition problems; Section 3 about types of experiences.

5. This survey should take you less than 40 minutes to complete. Some sections may require more time for thought than others. Please allow that time in order to answer as accurately as possible. When you are finished, **please return by September 15, 1997** in the postpaid envelope.

6. Should you have any questions at all, feel free to call me at the following numbers.

Work 1-800-327-0007 (in Arizona only)

Work 1-520-327-0007 (outside Arizona)

Home 1-520-327-6893 (early mornings, evenings or weekends)

This research is supported in part by a grant from the Fairchild-Kight Endowment Fund.

Section 1

Below are a few questions about your current position in dietetics. Please answer all of the questions.

1. **Are you currently employed in dietetics practice? Dietetic practice may include administration, education, or research as well as direct client care and service.** (*Employment* is defined as working any number of hours per month.)

) NO Do not answer any of the following questions. Please return the questionnaire in the postpaid envelope.

) YES

2. **How many years have you practiced as a dietitian?** Do not count any time when you were not working as a dietitian in terms of the definition of dietetic practice given in question 1.

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

   ------Write the number of years in the boxes

   ------Then fill in the matching circle for each box

3. **How many years have you practiced as a renal nutritionist?** (Blacken one)

) Do not practice in renal

) Less than 6 months

) 6 months - 11 months

) 12 months - 35 months

) 3 years - 6 years

) 7 years - 9 years

) 10 years - 14 years

) 15 years - 19 years

) 20 years or more

4. **What is your area of specialization, if not renal?** Please specify below

5. **Total number of hours in a typical week that you practice dietetics—all areas, primary and specialty** (if you have an area of specialization)

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

   -----Write the number of hours in the boxes

   -----Then fill in the matching circle for each box

6. **Total number of hours in a typical week that you practice as a renal nutritionist.**

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

   ----Write the number of of hours in the boxes

   ----Then fill in the matching circle for each box

7. **Are you a certified renal nutrition specialist?**

) NO

) YES

8. Are you a member of other ADA Practice Groups?

) NO

) YES (specify)

9. **Are you a member of the Council on Renal Nutrition?**

) NO

) YES

Professional practice in dietetics can be divided into a number of more-or-less distinct professional roles. Each of these involves somewhat different responsibilities, relationships and activities.

1. **For the professional roles listed, which have you performed in your work as a dietitian <u>in the last 12 months?</u>**
(Blacken the circles for <u>all the role/s applicable</u>).

( ) 1 Clinician (in-patient, out-patient, consultant, etc.)
( ) 2 Supervisor (of staff, NO budget authority)
( ) 3 Manager (of staff AND budget authority)
( ) 4 Teacher (classroom)
( ) 5 Preceptor (clinical)
( ) 6 Researcher (any capacity)
( ) 7 Consultant (to agencies/organizations/businesses/etc.)
( ) 8 Advisor (to colleagues and other professionals)
( ) 9 Referee (recommendations for students/colleagues)
( ) 10 Presenter (to professional/public conferences)
( ) 11 Evaluator (of research protocol, articles for publication, dietetic services/programs)
( ) 12 Author (of peer-reviewed journal articles, books)
( ) 13 Writer (of newsletter, in-house publications, etc.)
( ) 14 Creator/Developer of New Dietetic Services or Programs
( ) 15 Office Holder in ADA (National Level)
( ) 16 Office Holder in ADA (State Level)
( ) 17 Office Holder in ADA (Local/District Level)
( ) 18 Committee Member (of job-related committee/s)
( ) 19 Committee Member in ADA (National Level)
( ) 20 Committee Member in ADA (State Level)
( ) 21 Committee Member in ADA (Local/District Level)
( ) 22 Member of other professional associations (CRN, NKF, etc.)
( ) 23 Committee Member (of other professional association committee/s)
( ) 24 Other (specify)

11. **Of the roles you marked in Question13, blacken the <u>ONE</u> in which you spent the <u>majority of time</u> during the <u>past 12 months.</u>**

0	0
1	1
2	2
	3
	4
	5
	6
	7
	8
	9

----Write the role number in the boxes.
----Then fill in the matching circle for each box

---

12. **Indicate how frequently you have had contact with the INDIVIDUALS/COMMITTEES/ORGANIZATIONS listed below <u>in the past 12 months</u> while performing your professional roles.** (*Contact* is defined as providing care, working with, working for, supervising/managing, seeking or offering advice or teaching.)

INDIVIDUALS	Frequency of Contact (Blacken <u>one</u> for each line)				
	No Contact	Less than Monthly	Monthly	Weekly	Daily
Patients/Clients	0	0	0	0	0
RD Colleagues	0	0	0	0	0
Other Health Professionals	0	0	0	0	0
Non-Health Professionals	0	0	0	0	0
Staff	0	0	0	0	0
Management	0	0	0	0	0
Students/Interns	0	0	0	0	0
Volunteers	0	0	0	0	0

COMMITTEES/ ORGANIZATIONS	Frequency of Contact (Blacken <u>one</u> for each line)				
	No Contact	Less Than Monthly	Monthly	Weekly	Daily
Job-related Department	0	0	0	0	0
Institutional	0	0	0	0	0
Businesses	0	0	0	0	0
ADA Committees	0	0	0	0	0
Government—State/National	0	0	0	0	
Media	0	0	0	0	0
Volunteers	0	0	0	0	0

13. **What is the highest degree you have or are working toward? (Blacken one)**
O Bachelor's degree
O Working on master's degree
O Master's degree
O Working on doctoral degree
O Doctoral degree

14. **Have you received professional awards and/or honors during your career?**
O No
O Yes (specify title/s and year/s awarded):

15. **Have you been involved in any of the following activities during your career?**

Authored Peer Reviewed Journal Articles:
O No
O Yes (indicate number): O 1-3 O 4-9 O 10-19 O 20 or more

Authored Book Chapters:
O No
O Yes (indicate number): O 1-3 O 4-9 O 10 or more

Authored Books:
O No
O Yes (indicate number): O 1-3 O 4-9 O 10 or more

Editor of Professional Journals:
O No
O Yes (indicate number): O 1-3 O 4-9 O 10-19 O 20 or more

Editor of Books (conceptualizing, soliciting and reviewing a collection of works):
O No
O Yes (indicate number): O 1-3 O 4-9 O 10 or more

16. **Have you made any professional presentations during the last three years?**

Invited Presentations (being asked to, preparing and then making the presentation):
O No
O Yes (indicate number): O 1 O 2-3 O 4 or more

Conference Presentations (submitting an abstract, being accepted and then making the presentation):
O No
O Yes (indicate number): O 1 O 2-3 O 4 or more

17. **In what capacity have you been involved in research during your career?** (Blacken all that apply)
O Not involved
O Principal investigator (indicate number): O 1 O 2-3 O 4 or more
O Co-investigator (indicate number): O 1 O 2-3 O 4 or more
O Contributing to (indicate number): O 1 O 2-3 O 4 or more

18. **Have you ever intentionally enlisted the assistance of a teacher/mentor/coach in order to improve your dietetics work performance? This experience must include all of the following:**
    a) **initial evaluation of your performance by your mentor/teacher**
    b) **immediate feedback detailing strategies for making changes in your performance**
    c) **hours of practice perfecting the changes in your performance.**

    Examples: intense graduate work, but not continuing education;
    work experience with verbal and written reviews, then technique revision;
    piano lessons, competitive skating or swimming (non-dietetic examples)

    O NO
    O YES

    If YES, how frequently have you had this experience?
    (indicate number): O 1 O 2-3 O 4 or more

Please describe your experience(s):

____

____

____

____

____

____

____

Section 2

This section contains items concerning clinical reasoning/diagnostic thinking patterns used to solve nutrition problems of individuals in your work as a clinical dietitian. (*Diagnosis* is defined as the identification and classification of nutrition problems/disorders.) Blacken the circle to indicate your response.

<u>If you do not work as a clinical dietitian, blacken the circle and skip to Section 3</u>.)

A. Do you diagnose nutrition problems?
-) NO
-) YES

B. If YES, which classification/coding system do you use? (Blacken <u>all</u> that apply.)
-) Medical Diagnostic Codes: ICD 9/10 CMs
-) Nursing Diagnostic Categories
-) Dietetic-Specific Nutritional Diagnostic Codes

This inventory contains 40 items concerning your diagnostic thinking patterns. Each item contains a stem, two accompanying statements plus a rating scale. THE SCALE REFERS TO A CONTINUUM BETWEEN THE TWO STATEMENTS. <u>Please place an X in the space between the markers</u> which best describes your perceptions of your diagnostic patterns. There is no right or wrong answer. Simply respond as spontaneously as you can.

1. When the patient presents symptoms,

I think of the symptoms in the precise words used by the patient..	|___|___|___|___|___|___|	I think of the symptoms in more abstract terms than actually used. ("high blood pressure" becomes "hypertension").

2. In considering each nutritional diagnosis,

I try to evaluate their relative importance.	|___|___|___|___|___|___|	I try to give them equal importance and weighting.

3. In thinking of diagnostic possibilities,

I think of diagnostic possibilities early in the case.	|___|___|___|___|___|___|	I collect the clinical information before I think about a diagnosis.

4. When I interview a patient,

I often seem to get one idea stuck in my mind.	|___|___|___|___|___|___|	I usually find it easy to explore various possible nutrition diagnoses.

5. Throughout the Interview,

If I follow the patient's line of thought, I tend to lose my own thread.	|___|___|___|___|___|___|	I can still keep my own ideas clear if I follow the patient's line of thought

6. Once the patient has clearly presented signs and symptoms,

I think about them in my mind in the patient's own words.	|___|___|___|___|___|___|	I translate them in my mind into more Abstract terms ("sore tongue" becomes "glossitis")

7. Concerning the routine history,

I often feel that I did not sufficiently cover the routine history.	|___|___|___|___|___|___|	I usually cover the routine history to my satisfaction.

8. During the course of an interview,

I find that some key pieces of information leap out at me.	|___|___|___|___|___|___|	It is often difficult to know which items of information to latch onto.

9. **When I cannot make sense of the patient's symptoms,**

I gather new information to trigger new ideas.	└─┴─┴─┴─┴─┴─┘	I ask the patient to define those symptoms more clearly.

10. **As I consider diagnostic possibilities,**

I often come up with unlikely diagnoses.	└─┴─┴─┴─┴─┴─┘	I am usually in the right area.

11. **While I am collecting information about a patient,**

The various items of information usually group themselves together in my mind.	└─┴─┴─┴─┴─┴─┘	I often have difficulty understanding how the pieces of information relate to each other.

12. **When I realize I missed the nutrition diagnosis initially,**

It is often because I knew the nutrition disorder but failed to think of it.	└─┴─┴─┴─┴─┴─┘	It is often because I did not know enough about the nutrition disorder.

13. **During the clinical interview,**

I cannot bring myself to dismiss some information as irrelevant.	└─┴─┴─┴─┴─┴─┘	I am quite happy to dismiss some information as irrelevant.

14. **When I cannot make sense of the patient's symptoms and signs,**

I move on to get new information to get a new perspective.	└─┴─┴─┴─┴─┴─┘	I look at the symptoms and signs from a different perspective before moving on.

15. **When I consider a number of possible nutritional diagnoses,**

The diagnoses tend to be related to one another.	└─┴─┴─┴─┴─┴─┘	The diagnoses tend to be scattered.

16. **When a possible diagnosis comes into my mind,**

I usually find myself anticipating possible abnormal signs and symptoms that go with that diagnosis.	└─┴─┴─┴─┴─┴─┘	It rarely helps me to decide what to ask the patient next

17. **When I know very little about a particular type of disorder,**

I can usually come up with a diagnosis.	└─┴─┴─┴─┴─┴─┘	I have great difficulty reaching a diagnosis.

18. **As the history progresses and I have some ideas about the possible diagnosis(es),**

New information often makes me have more ideas.	└─┴─┴─┴─┴─┴─┘	New information does not often make me have more ideas

19. **When I am taking a history, I find that,**

I can get new ideas just by going over the existing information in my mind.	└─┴─┴─┴─┴─┴─┘	I need to have new information to make me have a new idea about the case.

20. **When the patient uses imprecise or ambiguous expressions,**

I let him/her go on to maintain the flow of the interview	└─┴─┴─┴─┴─┴─┘	I make the patient clarify precisely what is meant before going on.

21. **After an interview with a patient,**

I rarely think of other things that I should have asked in relation to the patient's disorder.	└─┴─┴─┴─┴─┴─┘	I often think of other things that I should have asked in relation to the disorder.

22. **When I think of a possible nutritional diagnosis due to a new piece of information,**

It often makes me go back to previous information to see if things fit together.	L__l__l__l__l__l__J	It rarely makes me review the information that I gathered previously.

23. **Concerning the diagnosis I eventually make,**

I usually have very few doubts.	L__l__l__l__l__l__J	I often feel uncomfortable about my decision.

24. **In making a diagnostic decision,**

I consider each possible diagnosis separately on its own merits.	L__l__l__l__l__l__J	I compare and contrast the various possible diagnoses.

25. **As the case unfolds,**

I do not find it useful to summarize as I go along.	L__l__l__l__l__l__J	I periodically take stock of the data and my ideas.

26. **When I have an idea about what might be wrong with the patient,**

I feel most comfortable if I can follow it up without being diverted.	L__l__l__l__l__l__J	I can easily work on something else before coming back to my original idea.

27. **When I have a broad idea as to what might be wrong with the patient,**

I can usually proceed to a specific diagnosis.	L__l__l__l__l__l__J	I find it difficult to proceed to a specific diagnosis.

28. **In choosing from among the diagnostic ideas that I have,**

I am not capable of ruling out many of the ideas that I have.	L__l__l__l__l__l__J	I am capable of ruling out most of my ideas completely.

29. **Once I have made up my mind about a patient,**

I am prepared to change my mind.	L__l__l__l__l__l__J	I really do not like to change my mind

30. **When I consider my diagnostic ideas, I do so on the basis of,**

The case as a whole so far.	L__l__l__l__l__l__J	A few outstanding symptoms or signs

31. **If I cannot make sense of a clinical interview,**

I can readily see the information in new ways.	L__l__l__l__l__l__J	I find it difficult to see the information in new ways.

32. **When I order laboratory tests,**

I do it as a part of the routine clinical investigation.	L__l__l__l__l__l__J	I do it expecting specific information.

33. **When I am making up my mind about a diagnosis,**

I do not mind postponing my decisions about a case.	L__l__l__l__l__l__J	I feel obliged to go for a decision even if I am not very certain

34. **As the patient story and case unfolds,**

I often find it difficult to remember what has been said.	L__l__l__l__l__l__J	I can usually keep track in my mind what has been said

35. **When I have to make a diagnosis about a nutrition disorder that I am very familiar with,**

I find it relatively easy to pin down a diagnosis.	L__l__l__l__l__l__J	I often seem to be all over the place concerning the diagnosis.

36. When I have to make a diagnosis about a nutrition disorder that I am very familiar with,

I check up on most possibilities before reaching a decision.	|___|___|___|___|___|___|	I often have many ideas that I don't explore further.

37. When I reach my diagnostic decision,

There is often left-over information that I have forgotten.	|___|___|___|___|___|___|	I usually have considered all the information.

38. Throughout the interview,

I test my ideas even if the patient controls the interview.	|___|___|___|___|___|___|	I am successful only if I control the direction of the interview.

39. In considering possibilities in the case,

I compare and contrast the possible diagnoses.	|___|___|___|___|___|___|	I consider each diagnosis separately on it's own merit.

40. In terms of how I conduct an interview,

I usually cover all the necessary ground during the interview.	|___|___|___|___|___|___|	Often I do not ask all the necessary questions during the interview.

Section 3

Please read the following three narratives describing the experience of *flow*.

A. *My mind isn't wandering. I am not thinking of something else. I am totally involved in what I am doing. My body feels good. I don't seem to hear anything. The world seems to be cut off from me. I am less aware of myself. I am oblivious to time.*

B. *My concentration is like breathing. I never think of it. I am really quite oblivious to my surroundings after I really get going. When I start, I really do shut out the whole world. Once I stop, I can let it back in again.*

C. *I am so involved in what I am doing. I don't see myself as separate from what I am doing.*

1. **During my work as a dietitian, I have experienced the above in the past 12 months (blacken all that apply):**
) A) B) C) None. (If none, skip to question 3)

2. **If you experienced A, B or C during your work as a dietitian the last 12 months, blacken the circle beside the roles/tasks that in which you were involved, describe the experience and explain what you believe caused the experience of flow to occur. Choose all that apply.**

Example:) **During diagnostic work**—*diagnosing riboflavin deficiency by recognizing magenta tongue.*

( ) a. Clinician ______________________________
( ) b. Manager ______________________________
( ) c. Preceptor ______________________________
( ) d. Researcher ______________________________
( ) e. Author ______________________________
( ) f. Creator/Developer ______________________________
( ) g. ADA participation ______________________________
( ) h. During diagnostic work ______________________________
( ) i. Reflective thinking/theorizing ______________________________
( ) j. Other, please specify:

____
____
____
____
____
____
____
____

3. **Do you belong to a group/organization which provides all of the following:**
   a) **help and cooperation leading to your professional growth**
   b) **consistent recognition of your successes**
   c) **successful career models?**

) NO
) YES

If YES, please specify types of organizations and/or activities which meet all 3 of the above criteria (Blacken all that apply):

) a. American Dietetic Association
) b. Council on Renal Nutrition
) c. Public speaking with critique
) d. Publish in peer-reviewed journal
) e. Group facilitator with critique
) f. Collaborative research
) g Interdisciplinary medical team participation
) h. Conducting medical/nutrition patient rounds
) i. Others, please specify: ______

Comments

○ Please blacken the circle if you wish to receive study results.

You are welcome to write any additional comments in the space provided below.

Thank you for your assistance. Please return in the enclosed postpaid envelope within two (2) weeks to:.

Ronna Biesecker, MS, RD
P.O. Box 40936
Tucson, Arizona 85717-0936

This section contains items concerning clinical reasoning/diagnostic thinking patterns used to solve nutrition problems of individuals in your work as a clinical dietitian. ("Diagnosis" is defined in clinical dietetics as the identification and classification of nutrition problems/disorders.) Blacken the circle to indicate your response.

If you do not work as a clinical dietitian, blacken the circle and skip to Section 4.)

A. Do you diagnose nutrition problems?
) No
) Yes

B. If yes, which classification/coding system do you use? (Blacken all that apply)
) Medical Diagnostic Codes: ICD-9/10 CMs
) Nursing Diagnostic Categories
) Dietetic-Specific Nutritional Diagnostic Codes

Using the following scale, blacken the circles to indicate how frequently you actually experience the following behaviors, thought or feelings. Please respond as accurately as possible concerning your perceptions of your diagnostic patterns.

NEV = Never (none of the time)
RARE = Rarely (a little of the time, seldom)
INF = Infrequent (some of the time, occasionally)
AL ALW = Almost Always (most of the time)
ALL = All of the time

	NEV	RARE	INF	AL ALW	ALL
1. When the patient presents symptoms,					
I think of the symptoms in the precise words used by the patient.	O	O	O	O	O
I think of the symptoms in more abstract terms than actually used, ("high blood pressure" becomes "hypertension").	O	O	O	O	O
2. In considering each diagnosis,					
I try to evaluate their relative importance.	O	O	O	O	O
I try to give them equal importance or weighting.	O	O	O	O	O
3. In thinking of diagnostic possibilities,					
I think of diagnostic possibilities early in the case.	O	O	O	O	O
I collect the clinical information before I think about a diagnosis.	O	O	O	O	O
4. When I interview a patient,					
I seem to get one idea stuck in my mind.	O	O	O	O	O
I find it easy to explore various possible diagnoses.	O	O	O	O	O
5. Throughout the interview,					
If I follow the patient's line of thought, I tend to lose my own thread.	O	O	O	O	O
I can still keep my own ideas clear if I follow the patient's line of thought.	O	O	O	O	O
6 When it comes to making up my mind about a diagnosis,					
I do not mind postponing my diagnostic decisions about a case.	O	O	O	O	O
I feel obliged to go for one diagnosis or another even if I am not certain.	O	O	O	O	O
7. Once the patient has clearly presented signs and symptoms,					
I think about them in my mind in the patient's own words.	O	O	O	O	O
I translate them in my mind into more abstract terms ("sore tongue" becomes "glossitis").	O	O	O	O	O
8. Concerning the routine history,					
I feel that I did not sufficiently cover the routine history.	O	O	O	O	O
I cover the routine history to my satisfaction.	O	O	O	O	O
9. As the case unfolds,					
I find it difficult to remember what has been said.	O	O	O	O	O
I keep track of what has been said in my mind.	O	O	O	O	O

	NEV	RARE	INF	AL ALW	ALL
10. During the course of the interview,					
I find that some key pieces of information leap out at me.	O	O	O	O	O
It is difficult to know which items of information to keep.	O	O	O	O	O
11. When I cannot make sense of the patient's symptoms,					
I gather new information to trigger new ideas.	O	O	O	O	O
I ask the patient to define those symptoms more clearly.	O	O	O	O	O
12. As I consider diagnostic possibilities,					
I come up with unlikely diagnoses.	O	O	O	O	O
I am in the right area.	O	O	O	O	O
13. While I am collecting information about a patient,					
The various items of information group themselves together in my mind.	O	O	O	O	O
I have difficulty understanding how the pieces of information relate to each other.	O	O	O	O	O
14. When I realize I missed the diagnosis initially,					
It is because I knew the disorder but failed to think of it.	O	O	O	O	O
It is because I did not know enough about the disorder.	O	O	O	O	O
15. During the clinical interview,					
I cannot bring myself to dismiss some information as irrelevant.	O	O	O	O	O
I am quite happy to dismiss some information as irrelevant.	O	O	O	O	O
16. When I cannot make sense of the patient's symptoms and signs,					
I move on to get new information to get a new perspective.	O	O	O	O	O
I look at the information from a different perspective before moving on.	O	O	O	O	O
17. When I consider a number of possible diagnoses,					
The diagnoses tend to be related to one another.	O	O	O	O	O
The diagnoses tend to be scattered.	O	O	O	O	O
18. When a possible diagnosis comes into my mind,					
I find myself anticipating possible abnormal signs and symptoms that go with that diagnosis.	O	O	O	O	O
It does not help me to decide what to ask the patient next.	O	O	O	O	O
19. When I know very little about a particular type of disorder,					
I can come up with a diagnosis.	O	O	O	O	O
I have great difficulty reaching a diagnosis.	O	O	O	O	O
20. When I consider the patient's signs and symptoms,					
I think of them in absolute terms as stated by the patient.	O	O	O	O	O
I think of them in terms of possible opposites (overhydration vs. dehydration).	O	O	O	O	O
21. When I know a lot about a particular type of disorder and have to make a diagnosis,					
I find it relatively easy to pin down a diagnosis.	O	O	O	O	O
I have difficulty pinning down a diagnosis.	O	O	O	O	O
22. As the history progresses and I have some ideas about the possible diagnosis(es),					
New information makes me have more ideas.	O	O	O	O	O
New information does not make me have more ideas.	O	O	O	O	O
23. When I am taking a history, I find that,					
I can get new ideas just by going over the existing information in my mind	O	O	O	O	O
I need to have new information to make me have a new idea about the case.	O	O	O	O	O
24. When the patient uses imprecise or ambiguous expressions,					
I let him/her go on to maintain the flow of the interview.	O	O	O	O	O
I make the patient clarify precisely what is meant before going on.	O	O	O	O	O
25. After an interview with a patient,					
I think of other things that I should have asked in relation to the patient's disorder.	O	O	O	O	O
I think I gathered all the information I needed.	O	O	O	O	O

	NEV	RARE	INF	AL ALW	ALL
26. When I think of a possible diagnosis due to a new piece of information,					
It makes me go back to previous information to see if things fit together.	O	O	O	O	O
I consider the new information only.	O O	O	O	O	
27. Concerning the diagnosis I eventually make,					
I have very few doubts.	O	O	O	O	O
I feel uncomfortable.	O	O	O	O	O
28. In making a diagnostic decision,					
I decide by considering each possible diagnosis separately on its own merits.	O	O	O	O	O
I decide by comparing and contrasting the various possible diagnoses.	O	O	O	O	O
29. When I know a great deal about a particular disorder and have to make a diagnosis,					
I check up on most possibilities before reaching a decision.	O	O	O	O	O
I have lots of ideas that I don't explore further.	O	O	O	O	O
30. As the case unfolds,					
I do not find it useful to summarize as I go along.	O	O	O	O	O
I periodically take stock of the data and my ideas.	O	O	O	O	O
31. When I reach my diagnostic decisions,					
There is left-over information I have just forgotten.	O O	O	O	O	
I will have considered all the information.	O	O	O	O	O
32. When I have an idea about what might be wrong with the patient,					
I feel most comfortable if I can follow it up without being diverted.	O	O	O	O	O
I can easily work on something else before coming back to my original idea..	O	O	O	O	O
33. When I have a broad idea as to what might be wrong with the patient,					
I can proceed to a specific diagnosis.	O	O	O	O	O
I find it difficult to proceed to a specific diagnosis.	O	O	O	O	O
34. Throughout the interview,					
I manage to test my ideas even if I let the patient control the interview.	O	O	O	O	O
I am only successful if I can control the direction of the interview.	O	O	O	O	O
35. In choosing from among the diagnostic ideas that I have,					
I am not capable of wholly ruling out any of the ideas that I have.	O O	O	O	O	
I am capable of ruling out most of my ideas completely.	O	O	O	O	O
36. Once I have made up my mind about a patient,					
I am prepared to change my mind.	O	O	O	O	O
I really do not like to change my mind.	O	O	O	O	O
37. When I consider my diagnostic ideas, I do so on the basis of,					
The case as a whole so far.	O	O	O	O	O
A few outstanding symptoms or signs.	O	O	O	O	O
38. If I cannot make sense of a clinical interview,					
I can readily see the information in new ways.	O	O	O	O	O
I find it difficult to view the information in new ways.	O	O	O	O	O
39. When I order laboratory tests,					
I do it as a part of the routine clinical investigation.	O	O	O	O	O
I do it expecting specific information.	O	O	O	O	O
40. In terms of the way I conduct an interview,					
I cover the ground that I need to during the interview.	O	O	O	O	O
I do not ask all the questions that I should at the time.	O	O	O	O	O

APPENDIX B

COVER LETTER AND EXPERT STATUS INVENTORY

FIRST MAILING COVER LETTER

P.O. Box 40936
Tucson, Arizona 85717

January 30, 1998

Dear Fellow Dietitian,

For my dissertation research, I am examining one aspect of advanced-level practice--specifically, measuring selected thinking patterns of renal dietitians. This study is in partial fulfillment of the requirements for the Ph.D. in Nutritional Sciences from The University of Arizona under the research direction of Drs. Mary Ann Kight and Pamela Reed.

I have enclosed a questionnaire asking about your dietetics' experience, education and perceptions about how frequently you use certain thinking patterns to solve nutritional problems. There are no right or wrong answers and you are under no obligation to participate. However, I would certainly appreciate your input.

Upon receipt of your completed questionnaire, your name will be placed in a drawing for a one-year membership to your choice of either the ADA Renal Dietetic Practice Group or the Council on Renal Nutrition.

Our profession, like other health care professions, is undergoing tremendous change. Therefore, now is the time to measure what our status is relevant to being THE CLINICAL NUTRITION EXPERTS.

Sincerely,

Ronna Biesecker

Ronna Biesecker, MS, RD
Doctoral Candidate at The University of Arizona and
Renal Nutritionist, Desert Dialysis Center, Tucson, AZ

FOLLOW-UP POST CARD

Dear Registered Dietitian,

Just a reminder that you recently received a survey on Clinical Practice Performance asking for your input regarding your practice, diagnostic thinking patterns, etc. It is very important to have a response from every one.

Please take the time to fill out the survey and return to me in the envelope enclosed with the survey. If you need another copy, just let me know at 520-327-0007 or by mail.

I appreciate your time and response.

Thanks,
Ronna Biesecker, MS, RD, P.O. Box 40936, Tucson, AZ 85717-0936

SECOND MAILING LETTER

P.O. Box 40936
Tucson, Arizona 85717

January 30, 1998

Dear Fellow Dietitian,

For my dissertation research, I am examining one aspect of advanced-level practice--specifically, measuring selected thinking patterns of renal dietitians. This study is in partial fulfillment of the requirements for the Ph.D. in Nutritional Sciences from The University of Arizona under the research direction of Drs. Mary Ann Kight and Pamela Reed.

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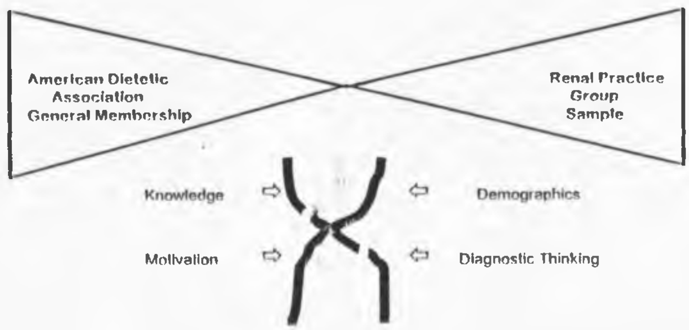
Our profession, like other health care professions, is undergoing tremendous change. Therefore, now is the time to measure what our status is relevant to being THE CLINICAL NUTRITION EXPERTS.

Sincerely,

Ronna Biesecker

Ronna Biesecker, MS, RD
Doctoral Candidate at The University of Arizona and
Renal Nutritionist, Desert Dialysis Center, Tucson, AZ



Clinical Nutrition Expert Status
Professional Performance Survey

- ▲ This survey is being conducted in partial fulfillment of the requirements for a Ph.D. in Nutritional Sciences at The University of Arizona.

- ▲ You have been selected to participate in this survey as a representative member of The American Dietetic Association. Participation in this survey is completely voluntary; completion and return of the survey signifies your consent to participate.

- ▲ Your response is important to assist in the development of an expert status model for clinical practice.

- ▲ If you are not employed in dietetic practice in any capacity, there is no need to complete the survey. Simply blacken the circle below and return the survey in the postpaid envelope. It is important that we have a reply from everyone.

- ▲ Employment is defined as working any number of hours per month. Dietetic practice includes clinical, administration, education and research.

( ) I am not currently employed in dietetics.
(Please return in the postpaid envelope.)

GENERAL INSTRUCTIONS

1. Use a # 2 pencil to complete this survey. Blacken the circle for the alternative that best represents your professional practice in dietetics. Responses will be confidential and will not affect your job in any way. Where you are invited to write your responses, please write or print legibly.

2. Please answer all questions unless instructed otherwise.

3. "Specialty" or "area of specialization" refers to an area of practice within dietetics that has a substantial and verifiable knowledge base, an identified dimension of advanced practice, and reasonable pool of practitioners (ADA). Three specialty areas of dietetic practice offer credentialing: metabolic, pediatric and renal.

4. This survey is designed to compare data with the 1991 Role Delineation Study, so you may recognize some questions. Please answer questions as you currently practice dietetics. Section 1 asks about your *current practice* and/or specialization, about professional *roles and actions*, about professional *achievements and activities*; Section 2 asks about how you *reason* when encountering nutrition problems; Section 3 asks about types of *experiences*.

5. This survey should take you less than 40 minutes to complete. Some sections may require more time for thought than others. Please allow that time in order to answer as accurately as possible. **Please return the questionnaire within 2 weeks** in the enclosed postpaid envelope.

6. Should you have any questions at all, feel free to call me at the following numbers.

Work 1-800-327-0007 (in Arizona only)

Work 1-520-327-0007 (outside Arizona)

Home 1-520-327-6893 (early mornings, evenings or weekends)

7. ***Completion and return of this questionnaire will place your name in a drawing to receive one year's membership to your choice of either the American Dietetic Association's Renal Practice Group or the Council on Renal Nutrition of the National Kidney Foundation.***

This research is supported in part by a grant from the Fairchild-Kight Endowment Fund.

Section 1

Below are a few questions about your current position in dietetics. Please answer ALL of the questions.

1. **Are you currently employed in dietetics practice? Dietetic practice may include administration, education, or research as well as direct client care and service.** (*Employment* is defined as working any number of hours per month.)

( ) NO Do not answer any of the following questions. Please return the questionnaire in the postpaid envelope.

( ) YES

2. **How many years have you practiced as a dietitian?** Do not count any time when you were not working as a dietitian in terms of the definition of dietetic practice given in question 1.

0–9 | 0–9 — Write the number of years in the boxes. Then fill in the matching circle for each box.

3. **How many years have you practiced as a renal nutritionist?** (Blacken one.)

( ) Do not practice in renal
( ) Less than 6 months
( ) 6 months - 11 months
( ) 12 months - 35 months
( ) 3 years - 6 years
( ) 7 years - 9 years
( ) 10 years - 14 years
( ) 15 years - 19 years
( ) 20 years or more

4. **What is your area of specialization, if not renal?** Please specify below

5. **Total number of hours in a typical week that you practice dietetics--all areas, primary and specialty** (if you have an area of specialization)

0–9 | 0–9 — Write the number of hours in the boxes. Then fill in the matching circle for each box.

6. **Total number of hours in a typical week that you practice as a renal nutritionist.**

0–9 | 0–9 — Write the number of hours in the boxes. Then fill in the matching circle for each box.

7. **Are you a member of any ADA practice group other than the Renal Practice Group?**

( ) NO
( ) YES (specify)

8. **Are you a certified renal nutrition specialist?**

( ) NO
( ) YES

9. **Are you a member of the Council on Renal Nutrition?**

( ) NO
( ) YES

10. What is your practice setting? (Blacken ALL that apply)

( ) Hospital ( ) Free Standing Clinic ( ) Physician's Office ( ) HMO ( ) Other

11. What is your total case load? (Number of patients you are responsible for)

( ) Less than 50 ( ) 50-100 ( ) 101-150 ( ) 151-200 ( ) Greater than 200

12. What is your renal case load?

( ) Less than 50 ( ) 50-100 ( ) 101-150 ( ) 151-200 ( ) Greater than 200

Professional practice in dietetics can be divided into a number of more-or-less distinct professional roles. Each of these involves somewhat different responsibilities, relationships and activities.

13. For the professional roles listed, which have you performed in your work as a dietitian in the last 12 months?
(Blacken the circles for ALL the role/s applicable)

( ) 1. Clinician (in patient, out patient, consultant, etc)
( ) 2. Supervisor (of staff, NO budget authority)
( ) 3. Manager (of staff AND budget authority)
( ) 4. Teacher (classroom)
( ) 5. Preceptor (clinical)
( ) 6. Researcher (any capacity)
( ) 7. Consultant (to agencies, organization, businesses, etc.)
( ) 8. Advisor (to colleagues and other professionals)
( ) 9. Referee (recommendations for students/colleagues)
( ) 10. Presenter (to professional/public conferences)
( ) 11. Evaluator (of research protocol, articles for publication, dietetic services/programs)
( ) 12. Author (of peer-reviewed journal articles, books)
( ) 13. Writer (of newsletter, in house publications, etc.)
( ) 14. Creator/Developer of New Dietetic Services or Programs
( ) 15. Office Holder in ADA (National Level)
( ) 16. Office Holder in ADA (State Level)
( ) 17. Office Holder in ADA (Local/District Level)
( ) 18. Committee Member (of job related committee/s)
( ) 19. Committee Member in ADA (National Level)
( ) 20. Committee Member in ADA (State Level)
( ) 21. Committee Member in ADA (Local/District Level)
( ) 22. Member of other professional associations (CRN, NKF, etc.)
( ) 23. Committee Member (of other professional association committee/s)
( ) 24. Other (specify) ______________________________

____

____

14. Of the roles you marked in Question 13, blacken the ONE in which you spent the majority of time during the past 12 months.

0		0
1		1
2		2
3		3
4		4
5		5
6		6
7		7
8		8
9		9

Write the role number in the boxes.

Then fill in the matching circle for each box

15. Indicate how frequently you have had contact with the INDIVIDUALS/COMMITTEES/ORGANIZATIONS listed below in the past 12 months while performing your professional roles. (Contact is defined as providing care, working with, working for, supervising/managing, seeking or offering advice or teaching.)

INDIVIDUALS	Frequency of Contact (Blacken one for each line)				
	No Contact	Less than Monthly	Monthly	Weekly	Daily
Patients/Clients	( )	( )	( )	( )	( )
RD Colleagues	( )	( )	( )	( )	( )
Health Professionals	( )	( )	( )	( )	( )
Non health professionals	( )	( )	( )	( )	( )
Staff	( )	( )	( )	( )	( )
Management	( )	( )	( )	( )	( )
Students/Interns	( )	( )	( )	( )	( )
Residents/ Fellows	( )	( )	( )	( )	( )
Volunteers	( )	( )	( )	( )	( )

COMMITTEES/ ORGANIZATIONS	Frequency of Contact (Blacken one for each line)				
	No Contact	Less than Monthly	Monthly	Weekly	Daily
Job related	( )	( )	( )	( )	( )
Department	( )	( )	( )	( )	( )
Institutional	( )	( )	( )	( )	( )
Government State/National	( )	( )	( )	( )	( )
ADA Committees	( )	( )	( )	( )	( )
Prof Committees	( )	( )	( )	( )	( )
Media	( )	( )	( )	( )	( )
Businesses	( )	( )	( )	( )	( )
Volunteers	( )	( )	( )	( )	( )

16. What is the highest degree you have or are working toward? (Blacken one)

( ) Bachelor's degree
( ) Working on master's degree
( ) Master's degree
( ) Working on doctoral degree
( ) Doctoral degree

17. Are you:

( ) Male
( ) Female

18. Have you received professional awards and/or honors during your career?

( ) NO
( ) YES (specify title/s and year/s awarded):

19. Have you been involved in any of the following activities during your career?

Authored Peer Reviewed Journal Articles:

( ) NO
( ) YES (indicate number): ( ) 1-3 ( ) 4-9 ( ) 10-19 ( ) 20 or more

Authored Book Chapters:

( ) NO
( ) YES (indicate number): ( ) 1-3 ( ) 4-9 ( ) 10 or more

Authored Books:

( ) NO
( ) YES (indicate number): ( ) 1-3 ( ) 4-9 ( ) 10 or more

19. (continued) Have you been involved in any of the following activities during your career?

Editor of Professional Journals:

( ) NO
( ) YES (indicate number) ( ) 1-3 ( ) 4-9 ( ) 10-19 ( ) 20 or more

Editor of Books (conceptualizing, soliciting, and reviewing a collection of works)

( ) NO
( ) YES (indicate number) ( ) 1-3 ( ) 4-9 ( ) 10 or more

20. Have you made any professional presentations during the last three years?

Invited Presentations (being asked to, preparing and then making the presentation)

( ) NO
( ) YES (indicate number) ( ) 1 ( ) 2-3 ( ) 4 or more

Conference Presentations (submitting an abstract, being accepted, and then making the presentation)

( ) NO
( ) YES (indicate number) ( ) 1 ( ) 2-3 ( ) 4 or more

21. In what capacity have you been involved in research during your career? (Blacken all that apply)

( ) Not Involved
( ) Principal Investigator (indicate number): ( ) 1 ( ) 2-3 ( ) 4 or more
( ) Co Investigator (indicate number): ( ) 1 ( ) 2-3 ( ) 4 or more
( ) Contributing to (indicate number): ( ) 1 ( ) 2-3 ( ) 4 or more

22. Have you ever intentionally enlisted the assistance of a teacher/mentor/coach in order to improve your dietetics work performance? This experience MUST include all of the following:

a) initial evaluation of your performance by your mentor/teacher
b) immediate feedback detailing strategies for making changes in your performance
c) hours of practice perfecting the changes in your performance

Examples: Intense graduate work, but not continuing education;
work experience with verbal and written reviews, then technique revision;
grant application, review, and revision.

( ) NO
( ) YES

Please describe your experience(s):

If NO, would you like to have this experience?

( ) NO
( ) YES

If YES, how frequently have you had this experience?

(indicate number) ( ) 1 ( ) 2-3 ( ) 4 or more

23. What was your route of entry into clinical dietetics?

( ) Internship ( ) CUP ( ) Experience
( ) AP4 ( ) Other

Section 2

This section contains items concerning thinking processes/clinical reasoning/diagnostic thinking used to solve nutrition problems of patients/clients in your work as a clinical dietitian. (*Diagnosis* in clinical dietetics means to *distinguish* one nutrition problem from another.) **Blacken the circles to indicate your responses**

If you do not work as a clinical dietitian, blacken the circle and skip to Section 3. ( )

A. **Do you diagnose nutrition problems?**

( ) NO
( ) YES

B. **If YES, which classification/coding system do you use?** (Blacken all that apply.)

( ) Medical Diagnostic Codes: ICD 9/10 CMs
( ) Nursing Diagnostic Categories
( ) Dietetic Specific Nutritional Diagnostic Codes

This inventory contains 41 items concerning your diagnostic thinking patterns. Each item contains a stem, two accompanying statements plus a rating scale. THE SCALE REFERS TO A CONTINUUM BETWEEN THE TWO STATEMENTS. Please blacken the ○ corresponding to your position on the continuum. There is no right or wrong answer. Simply respond as spontaneously as you can.

* * * * * *

IF YOU DO NOT DIAGNOSE NUTRITION PROBLEMS, please mark the answer which best describes how you think when you solve problems. YOU ARE ALSO INVITED to write your pattern or strategy below each question if you find that your pattern/strategy differs from those presented.

* * * * * *

1. **When the patient presents symptoms,**

I think of the symptoms in the precise words used by the patient.	( ) ( ) ( ) ( ) ( ) ( )	I think of the symptoms in more abstract terms than the expressions actually used (e.g., "not eating" becomes "anorexia")

2. **In considering each nutritional diagnosis,**

I try to evaluate their relative importance.	( ) ( ) ( ) ( ) ( ) ( )	I try to give them equal importance or weighting.

3. **In thinking of diagnostic possibilities,**

I think of diagnostic possibilities early in the case.	( ) ( ) ( ) ( ) ( ) ( )	I collect the clinical information before I think about possible diagnoses.

4. **When I interview a patient,**

I often seem to get one idea stuck in my mind about what might be wrong.	( ) ( ) ( ) ( ) ( ) ( )	I usually find it easy to explore various possible nutritional diagnoses.

5. **Throughout the interview,**

If I follow the patient's line of thought, I tend to lose my own thread.	( ) ( ) ( ) ( ) ( ) ( )	I can still keep my own ideas clear even if I follow the patient's line of thought.

6. **Once the patient has clearly presented their symptoms and signs,**

I think about them in my mind in the patient's own words.	( ) ( ) ( ) ( ) ( ) ( )	I translate them in my mind into nutritional terms (e.g., "sore tongue" becomes "glossitis")

7 **Concerning the routine history,**

I often feel that I did not sufficiently cover the routine history | ( ) ( ) ( ) ( ) ( ) ( ) | I usually cover the routine history to my satisfaction

8 **During the course of an interview, I find that**

Some key pieces of information seem to leap out at me | ( ) ( ) ( ) ( ) ( ) ( ) | It is often difficult to know which items of information to latch onto

9 **When I cannot make sense of the patient's symptoms,**

I gather new information to trigger new ideas. | ( ) ( ) ( ) ( ) ( ) ( ) | I ask the patient to define those symptoms more clearly

10. **In considering nutritional diagnostic possibilities,**

I often come up with unlikely diagnoses | ( ) ( ) ( ) ( ) ( ) ( ) | I am usually in the right area

11. **While I am collecting information about a patient,**

The various items of information usually seem to group themselves together in my mind | ( ) ( ) ( ) ( ) ( ) ( ) | I often have difficulty understanding how the pieces of information relate to each other.

12. **When I realize I missed the nutritional diagnosis initially,**

It is often because I knew the nutrition disorder but failed to think of it | ( ) ( ) ( ) ( ) ( ) ( ) | It is often because I did not know enough about the disorder

13. **During the clinical interview,**

I cannot bring myself to dismiss some information as irrelevant | ( ) ( ) ( ) ( ) ( ) ( ) | I am quite happy to dismiss some information as irrelevant

14. **When I cannot make sense of the patient's symptoms and signs,**

I move on to get new information in order to get a new perspective | ( ) ( ) ( ) ( ) ( ) ( ) | I look at the symptoms and signs from a different perspective before moving on

15 **When I consider a number of possible nutritional diagnoses,**

The diagnoses tend to be related to one another | ( ) ( ) ( ) ( ) ( ) ( ) | The diagnoses tend to be scattered

16. **When a possible diagnosis comes into my mind,**

I usually find myself anticipating possible abnormal signs and symptoms that go with that diagnosis | ( ) ( ) ( ) ( ) ( ) ( ) | Quite often, it does not help me to decide what to ask the patient next

27. When I have a broad idea as to what might be wrong with the patient,

I can usually proceed to a specific diagnosis	( ) ( ) ( ) ( ) ( ) ( )	I find it difficult to put into specific terms

28. In choosing among the diagnostic ideas that I have,

I am usually not capable of wholly ruling out any of the ideas that I have had	( ) ( ) ( ) ( ) ( ) ( )	I am capable of ruling out most of my ideas completely

29. Once I have made up my mind about a patient,

I am prepared to change my mind	( ) ( ) ( ) ( ) ( ) ( )	I really do not like to change my mind

30. When I consider my diagnostic ideas, I do so on the basis of

The case as a whole so far	( ) ( ) ( ) ( ) ( ) ( )	A few outstanding symptoms or signs

31. If I cannot make sense of a clinical interview,

I can readily see the information in new ways	( ) ( ) ( ) ( ) ( ) ( )	I find it difficult to see the information in new ways

32. When I order laboratory tests,

I do it as part of the routine clinical investigation	( ) ( ) ( ) ( ) ( ) ( )	I do it expecting specific information or supporting evidence

33. When it comes to making up my mind about a diagnosis,

I do not mind postponing my diagnostic decisions about a case	( ) ( ) ( ) ( ) ( ) ( )	I feel obliged to go for one diagnostic decision or another, even if I am not very certain

34. As the patient case unfolds,

I often find it difficult to remember what has been said	( ) ( ) ( ) ( ) ( ) ( )	I can usually keep track in my mind what has been said

35. When I have to make a diagnosis about a very familiar nutritional disorder,

I find it relatively easy to pin down a diagnosis	( ) ( ) ( ) ( ) ( ) ( )	I often seem to be all over the place or have difficulty pinning down a diagnosis

36. When I have to make a diagnosis about a very familiar nutritional disorder,

I check up on most possibilities before reaching a decision	( ) ( ) ( ) ( ) ( ) ( )	I often have many ideas that I don't explore further

17. **When I know very little about a particular type of nutritional disorder,**

I can still usually come up with a diagnosis	( ) ( ) ( ) ( ) ( ) ( )	I have great difficulty reaching a diagnosis

18. **As the history progresses with some ideas about the possible diagnosis(es),**

New information often makes me have more ideas	( ) ( ) ( ) ( ) ( ) ( )	New information does not often make me have more ideas

19. **When I am taking a history, I find that**

I can get new ideas just by going over the existing information in my mind	( ) ( ) ( ) ( ) ( ) ( )	I need to have new information to make me have a new idea about the case

20. **When the patient uses imprecise or ambiguous expressions,**

I let the patient go on to maintain the flow of the interview	( ) ( ) ( ) ( ) ( ) ( )	I make the patient clarify precisely what is meant before going on

21. **After an interview with a patient,**

I rarely think of other things that I should have asked in relation to the patient's disorder	( ) ( ) ( ) ( ) ( ) ( )	I often think of other things that I should have asked in relation to the patient's disorder

22. **When I think of a possible nutritional diagnosis due to a new piece of information,**

It often makes me go back to previous information to see if things fit together or not.	( ) ( ) ( ) ( ) ( ) ( )	It rarely makes me review the information that I gathered previously

23. **Concerning the diagnosis I eventually make,**

I usually have very few doubts	( ) ( ) ( ) ( ) ( ) ( )	I often feel too uncertain for my own comfort

24. **In making a diagnostic decision,**

I decide by considering each possible diagnosis separately on its own merits.	( ) ( ) ( ) ( ) ( ) ( )	I decide by comparing or contrasting the various possible diagnoses

25. **As the case unfolds,**

I do not find it useful to summarize as I go along	( ) ( ) ( ) ( ) ( ) ( )	I periodically take stock of the data or my ideas

26. **When I have an idea about what might be wrong with the patient,**

I feel most comfortable if I can follow it up without being diverted	( ) ( ) ( ) ( ) ( ) ( )	I can easily work on something else before coming back to my original idea

37. When I reach my diagnostic decisions,		
there is often left over information that I have just forgotten about.	( ) ( ) ( ) ( ) ( ) ( )	I usually will have considered all the information
38. Throughout the interview,		
I manage to test my ideas even if I let the patient control the interview	( ) ( ) ( ) ( ) ( ) ( )	I am only successful if I can control the direction of the interview
39. In considering diagnostic possibilities,		
I compare or contrast the possible diagnoses	( ) ( ) ( ) ( ) ( ) ( )	I consider each diagnosis separately on its own merit
40. In terms of the way I conduct an interview,		
I usually cover the ground that I need to during the interview	( ) ( ) ( ) ( ) ( ) ( )	Quite often I do not ask all the questions that I should at the time.
41. In considering the patients' signs and symptoms,		
I think of them each in absolute terms as stated by the patient	( ) ( ) ( ) ( ) ( ) ( )	I think of them in terms of possible opposites (e.g., "deficiency" vs. "toxicity".)

Section 3

Please read the following three narratives describing the experience of flow.

A. *My mind isn't wandering. I am not thinking of something else. I am totally involved in what I am doing. My body feels good. I don't seem to hear anything. The world seems to be cut off from me. I am less aware of myself. I am oblivious to time.*

B. *My concentration is like breathing. I never think of it. I am really quite oblivious to my surroundings after I really get going. When I start, I really do shut out the whole world. Once I stop, I can let it back in again.*

C. *I am so involved in what I am doing. I don't see myself as separate from what I am doing.*

1. During my work as a dietitian, I have experienced the above in the past 12 months (blacken all that apply)

( ) A ( ) B ( ) C ( ) None (if none, skip to question 3)

2. If you experienced A, B or C during your work as a dietitian in the last 12 months, blacken the circle beside the roles/tasks in which you were involved, describe the experience and explain what you believe caused the experience of flow to occur. Choose all that apply.

Example: ● h. During diagnostic work: *Conducting the physical assessment and associative reasoning*

( ) a. Clinician ______________________________

( ) b. Manager ______________________________

( ) c. Preceptor ______________________________

( ) d. Researcher ______________________________

( ) e. Author ______________________________

( ) f. Creator/Developer ______________________________

( ) g. ADA participation ______________________________

( ) h. During diagnostic work ______________________________

( ) i. Reflective thinking/theorizing ______________________________

( ) j. Other, please specify ______________________________

3. Do you belong to a group/organization which provides ALL of the following:
   a) help and cooperation leading to your professional growth
   b) consistent recognition of your successes
   c) successful career models?

( ) NO
( ) YES

If YES, please specify types of organizations and/or activities which meet all 3 of the above criteria (Blacken all that apply)

( ) a. American Dietetic Association
( ) b. Council on Renal Nutrition
( ) c. Public speaking with critique
( ) d. Authored peer reviewed journal articles
( ) e. Group facilitator with critique
( ) f. Collaborative research
( ) g. Interdisciplinary medical team participation
( ) h. Conducting medical/nutrition patient rounds
( ) i. Others, please specify: ______

Comments

○ Please blacken the circle if you wish to receive study results.

You are welcome to write any additional comments in the space provided below.

Thank you for your assistance. Please return in the enclosed postpaid envelope within two (2) weeks to:.

Ronna Biesecker, MS, RD
P.O. Box 40936
Tucson, Arizona 85717-0936

APPENDIX C

PERMISSIONS

THE AMERICAN DIETETIC ASSOCIATION
216 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60606-6995

May 15, 1996

Ronna Biesecker
Desert Dialysis Center
2022 E. Prince Road
Tucson, AZ 85719

Dear Ms. Biesecker:

Please forgive the lateness in responding to your request for permission to reprint. from our publication entitled *Role Delineation Study Vol. 3.* As stated in your letter, you wish to reprint pages 3 and 4 from Section 1, pages 5 and 6 from Section 2, page 15 of Section 5, and appendix 3C. It is my understanding that this will be used as a comparison for your study in Nutritional Sciences at the University of Arizona.

Based on the above, permission is granted contingent upon your acknowledging the source publication and remitting a fee for use. The following credit line is required:

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Per ADA's permission policy, there is a fee of $25 per text page. I will gladly approve your request for $100. If you change your mind about using this permission, please cancel your request within three weeks. If I do not hear from you, I will assume the material was used and you will be invoiced accordingly.

If you need further assistance or information, please do not hesitate to contact me. We are happy to be of service to you, and we thank you for your interest in ADA publications.

Sincerely,

Saudia Muhammad

Saudia Muhammad
Publication Department
312/899-0040 ext. 4659

UIC The University of Illinois at Chicago

College of Medicine
Department of Medical Education (M/C 591)
808 South Wood Street, 986 CME
Chicago, Illinois 60612-7309
(312) 996-3590 Fax: (312) 413-2048

World Health Organization
Collaborating Center in Educational
Development of Health Professionals
and Health Care Systems

September 19, 1996

Ms. Ronna Lee Biesecker
P.O. Box 40936
Tucson, Arizona 85717-0936

Object: Diagnostic Thinking Inventory.

Dear Ms. Biesecker:

I received in the mail this week a copy of your letter to Dr. Walton requesting permission to use our Diagnostic Thinking Inventory. I moved four years ago to Chicago from Quebec.

I am delighted to see that you will be using the inventory as part of your dissertation work. I also thank you for citing the appropriate acknowledgment when using the inventory and in publishing.

I know of four other persons who have used the inventory: (1) Sobral in Brazil (see Med. Educ., 1995, 29: 278-282), (2) Ms Una F. Jones from Wales (Dept. of Physiotherapy Education, School of Healthcare Studies, University of Wales College of Medicine, Heath Park, Cardiff CF4 4XN), (3) Dr. Wayne Woloschuck at the University of Calgary in Canada, and (4) Ms. Barbara Caldwell in the School of Nursing at the University of Medicine and Dentistry of New Jersey.

Best of luck with your study.

Sincerely,

Georges Bordage, MD, PhD

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August 18, 1996

Ronna Biesecker
P.O. Box 40936
Tucson, Arizona 85717-0936

Reference

ISBN/Journal:	43809-8
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APPENDIX D

HUMAN SUBJECTS COMMITTEE COMMUNICATION

Human Subjects Committee

THE UNIVERSITY OF
ARIZONA.
HEALTH SCIENCES CENTER

1622 E. Mabel St
Tucson, Arizona 85721
(520) 626-6721

27 November 1996

Ronna L. Biesecker, B.S., M.S.
c/o Mary Ann Kight, Ph.D.
Department of Nutritional Sciences
Shantz Building, Room 308
PO BOX 210038

RE: EXPERT CHARACTERISTICS: DO THEY EXIST IN RENAL DIETITIANS?

Dear Ms. Biesecker:

We have received documents concerning your above cited project. Regulations published by the U.S. Department of Health and Human Services [45 CFR Part 46.101(b) (2)] exempt this type of research from review by our Committee.

Thank you for informing us of your work. If you have any questions concerning the above, please contact this office.

Sincerely yours,

WFDenny

William F Denny, M.D.
Chairman
Human Subjects Committee

WFD:js
cc: Departmental/College Review Committee

The University of Arizona
Health Sciences Center

Human Subjects Committee

24 November 1997

Ronna L. Biesecker, B.S., M.S.
c/o Mary Ann Kight, Ph.D.
Department of Nutritional Sciences
Shantz Building, Room 308
PO BOX 210038

RE: EXPERT CHARACTERISTICS: DO THEY EXIST IN RENAL DIETITIANS?

Dear Ms. Biesecker:

We received your revised proposal and accompanying case study instrument for the above referenced project. Protocol change involves the addition of a telephone interview or on site observation of 2-3 members of the subject population while they evaluate a case study (consent to be obtained orally). Approval for this change to your exempt project is granted effective 24 November 1997.

Thank you for keeping us informed of your work. If you have any questions concerning the above, please contact this office.

Sincerely,

William F Denny

William F Denny, M.D.
Chairman
Human Subjects Committee

WFD/js
cc: Departmental/College Review Committee

APPENDIX E

TABLES

Table 15. **Response Rate by State**

State	**n=309**
California	33
Pennsylvania	23
Texas	17
New York and Ohio	16 each
Florida	13
Massachusetts	12
Michigan	11
Tennessee and Virginia	10 each
Maryland	9
Illinois and Indiana	8 each
Colorado, Georgia and Minnesota	7 each
Arizona, Connecticut, Kentucky, Louisiana, Missouri, and New Jersey	6 each
North Carolina, Oregon, and Wisconsin	5 each
Kansas, South Carolina and Washington	4 each
Alabama, Arkansas, Iowa, Nevada, New Mexico, N. Dakota, Oklahoma, and Utah	3 each
Idaho, S. Dakota, and West Virginia	2 each
Alaska, Mississippi, Montana, Nebraska and Washington DC	1 each
Unknown	4

Table 21. **Specialty Other Than Renal**

Specialty	**n**
Diabetes	12
Critical Care/Nutrition Support	8
Consulting	7
Clinical Management	6
Education	4
Administration	5
Sports/Wellness/Weight Management	3
Gerontology	4
Business/Industry	2
Sub-Acute/Rehabilitation	2
Research	2
Nutrition Counseling	1
Cardiology	1
Transplant	1
Oncology	1
Phenylketonuria	1
Gastrointestinal/Pulmonary	1
Pediatrics	1
Public Health	1
General Clinical Practice	18

Table 22. **Dietetic Practice Group Memberships**

Practice Group	**n**
Diabetes Care and Education (DCE)	50
Dietitians in Nutrition Support (DNS)	35
Consultant Dietitians in Health Care Facilities (CDHCF)	28
Sports, Cardiovascular and Wellness Nutritionists (SCAN)	20
Dietitians in General Clinical Practice (DGCP)	19
Pediatric Nutrition (Peds N)	13
Clinical Nutrition Management (CNM)	12
Nutrition Entrepreneurs (NE)	9
Vegetarian Nutrition (VN)	8
Gerontological Nutritionists (GN)	7
Management in Food and Nutrition Systems (MFNS)	7
Oncology Nutrition (ON)	7
Dietetics in Physical Medicine and Rehabilitation (DPM&R)	5
Dietitians in Business and Communications (DBC)	4
Dietetics in Developmental and Psychiatric Disorders (DDPD)	4
Nutrition Educators of Health Professionals (NEHP)	4
Dietetic Educators of Practitioners (DEP)	3
Nutrition Education for the Public (NEP)	3
Perinatal Nutrition (Peri N)	3
School Nutrition Services (SNS)	3
Environmental Nutrition (EN)	2
Food & Culinary Professionals (FCP)	2
Research Dietetic Practice Group (RDPG)	2
HIV/IDS (HIV)	1
Public Health Nutrition (PHN)	1

Table 29. **Honors and Awards by Category**

National Kidney Foundation
Distinguished Service
Trustees Award
State and local Recognition Award
Council on Renal Nutrition
Committee Award
Regional Representative and Alternate
Research Grant
Network Outstanding Dietitian
Recognized Renal Dietitian
Lifetime Achievement
American Dietetic Association
Recognized Young Dietitian of the Year
Outstanding Service Award
Practice group scholarship
Certified practitioner of a specialty
Fellow of The American Dietetic Association
Practice Group Recognition
State and Local Dietetic Association Awards
Distinguished Service
District and local Recognized Dietitian Award
State Outstanding Dietitian of the Year
Preceptor of the Year
VIP Award
Commendations
Award of Merit
Outstanding Intern
Academic
Honor Society
Graduated cum laude
Distinguished Alumnus

Table 29 Continued. Honors and Awards by Category

Institutional Awards
Distinguished Administrator
Clinical Nutrition Manager
Who's Who
Spirit Awards
Service Awards
Attendance
Performance
Public Service Award
Outstanding Woman of the Year
Employee of the Month
Extra-Mile Award
Community Award

Table 37. **Results of Principal Factors Analysis, Promax Rotation, on Diagnosing Respondents Answering Diagnostic Thinking Inventory, Eigenvalues and Percent Explained Variance (n=140)**

Items	Factors 1	2	3	4	5	6	7
1	0.03	0.10	-0.06	0.05	0.66	-0.14	0.01
2	0.34	0.04	-0.20	0.14	-0.35	0.33	0.01
3	0.01	-0.14	-0.37	0.40	-0.16	-0.05	0.16
4	0.24	0.32	0.53	0.09	0.07	-0.03	0.33
5	0.36	0.50	0.42	0.13	0.14	0.22	0.00
6	0.15	0.23	0.06	0.07	0.71	-0.05	-0.06
7	0.16	0.52	0.16	0.39	0.09	0.18	-0.12
8	0.59	0.32	-0.01	0.15	-0.04	-0.03	0.15
9	-0.01	0.08	0.21	-0.03	-0.00	-0.04	-0.36
10	0.51	0.63	0.23	0.36	0.01	0.16	-0.15
11	0.55	0.68	0.12	0.33	0.04	-0.10	0.03
12	0.10	0.16	-0.07	0.19	0.02	-0.21	-0.37
13	0.24	0.17	-0.37	0.06	0.03	0.18	-0.01
14	-0.12	-0.10	0.12	0.27	0.29	0.16	-0.02
15	0.50	0.30	0.07	0.20	0.07	0.03	-0.08
16	0.55	0.21	0.13	0.26	-0.02	-0.03	0.11
17	0.33	0.38	0.15	0.58	0.08	-0.30	-0.14
18	0.43	0.10	0.49	0.27	0.11	-0.07	0.13
19	0.42	0.19	0.35	0.46	-0.00	-0.12	0.11
20	0.04	0.08	-0.07	-0.06	-0.05	0.40	-0.06
21	0.04	0.42	-0.06	0.05	0.02	-0.10	-0.05
22	0.68	0.19	0.38	0.07	0.11	0.02	0.11
23	0.60	0.63	0.30	0.39	0.00	-0.15	-0.13
24	-0.09	-0.10	0.00	0.05	-0.01	0.53	-0.06
25	0.36	0.31	0.13	0.01	0.04	-0.09	0.45
26	-0.02	0.13	0.09	0.22	0.21	0.00	0.29
27	0.49	0.48	0.11	0.53	0.22	-0.10	-0.18
28	-0.29	-0.30	-0.28	-0.01	-0.05	0.11	-0.25
29	0.22	0.05	0.31	0.14	-0.05	-0.25	0.53
30	0.59	0.37	0.33	0.10	0.12	-0.04	0.08
31	0.29	0.36	0.50	0.18	0.30	-0.23	0.03
32	0/23	0.11	0.17	-0.10	-0.08	0.35	0.14
33	0.19	0.12	0.52	0.04	-0.09	0.02	0.10
34	0.34	0.56	0.16	-0.06	0.10	-0.02	0.06
35	0.63	0.42	0.30	0.11	0.03	0.05	-0.02
36	0.27	0.14	0.44	0.16	0.01	0.10	-0.01
37	0.36	0.53	0.16	0.09	0.11	0.02	0.03
38	0.32	0.19	0.20	0.22	-0.10	-0.18	0.19
39	0.12	0.09	0.32	0.31	-0.22	0.25	-0.02
40	0.28	0.69	0.21	0.02	0.16	-0.07	0.02
41	0.24	-0.00	0.14	0.36	0.26	0.02	0.09
Eigenvalues	5.20	4.73	2.99	2.36	1.64	1.32	1.31
Percent Total Variance	27.04	22.38	8.95	5.59	2.70	1.73	1.72

Table 38. **Results of Principal Factors Analysis, Promax Rotation, on All Respondents Answering Diagnostic Thinking Inventory, Eigenvalues and Percent Explained Variance (n=246)**

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
II1	0.15127	0.02523	0.56831	-0.05100	0.09016
II2	0.02330	0.10366	-0.30089	0.11605	0.39796
II3	-0.05065	-0.01968	-0.02850	-0.11296	0.40391
II4	0.36826	0.49730	0.23650	0.14619	-0.37292
II5	0.52926	0.46790	0.13059	0.14726	-0.27076
II6	0.29619	0.18551	0.60892	-0.05691	-0.08532
II7	0.57625	0.21560	0.18746	-0.00567	-0.14153
II8	0.41822	0.46930	-0.04003	0.00298	0.36472
II9	0.04553	0.02941	-0.16168	-0.11508	-0.30634
II10	0.56350	0.43803	-0.11961	-0.09687	0.02012
II11	0.69860	0.45765	0.07055	0.01313	0.09658
II12	0.12718	0.01557	-0.07039	-0.34134	-0.01165
II13	0.18347	0.03479	0.00704	0.11405	0.27774
II14	0.02460	-0.00296	0.31263	0.10931	-0.22874
II15	0.37936	0.40027	-0.03644	-0.08356	0.17478
II16	0.32258	0.53129	0.00702	-0.14264	0.21366
II17	0.42369	0.25967	0.18116	-0.39431	-0.05121
II18	0.21398	0.61590	0.20913	-0.10306	-0.12819
II19	0.30244	0.53055	0.14704	-0.16338	0.03031
II20	0.07210	-0.02259	-0.09167	0.28720	0.01245
II21	0.41119	-0.01864	0.09028	-0.11886	-0.03381
II22	0.31776	0.64215	0.08979	0.07718	0.03440
II23	0.69552	0.51135	0.09263	-0.19085	0.06901
II24	-0.04275	-0.06400	0.01217	0.40729	-0.01469
II25	0.18176	0.37021	0.12175	0.19618	0.07062
II26	0.23338	0.07725	0.34147	0.16761	-0.04405
II27	0.59224	0.41032	0.17831	-0.18409	0.12769
II28	-0.34651	-0.32843	-0.11461	-0.26664	0.05963
II29	0.03338	0.44373	0.10426	0.05381	-0.00991
II30	0.38985	0.53128	-0.11686	-0.13551	0.02636
II31	0.45003	0.39811	0.28893	-0.07063	-0.29706
II32	0.14552	0.25653	-0.03725	0.29375	-0.01288
II33	0.18053	0.38269	0.00288	0.08890	-0.26885
II34	0.52072	0.31411	0.07235	0.22614	-0.02585
II35	0.51038	0.57353	-0.01796	0.05169	0.07320
II36	0.27113	0.47482	-0.02246	-0.00563	-0.14650
II37	0.59640	0.32492	0.17371	0.03436	0.00695
II38	0.29394	0.42382	0.00176	0.00381	-0.00053
II39	0.17124	0.22876	-0.07256	0.19582	-0.10033
II40	0.65347	0.27673	0.19100	0.24585	-0.09110
II41	0.06298	0.20391	0.41667	-0.10737	-0.03297

Variance explained by each factor ignoring other factors

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
5.695352	5.410203	1.713244	1.221792	1.274415

Table 39. **Inter-Factor Correlations Using Non-Orthogonal Rotation on Diagnosing Respondents** (n =140)

	FACTOR1	FACTOR2	FACTOR3	FACTOR4
FACTOR1	1.00000	0.46422	0.24926	0.26180
FACTOR2	0.46422	1.00000	0.23108	0.20684
FACTOR3	0.24926	0.23108	1.00000	0.09926
FACTOR4	0.26180	0.20684	0.09926	1.00000
FACTOR5	0.01373	0.14794	0.13982	-0.00433
FACTOR6	-0.03095	-0.05351	-0.02872	-0.04170
FACTOR7	0.09356	-0.08650	0.11170	-0.10467

	FACTOR5	FACTOR6	FACTOR7
FACTOR1	0.01373	-0.03095	0.09356
FACTOR2	0.14794	-0.05351	-0.08650
FACTOR3	0.13982	-0.02872	0.11170
FACTOR4	-0.00433	-0.04170	-0.10467
FACTOR5	1.00000	-0.09478	-0.04335
FACTOR6	-0.09478	1.00000	-0.08749
FACTOR7	-0.04335	-0.08749	1.00000

Table 40. **Inter-Factor Correlations Using Non-Orthogonal Rotation on All Respondents (n =246)**

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5
FACTOR1	1.00000	0.50935	0.14324	-0.00929	-0.01157
FACTOR2	0.50935	1.00000	0.08128	-0.02600	0.00177
FACTOR3	0.14324	0.08128	1.00000	-0.00267	-0.17015
FACTOR4	-0.00929	-0.02600	-0.00267	1.00000	-0.12511
FACTOR5	-0.01157	0.00177	-0.17015	-0.12511	1.00000

Table 54. **Examples of "Other" Expert Subculture Groups**

National Kidney Foundation
Renal nutrition groups
Current work environment
Council on Renal Nutrition local or regional organizations
Local or regional dietetic councils
Dietetic practice groups
Diagnostic group
Other professional organizations
Book/journal club
Church groups
Mary Kay Cosmetics

APPENDIX F

ITEM STATISTICS AND TAXONOMIES

Table F - 1. **Overall Questionnaire, Standardized Variables, Coefficient Alpha = 0.83**

Item	*Correlation With Total*	*Alpha*
1	.12	.83
2	.03	.84
3	-.02	.84
4	.44	.83
5	.54	.82
6	.32	.83
7	.45	.83
8	.46	.83
9	.02	.84
10	.49	.82
11	.61	.82
12	.07	.84
13	.13	.83
14	.05	.84
15	.39	.83
16	.43	.83
17	.37	.83
18	.43	.83
19	.44	.83
20	.03	.84
21	.20	.83
22	.51	.82
23	.60	.82
24	-.01	.84
25	.27	.83
26	.21	.83
27	.52	.82
28	-.38	.85
29	.22	.83
30	.45	.83
31	.45	.83
32	.20	.83
33	.28	.83
34	.42	.83
35	.56	.82
36	.38	.83
37	.49	.82
38	.37	.83
39	.21	.83
40	.48	.83
41	.21	.83

Table F - 2. **Flexibility Sub-Scale, Standardized Variables, Coefficient Alpha = 0.54**

Item	*Correlation With Total*	*Alpha*
2	.05	.60
3	-.03	.61
4	.41	.55
5	.47	.54
9	-.00	.61
13	.08	.60
14	.12	.59
19	.39	.56
20	.01	.61
22	.44	.55
23	.36	.56
24	.07	.60
25	.26	.57
26	.22	.58
28	-.42	.66
29	.22	.58
31	.36	.56
33	.26	.57
38	.35	.56
39	.26	.57
40	.36	.56

Table F - 3. **Structure Sub-Scale, Standardized Variables, Coefficient Alpha = 0.81**

Item	*Correlation With Total*	*Alpha*
1	.18	.81
6	.35	.80
7	.43	.80
8	.43	.80
10	.51	.79
11	.57	.79
12	.10	.82
15	.38	.80
16	.44	.80
17	.38	.80
18	.39	.80
21	.24	.81
27	.54	.79
30	.44	.80
32	.16	.81
34	.41	.80
35	.55	.79
36	.33	.80
37	.51	.79
41	.19	.81

Table F - 4. **Results of Principal Factors Analysis, Promax Rotation, on All Respondents Answering Diagnostic Thinking Inventory; Eigenvalues and Percent Explained Variance** (n= 246)

Items	1	2	3	4	5
1	0.15	0.03	0.57	-0.05	0.09
2	0.02	0.10	-0.30	0.12	0.40
3	-0.05	-0.02	-0.03	0.15	-0.37
4	0.37	0.50	0.24	0.15	-0.37
5	0.53	0.47	0.13	0.15	-0.27
6	0.30	0.19	0.61	-0.06	-0.09
7	0.58	0.22	0.19	-0.01	-0.14
8	0.42	0.47	-0.04	0.00	0.36
9	0.05	0.03	-0.16	-0.12	-0.31
10	0.56	0.44	-0.12	-0.10	0.02
11	0.70	0.46	0.07	0.01	0.10
12	0.13	0.02	-0.07	-0.34	-0.01
13	0.18	0.03	0.01	0.11	0.28
14	0.02	-0.00	0.31	0.11	-0.23
15	0.38	0.40	-0.04	-0.08	0.17
16	0.32	0.53	0.01	-0.14	0.21
17	0.42	0.26	0.18	-0.39	-0.05
18	0.21	0.62	0.21	-0.10	-0.13
19	0.30	0.53	0.15	-0.16	0.03
20	0.07	-0.02	-0.09	0.29	0.01
21	0.41	-0.02	0.09	-0.12	-0.03
22	0.32	0.64	0.09	0.08	0.03
23	0.70	0.51	0.09	-0.19	0.07
24	-0.04	-0.06	0.01	0.41	-0.01
25	0.18	0.37	0.12	0.20	0.07
26	0.23	0.08	0.34	0.17	-0.04
27	0.60	0.41	0.18	-0.18	0.13
28	-0.35	-0.33	-0.11	-0.27	-0.06
29	0.03	0.44	0.10	0.05	-0.01
30	0.39	0.53	-0.12	-0.14	0.03
31	0.45	0.40	0.29	-0.07	-0.30
32	0.15	0.26	-0.04	0.30	-0.01
33	0.18	0.38	0.00	0.09	-0.27
34	0.52	0.31	0.07	0.23	-0.03
35	0.51	0.57	-0.02	0.05	0.07
36	0.27	0.47	-0.02	-0.01	-0.15
37	0.60	0.32	0.17	0.03	0.01
38	0.29	0.42	0.00	0.00	-0.00
39	0.17	0.23	-0.07	0.20	-0.10
40	0.65	0.28	0.19	0.25	-0.09
41	0.06	0.20	0.42	-0.11	-0.03
Eigenvalues	5.695	5.410	1.713	1.222	
	1.274				
Percent Total Variance	34.44	29.27	2.94	1.49	1.62

Table F - 5. **Examples of Flow Activities by Role**

Role	**Flow Activity**
Clinician:	New patient assessment
	Patient/family counseling/diet instruction
	Patient interviews/history
	Gathering information to deal with new problem
	Monthly counseling on laboratory values
	Calculating special diets
	Working with health care team
	Qualifying patient for nutritional supplements
	Medical record review
	Medical charting/monthly progress notes
	Care planning meetings
Reflective thinking:	
	Continuous quality improvement projects
	Developing care plans and diagnoses
	Long-range planning and goal setting for patient care strategies
	Evaluating clinical situations
	Reading scientific journals
	Risk-benefit analysis of feeding route
	Reviewing medial records
	Planning/strategizing sessions
	Thinking/contrasting evaluation and outcome
	Writing care plans/protocols
	Planning /implementing project—on computer
	Evaluating career/job choices/future of practice
Preceptor	Guiding learning activities of students/interns
	Teaching Certified Dietary Manager class
	Guiding student theses

Table F – 5 Continued. **Examples of Flow Activities by Role**

Role	Flow Activity
Diagnostic work:	Interviewing/assessing/reviewing data
	Collecting the pieces
	Integrating data from patient and medical records
	New "non-routine" problems/diagnoses
	Conducting physical assessment and associative reasoning
	Mock-interview of student as demonstration
	Discuss problems with other clinicians
Creator/Developer:	Organizing new programs
	Writing grant proposals
	Developing new educational materials/teaching modules
	Developing lectures/in-services/presentation
	Developing new clinical protocols
	New menu/computer systems
	Process flow diagram for diabetes management
	Planning patient group activities
Manager:	Performance review preparation
	Documentation of management issues
	Brainstorming options/problem-solving
	Calculating costs/treatments each month
	Scheduling/supervising
	Developing new care/menu guidelines
	Budgeting
	Major projects
Researcher:	Data collection/compilation/analysis
	Working with students on research projects
	Indirect calorimeter sessions and assessments
	Reviewing clinical practice articles
Other:	Analysis of situation/projects/needs
	Evaluating departmental functioning
	Creating programs/services as consultant
	Media work/presentations
	Graduate school
	Developing policies/job descriptions
	Literature review
	Computer work
	Professional presentations/preparation

Table F – 5 Continued. **Examples of Flow Activities by Role**

Role	**Flow Activity**
Author:	Writing newsletter/newspaper articles Revising brochures Writing journal articles Revising book chapter Writing research study Thesis
American Dietetic Association Participation:	
	Test item writing for specialty certification examination Executive committee work Technique and product reviews at annual meetings State/national committee work

Table F - 6. "Other" Roles by Category

Preceptor
    Administrative
Creator/developer
    Products
Manager
Sales
Advisor
    Institution
Consultant
    Lactation
    Menus
    Nutrition provider
    Professional resource
Counselor
Coordinator
    Community health screening program
    Continuous Quality improvement
    Laboratory services
Member
    Professional organizations
Office holder
    Professional organizations
Committee member
    Professional organizations
Editor
    Newsletter
Board member
    Volunteer organizations
Regulatory

Table F – 7. **Cronbach Coefficient Alpha, 1st Factor, All Subjects (n=253)**

Deleted Variable	Raw Variables: Correlation with Total	Raw Variables: Alpha	Std. Variables: Correlation with Total	Std. Variables: Alpha
II5	0.476727	0.827390	0.486012	0.836633
II7	0.494853	0.825189	0.497357	0.835878
II8	0.361239	0.833338	0.373228	0.844013
II10	0.492162	0.827255	0.504228	0.835421
II11	0.660942	0.816285	0.669595	0.824160
II17	0.409597	0.833008	0.402749	0.842102
II21	0.328498	0.839923	0.314800	0.847754
II23	0.649246	0.813858	0.655903	0.825110
II27	0.556313	0.820736	0.561637	0.831564
II31	0.447616	0.828489	0.449641	0.839036
II34	0.456070	0.828237	0.470347	0.837670
II37	0.541114	0.821760	0.544070	0.832750
II40	0.585362	0.818001	0.573283	0.830775

Table F – 8. Cronbach Coefficient Alpha, 2nd Factor, All Subjects (n=253)
for STANDARDIZED variables: 0.850150

	Raw Variables		Std. Variables	
Deleted Variable	Correlation with Total	Alpha	Correlation with Total	Alpha
II4	0.497423	0.832367	0.491890	0.840652
II5	0.493642	0.833599	0.496697	0.840415
II8	0.458550	0.834796	0.464759	0.841984
II10	0.469219	0.835046	0.476368	0.841415
II15	0.391429	0.837763	0.403701	0.844953
II16	0.472107	0.834061	0.476467	0.841410
II18	0.501577	0.832279	0.492481	0.840623
II19	0.480089	0.833845	0.477165	0.841376
II22	0.550660	0.831096	0.552825	0.837633
II23	0.534630	0.830262	0.549879	0.837780
II25	0.310745	0.842870	0.309596	0.849455
II29	0.329950	0.842528	0.319721	0.848975
II30	0.502415	0.832213	0.511650	0.839677
II31	0.408114	0.837646	0.402996	0.844987
II35	0.548452	0.830947	0.560261	0.837262
II36	0.417418	0.836601	0.419657	0.844181
II38	0.410186	0.837240	0.407908	0.844750

Table F – 9. **Cronbach Coefficient Alpha, 3rd Factor,** All Subjects (n=253)

for RAW variables : 0.548332
for STANDARDIZED variables: 0.554975

	Raw Variables		Std. Variables	
Deleted Variable	Correlation with Total	Alpha	Correlation with Total	Alpha
II1	0.365892	0.459798	0.373055	0.465166
II6	0.453393	0.406845	0.462836	0.408870
II14	0.196746	0.561994	0.195323	0.567243
II26	0.242332	0.534763	0.239905	0.542770
II41	0.320748	0.487418	0.324305	0.494379

Table F – 10. Cronbach Coefficient Alpha, 4th Factor, All Subjects (n=253)

for RAW variables : -.009169
for STANDARDIZED variables: -.009086

	Raw Variables		Std. Variables	
Deleted Variable	Correlation with Total	Alpha	Correlation with Total	Alpha
II12	-0.004767	-0.005477	-0.003504	-0.007519
II17	0.003909	-0.020653	0.005700	-0.023701
II24	-0.003118	-0.008215	-0.012323	0.007823
II32	-0.011373	0.007556	-0.005443	-0.004133

Table F – 11. **Cronbach Coefficient Alpha, 5th Factor,** All Subjects (n=253)

for RAW variables : -.052377
for STANDARDIZED variables: 0.003033

Deleted Variable	Raw Variables: Correlation with Total	Raw Variables: Alpha	Std. Variables: Correlation with Total	Std. Variables: Alpha
II2	0.049572	-0.157041	0.059976	-0.077981
II3	0.018617	-0.112869	0.028158	-0.033861
II4	-0.131821	0.079341	-0.093023	0.121908
II8	0.190596	-0.241607	0.198987	-0.287605
II9	-0.152807	0.159113	-0.150865	0.189767

Table F – 12. **Cronbach Coefficient Alpha, 1st Factor, Diagnosing Subjects (n=140)**

for RAW variables : 0.775288
for STANDARDIZED variables: 0.808980

Deleted Variable	Raw Variables Correlation with Total	Raw Variables Alpha	Std. Variables Correlation with Total	Std. Variables Alpha
II2	0.292927	0.787468	0.278330	0.812293
II8	0.527410	0.749035	0.534746	0.787296
II11	0.557882	0.746483	0.558472	0.784884
II13	0.245314	0.792715	0.232062	0.816599
II15	0.463563	0.755829	0.468819	0.793910
II16	0.447764	0.756704	0.471776	0.793616
II22	0.491422	0.753878	0.512639	0.789528
II23	0.547927	0.745341	0.586764	0.781985
II27	0.481799	0.751345	0.500921	0.790706
II30	0.468065	0.753680	0.508245	0.789970
II35	0.521991	0.749313	0.535439	0.787226

Table F – 13. **Cronbach Coefficient Alpha, 2nd Factor, Diagnosing Subjects (n=140)**

for RAW variables : 0.702964
for STANDARDIZED variables: 0.743145

	Raw Variables		Std. Variables	
Deleted Variable	Correlation with Total	Alpha	Correlation with Total	Alpha
II5	0.426314	0.676438	0.449896	0.716185
II7	0.436655	0.667163	0.454768	0.715515
II10	0.578386	0.661266	0.608772	0.693791
II11	0.633006	0.648873	0.650263	0.687746
II21	0.300895	0.695547	0.293062	0.737156
II23	0.518340	0.659967	0.555928	0.701370
II25	0.242880	0.700707	0.254614	0.742130
II28	-0.308028	0.783041	-0.302820	0.807278
II34	0.461864	0.662211	0.469383	0.713501
II37	0.453914	0.666455	0.468856	0.713574
II40	0.518061	0.653417	0.498091	0.709516

Table F – 14. **Cronbach Coefficient Alpha, 3rd Factor, Diagnosing Subjects (n=140)**

	Raw Variables		Std. Variables	
Deleted Variable	Correlation with Total	Alpha	Correlation with Total	Alpha
II4	0.312057	0.426670	0.326523	0.469650
II13	-0.100510	0.571586	-0.109017	0.591154
II18	0.344353	0.414470	0.364402	0.457887
II19	0.369851	0.389962	0.381530	0.452502
II28	-0.268297	0.595740	-0.278382	0.632058
II30	0.320654	0.426828	0.332450	0.467822
II31	0.342061	0.413745	0.370960	0.455830
II33	0.297671	0.429051	0.318531	0.472106
II36	0.381278	0.406840	0.393302	0.448777
II39	0.251517	0.438636	0.261967	0.489237

Table F – 15. **Cronbach Coefficient Alpha, 4th Factor, Diagnosing Subjects** (n=140)

for RAW variables : 0.391939
for STANDARDIZED variables: 0.463953

	Raw Variables		Std. Variables	
Deleted Variable	Correlation with Total	Alpha	Correlation with Total	Alpha
II12	0.106938	0.398916	0.134941	0.470483
II17	0.289547	0.273106	0.357949	0.344373
II23	0.449829	0.231160	0.477069	0.269336
II24	-0.005465	0.471489	-0.026896	0.551117
II27	0.421107	0.221256	0.471412	0.273026
II32	0.041637	0.458307	0.049152	0.514313

Table F – 16. **Cronbach Coefficient Alpha, 5th Factor, Diagnosing Subjects (n=140)**

for RAW variables : 0.557300
for STANDARDIZED variables: 0.559015

	Raw Variables		Std. Variables	
Deleted Variable	Correlation with Total	Alpha	Correlation with Total	Alpha
II1	0.412199	0.382897	0.415951	0.383045
II6	0.501262	0.242191	0.499367	0.242236
II41	0.213671	0.680498	0.215161	0.681095

Table F – 17. **Cronbach Coefficient Alpha, 6th Factor, Diagnosing Subjects** (n=140)

```
for RAW variables          :  0.361581
for STANDARDIZED variables:  0.417405
```

	Raw Variables		Std. Variables	
Deleted Variable	Correlation with Total	Alpha	Correlation with Total	Alpha
II5	0.258297	0.282702	0.322785	0.278309
II10	0.179556	0.325521	0.243645	0.341406
II14	0.053981	0.442051	0.060171	0.474067
II24	0.266172	0.225066	0.218211	0.360911
II39	0.227759	0.264913	0.238916	0.345061

Table F – 18. **Cronbach Coefficient Alpha, 7th Factor, Diagnosing Subjects** (n=140)

```
for RAW variables          :  0.328130
for STANDARDIZED variables:  0.328444
```

	Raw Variables		Std. Variables	
Deleted Variable	Correlation with Total	Alpha	Correlation with Total	Alpha
II3	0.196490	.	0.196490	.
II26	0.196490	.	0.196490	.

Table F - 21. **Taxonomy of ADA and Flow**

I. Committee work
   A. State Board of Directors
   B. American Dietetic Association House of Delegates
   C. CAADE
   D. Group projects
   E. Committee member
   F. Executive committee member
   G. Renal Practice Group board member

II. Writing
   A. Materials
   B. Test item for specialty examination

Table F – 22. **Taxonomy of Author and Flow**

I. Writing
   A. Research
   B. Newspaper articles
   C. Newsletters
   D. Journal articles
   E. Book chapters

Table F – 23. **Taxonomy of Creator/Developer and Flow**

I. Developing/organizing
   A. Process flow diagram for diabetes
   B. Patient group activities
   C. Education materials
   D. Nutrition education modules
   E. Clinical practice protocols
   F. New programs
   G. Menus
   H. Computer systems
   I. Lecture materials

II. Writing
   A. Grant proposals
   B. Patient education materials
   C. Presentations
   D. In-service/training

Table F – 24. **Taxonomy of Diagnosis and Flow**

I. Assessments
   A. Physical
   B. Kinetic
   C. Laboratory values
   D. Growth
   E. Nutritional
   F. Subjective Global Assessment

II. Interviews
   A. Patient
   B. Family
   C. "Mock" for students

III. Diagnosis
   A. Non-routine
   B. Challenging

Table F – 25. **Taxonomy of Manager and Flow**

I. Scheduling

II. Budgeting
   A. Costs/treatment/month
   B. Departmental goals

III. Supervising
   A. Problem-solving
   B. Mentoring
   C. Performance reviews
   D. Answering questions

IV. Documentation
   A. Patient
   B. Quality assurance
   C. Care guidelines

V. Projects
   A. Major

VI. Menus
   A. Guidelines

Table F – 26. **Taxonomy of "Other" and Flow**

I. Teach/presentations
   A. Conferences
   B. Fellows
   C. Interns
   D. Diabetic Class
   E. Colleagues
   F. Diet instruction

II. Analysis
   A. Situation
   B. Projects
   C. Needs
   D. Literature
   E. Systems

III. Evaluation
   A. Department
   B. Quality assurance

IV. Graduate School

V. Media
   A. Television
   B. Radio
   C. Health professionals

VI. Develop
   A. Programs
   B. Systems/systems
   C. Job descriptions/policies

VII. Writer
   A. Educational materials
   B. Newsletters

VIII. Computer

IX. Calcijex protocol

Table F – 27. **Taxonomy of Preceptor and Flow**

I. Student Activities
   A. Learning activities
   B. Needs
   C. Advance assessment and problem-solving skills
   D. Identify role of RD and specifics of renal nutrition

II. Preparation
   A. Setting up program
   B. Listening to students
   C. Avoid pitfalls

III. Specific Practicuums
   A. Certified Dietary Manager class
   B. Thesis
   C. CUP—practicuum
   D. Internships

Table F – 28. **Taxonomy of Reflective Thinking and Flow**

I. General
   A. Letting creative ideas flow
   B. Long-range planning
   C. Data collection and evaluation
   D. Care plan and diagnoses
   E. Review of meetings –new policies
   F. Integrating personal and professional life
   G. Helping others to recovery
   H. Completing nutritional assessments
   I. Career/job choices
   J. Planning education classes or materials
   K. Evaluating clinical situation
   L. Reading and updating knowledge
   M. Computer work
   N. Planning/implementing a project
   O. Planning for the future of practice

II. Specific
   A. CQI
   B. Writing protocols for various medications
   C. Plans of care—tube feeding versus parenteral
   D. Reviewing medication records
   E. Challenging diagnosis

Table F – 29. **Taxonomy of Researcher and Flow**

I. Organization prior to project

II. Literature review

III. Statistical analysis

IV. Data review/assess for outcomes

V. Writing paper for publication

VI. Preparation to present research

VII. Specific items
   A. CRN National Research Question
   B. Master's thesis
   C. Indirect calorimeter sessions and assessments
   D. Computer sessions
   E. Ruling out personal bias

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