# A decade of doctoral research in nutrition

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## ABSTRACT

**Objective** To describe North American dissertation research in human nutrition from 1986 through 1995.
**Design** A census collection.
**Subjects/setting** The unit of observation was the dissertation abstract submitted to *Dissertation Abstracts International* for the years 1986 through 1995. Only dissertations written in English with a human nutrition subject code (0570) that lead to a PhD, DrPH, EdD, or ScD at a North American university were included (N=2,044). Abstracts were reviewed by 2 raters who extracted pertinent data on variables describing the dissertation research (eg, topic of dissertation, type of sample).
**Analyses** Analyses were descriptive.
**Results** The majority (n=1,147) of doctoral dissertations were completed by female students. Male students were more likely to study in vitro samples than female students (11% vs 4%) and female students were more likely to study human subjects (64%). Male students tended to have male advisers, although overall male advisers appeared to predominate (34% men, 24% women, 42% unknown or missing). Topic areas for dissertation work reflected gender differences. Popular topics for dissertation research have changed over time; biochemical-, micronutrient-, and obesity-related research decreased and research in development of theoretical constructs and examination of dietary habits of selected groups increased.
**Conclusions** From 1986 through 1995 there was an increase in the proportion of female doctoral students. Female and male students varied in the type of sample studied, gender of advisers, age group of human subjects, and topics of their dissertations. Universities emphasized different topic areas and methodologies. There appears to have been an increase in areas of applied research (eg, dietary habits) and a decrease in basic science topic areas (eg, micronutrients) over the 10-year period examined. *J Am Diet Assoc. 1999; 99:1065-1071.*


Dietetics involves the "application of the science and art of human nutrition in helping people select and obtain food for the primary purpose of nourishing their bodies in health or disease throughout the life cycle" (1, p 77). This area of science is multifaceted (2), but focuses on interactions between 3 primary areas: food, people, and health (1). Research is an important vehicle for the expansion of the role of dietitian or nutritionist (3,4).

The most promising subjects for practice and research include functional foods and phytochemicals, molecular biology, nutrients and biologically active food constituents, genetic variations in dietary needs, identification of subgroups at risk, determinants of food intake, supplementary feeding programs, and nutrition support dietetics (2,5). An area of research that is receiving increased attention is the relationship between disease conditions and nutrition (2). Dietitians, however, are not conducting most of this research (2). Dietitians need to be primary investigators in research to demonstrate the wide role of nutrition in health; we must do research ourselves, especially in areas that link disease and disease management with diet (6).

The future leaders in the profession of dietetics are the advanced graduate students of today. Research conducted by students at the highest level, namely those who pursue a doctoral degree, has considerable influence on the direction of the profession (6). Thus, review of graduate-level research may lead to discussions that will shape the progress of nutrition professions (2).

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**Table 1**
Doctoral dissertation research from 1986 to 1995 (number of abstracts=2,044)[a]

| Variable | Absolute number | Percentage |
|---|---|---|
| **Country** | | |
| United States | 1,961 | 96 |
| Canada | 83 | 4 |
| **Year** | | |
| 1986 | 172 | 8 |
| 1987 | 169 | 8 |
| 1988 | 189 | 9 |
| 1989 | 144 | 7 |
| 1990 | 204 | 10 |
| 1991 | 204 | 10 |
| 1992 | 232 | 11 |
| 1993 | 247 | 12 |
| 1994 | 249 | 12 |
| 1995 | 234 | 11 |
| **Gender of author** | | |
| Female | 1,147 | 56 |
| Male | 440 | 22 |
| Unknown | 457 | 22 |
| **Degree** | | |
| PhD | 1,924 | 94 |
| DrPH | 46 | 2 |
| EdD | 64 | 3 |
| ScD | 10 | 1 |
| **Gender of adviser** | | |
| Female | 499 | 24 |
| Male | 697 | 34 |
| Unknown | 177 | 9 |
| Missing | 671 | 33 |
| **Sample type** | | |
| Human | 1,091 | 53 |
| Animal | 631 | 31 |
| In vitro | 153 | 8 |
| Historical | 31 | 2 |
| Economic | 8 | 0.5 |
| Media | 16 | 1 |
| Other | 114 | 6 |
| **Sample gender** | | |
| Female and male | 624 | 31 |
| Female | 326 | 16 |
| Male | 91 | 4 |
| Unknown | 50 | 2 |
| Not applicable | 953 | 47 |
| **Sample age** | | |
| Infant (<2 y) | 65 | 3 |
| Child (2-13 y) | 91 | 5 |
| Adolescent (13-18 y) | 57 | 3 |
| Adult (>18 y) | 719 | 35 |
| Senior (>65 y) | 55 | 3 |
| General population | 64 | 3 |
| Unknown | 40 | 2 |
| Not applicable | 953 | 47 |
| **International sample** | 188 | 9 |

[a]Absolute values and proportions are presented for variables abstracted from dissertation data. Percentages are rounded to whole numbers. We assumed that there was a proportionate distribution of men and women in the "unknown" and "missing" categories for gender of author and adviser.

This study describes a census collection of doctoral dissertations related to human nutrition submitted in Canada and the United States from 1986 through 1995. Review of this body of work suggests trends and directions that the profession may follow into the 21st century; doctoral research is an approximate indicator of research growth and activity in a discipline (7). The review may also demonstrate the need to promote initiatives deemed important to the profession, such as research links between universities and clinical environments (6).

## METHODS

A review of dissertation research relies on bibliometrics, the "application of mathematics and statistical methods to books and other media of communication" (8, p 348). This process has been used in other disciplines to monitor the scholarly output of a discipline (7) and to identify trends in a professional domain of research (9,10). Such a review has led to recommendations to promote changes within a field, such as recruitment of more women into a profession (10) or placement of greater emphasis on specific areas of research considered relevant to practice (11).

The doctoral dissertation abstract is a relatively brief summary (350 words) of the whole thesis. Typically, the abstract provides the objectives of the research project, basic procedures (eg, study design, sample, number of subjects, analytic methods), results, and conclusions (12). A review of doctoral dissertation abstracts in a discipline can provide a comprehensive picture of recent research advances and trends (11).

### Selection of Abstracts

To describe doctoral-level research in human nutrition, dissertation abstracts completed from 1986 through 1995 were reviewed. Abstracts were available on CD-ROM from the *Dissertation Abstracts International* database (Ann Arbor, Mich: University Microfilms; 1997). This database has been used by others to monitor trends in a discipline (11). The CD-ROM version of these abstracts is updated on a quarterly basis (13) and contains research from approximately 550 universities in Canada, the United States, and Europe (added in 1988). The database is nearly complete for North America, less so for Europe.

When a graduate student submits a dissertation, he or she completes an identifying form required for indexing the thesis. This form requests the author's name, name of institution, type of degree, date of degree, adviser's name, and subject indexing codes. The student selects subject area codes from a predefined list provided by University Microfilms; a maximum of 3 codes can be used for classification of the dissertation. Typical stem codes include health sciences, agriculture, education, and psychology. Within a category such as health sciences, several subcategories are defined, including nutrition (ie, Health Sciences, Nutrition 0570).

The subject area code Health Sciences, Nutrition (0570) was used as the search field within the database (13). Doctoral dissertations with this code as 1 of the possible 3 codes listed were extracted. Eligible abstracts were those for which the record was complete, the abstract was written in English, the university was Canadian or American, and the doctoral degree awarded was a PhD, ScD, EdD, or DrPH. European abstracts were excluded because a large number of institutions are not included in the database. This search identified 2,044 abstracts.

A preliminary sample of 50 abstracts was reviewed to determine which study variables could be readily extracted from most submissions. Data believed to best describe nutrition

research over the 10-year period were extracted by 2 trained graduate students in applied human nutrition at the University of Guelph (Guelph, Ontario, Canada). Data extracted included dissertation number, university number, gender of student author, degree awarded, year dissertation was published, number of pages, co-codes for subject area (subject codes other than human nutrition from abstracts with more than 1 subject code), gender of adviser, structured abstract (yes or no), human application of study (yes or no), sample type (eg, animal, human being, in vitro), animal model used, gender of human sample, age of human subjects, international data collection (yes or no), and primary and secondary topics of the dissertation. To determine inter-rater reliability, 50 abstracts were randomly selected and analyzed by both reviewers and selected variables were compared. Inter-rater reliability was generally good to excellent ($\kappa$=.32 to 1.0).

Gender of the dissertation author and gender of the adviser were determined based on the first name listed. In abstracts where only initials were given, where people had unisex names, and where male or female gender could otherwise not be unambiguously identified from the name, gender was listed as "unknown." A structured abstract was defined as one in which headings were used throughout the abstract (ie, hypothesis, methods, conclusions). Because of the large number of co-codes for subject areas, 6 general areas were defined: health, family, agriculture, anthropology, biology, and education. Topic areas (defined by H.H.K. and T.Ø.) considered the primary focus of the dissertation included growth, anthropometrics, dietary habits, dietary methodology, malnutrition/nutritional status, biochemical markers, exercise, obesity/weight loss, micronutrients, hypertension, cancer, cardiovascular disease, education, theoretical constructs (eg, educational theory, marketing models), and "other."

### Analyses

A complete census of all submitted doctoral dissertations from Canadian and American universities with English abstracts was used; therefore, analyses were descriptive and no statistical tests were performed. Primary analyses involved frequencies and proportions of the sample. Gender differences, temporal trends, and differences among the top 10 producers of doctoral dissertations were explored by comparing frequencies.

## RESULTS

Table 1 presents descriptive data as absolute values and proportions for the entire sample. The number of doctoral dissertations written each year increased from 172 in 1986 to 234 in 1995, and most were for PhD degrees. Less than 5% of the dissertations considered came from Canadian institutions. More than 50% of doctoral students completing a dissertation during this 10-year period were women. If it is assumed that the unknown category for gender of the author (22%) was proportionally distributed between male and female students, there were almost 5 female students to every 2 male students conducting human nutrition research. Most advisers during this time period were male, although approximately 33% of abstracts did not include the name of the adviser. Most abstracts (97%) were unstructured and 97% had a focus that clearly applied to the human population (data not shown). More than 50% of the sample types were human, and about 9% of the sample was international.

### Male and Female Doctoral Students

The proportion of male students completing dissertations changed little over the 10-year period: from a low of 16% in 1989 to a high of 27% in 1991. Male graduate students appeared more likely to have male advisers (45%) than female students did (29%) (Table 2). Female students were more likely to select health as a co-code, whereas male students were more likely to select biology and agriculture co-codes for the subject area of their dissertation. Male students were more likely than female students to use in vitro (11%) or animal samples (36%), whereas female students predominantly used human subjects (64%) in their studies. The top 3 topics for dissertations written by male students were micronutrients, biochemical markers, and exercise. For women, the top 3 topic areas were micronutrients, education, and theoretical constructs.

Trends in doctoral human nutrition research conducted in North America over a 10-year period suggest an increased proportion of female graduate students in nutrition sciences, an increase in applied research, and a decrease in basic science research

### Trends over Time

Co-codes for subject area provided more detail about the topic of the dissertation (Table 3). More than 50 co-codes were used in the 2,044 dissertations, but to facilitate comparisons, 6 general areas were derived: health, family, agriculture, anthropology, biology, and education. In 1986, most students did not select any co-code to help identify their dissertation, but over the 10-year period, more students used co-codes. By 1995, all but 14% of dissertations were identified by more than one code. It is difficult to identify changes over time within the 6 general co-codes because of the large overall increase in use of codes. It seems, however, that the use of the health and biology co-codes increased the most and continued to increase after the major jump in co-code use in 1989.

The primary topic area in which dissertation hypotheses were based also appeared to change over time. In the 1990s an increase occurred in the exploration of theoretical constructs and dietary habits. Areas that became less popular were malnutrition/nutritional status, obesity/weight loss, and micronutrients.

**Table 2**
Proportional gender differences in doctoral research from 1986 through 1995 (number of abstracts=1,587)[a]

| Variable | Male (n=440) | | Female (n=1,147) | |
|---|---|---|---|---|
| | % | No. | % | No. |
| **Gender of adviser** | | | | |
| Male | 45 | 199 | 29 | 334 |
| Female | 13 | 57 | 29 | 331 |
| **Co-code subject area** | | | | |
| Health | 16 | 69 | 21 | 241 |
| Family | 4 | 16 | 7 | 81 |
| Agriculture | 15 | 65 | 6 | 65 |
| Anthropology | 3 | 11 | 3 | 32 |
| Biology | 15 | 65 | 7 | 84 |
| Education | 5 | 23 | 9 | 100 |
| **Sample type** | | | | |
| Human | 43 | 188 | 64 | 737 |
| Animal | 36 | 158 | 25 | 283 |
| In vitro | 11 | 47 | 4 | 50 |
| **Gender of human sample** | | | | |
| Female and male | 23 | 100 | 36 | 417 |
| Female | 9 | 38 | 22 | 252 |
| Male | 8 | 36 | 3 | 40 |
| Not applicable | 55 | 244 | 33 | 384 |
| **Age of human sample** | | | | |
| Infant/child | 7 | 24 | 8 | 92 |
| Adolescent | 2 | 7 | 4 | 44 |
| Senior | 1 | 4 | 4 | 41 |
| General/adult | 33 | 143 | 47 | 535 |
| **Topic of dissertation** | | | | |
| Micronutrients | 10 | 45 | 11 | 127 |
| Biochemical markers | 8 | 32 | 4 | 45 |
| Cancer/CVD/HTN[b] | 8 | 37 | 7 | 83 |
| Dietary habits | 3 | 13 | 5 | 54 |
| Malnutrition | 2 | 9 | 3 | 29 |
| Exercise | 5 | 21 | 2 | 20 |
| Obesity/weight loss | 1 | 4 | 3 | 30 |
| Education | 2 | 9 | 6 | 69 |
| Theoretical constructs | 4 | 17 | 5 | 56 |

[a]Proportion of men and women and absolute number of abstracts are presented for variables of interest. Proportions are rounded to whole numbers. This table excludes those with gender unknown. Proportions do not add up to 100% because of omission of variable labels with minimal representation or exclusion of "other," "unknown," and "not applicable" groups.
[b]Cancer, cardiovascular disease (CVD), and hypertension (HTN) combined.

### Top 10 Universities

The 10 universities in the United States that produced the most doctoral dissertations between 1986 and 1995 were Cornell University (n=144); University of California, Davis (n=73); University of Illinois at Urbana/Champaign (n=70); University of Arizona (n=56); Pennsylvania State University (n=56); University of Nebraska (n=54); Texas Woman's University (n=52); Ohio State University (n=51); University of California, Berkeley (n=50); and University of Connecticut (n=47) (Note: university code did not specify campus location for all universities) (Table 4). There were more female than male doctoral graduates in nutrition at most of the 10 universities; the highest proportion was at Texas Woman's University and the lowest was at the University of Arizona. The amount of missing information on adviser gender differed considerably among universities; thus, meaningful comparisons cannot be made. At the universities of Arizona, California (Davis and Berkeley), and Illinois, animal samples were used more frequently than human samples. The University of Connecticut had the greatest proportion of dissertations focusing on a senior population, whereas Cornell University had the largest proportion of theses focusing on children and infants.

The most common topic area at all 10 of the universities was the study of micronutrients (data not shown). The University of Arizona, Cornell University, and Texas Woman's University had a greater proportion of students completing dissertations that emphasize health, as indicated by selection of health as a co-code. Family was frequently selected as a co-code at the University of Connecticut and Penn State University. Students at Connecticut frequently used co-codes in the area of anthropology, whereas agriculture was a common co-code at Cornell University and University of Illinois. Biology was a common code at most universities except Nebraska, Cornell, Connecticut, and Texas Woman's. All 10 of these universities are state or public institutions, and all but one (Texas Woman's) have been or are affiliated with a medical school.

## DISCUSSION

A primary limitation of this project was the format of data collection. Use of bibliographic techniques for data collection requires correct identification of trends from only written documentation. In the case of dissertation abstracts, it is possible that some dissertations were missed, especially if an abstract was not completed and only a bibliographic file was submitted. We think, however, that the number of missing abstracts was small and did not bias data collection. As the abstracts analyzed were limited to human nutrition (0570) subject codes, it is possible that dissertations that had a human nutrition application were missed if this coding was not used. Most likely this happened in the areas of basic science where the link to human nutrition applications may be more tenuous.

Another limitation in data collection was identification of gender of authors or advisers by their first name. Only clearly male or female names were categorized; thus, there were many unknowns in the gender category. We assumed, however, that a proportionate number of the missing or unknown gender for authors and advisers were men and women.

Topic areas were selected on the basis of a review of 50 abstracts. The primary topic area for the dissertation did not always fit readily into the 14 preselected areas, as shown by the large number of topics classified as "other." In future studies perhaps coding of topic areas should be done after all the data are reviewed.

In 1994 the Institute of Medicine published a review of nutrition and food science research and identified 5 promising areas for research (2): nutrients and biologically active food

**Table 3**
Common topic areas of doctoral dissertations from 1986 through 1995 (n=2,044)[a]

| Variable | 1986-87 (n=341) | | 1988-89 (n=333) | | 1990-91 (n=408) | | 1992-93 (n=479) | | 1994-95 (n=483) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | No. | % | No. | % | No. | % | No. | % | No. |
| **Co-code** | | | | | | | | | | |
| Health | 9 | 30 | 11 | 37 | 24 | 98 | 24 | 115 | 23 | 111 |
| Family | 3 | 10 | 5 | 17 | 5 | 20 | 8 | 38 | 4 | 19 |
| Agriculture | 3 | 9 | 11 | 38 | 12 | 49 | 11 | 53 | 13 | 62 |
| Anthropology | 3 | 11 | 2 | 7 | 2 | 8 | 2 | 10 | 4 | 18 |
| Biology | 5 | 17 | 7 | 23 | 6 | 24 | 9 | 43 | 16 | 77 |
| Education | 9 | 31 | 7 | 24 | 5 | 20 | 4 | 19 | 8 | 39 |
| Other | 7 | 24 | 18 | 61 | 20 | 82 | 18 | 86 | 18 | 87 |
| No area | 61 | 209 | 37 | 126 | 26 | 107 | 24 | 115 | 14 | 70 |
| **Topic** | | | | | | | | | | |
| Micronutrients | 28 | 96 | 22 | 73 | 16 | 67 | 15 | 73 | 11 | 55 |
| Biochemical markers | 9 | 29 | 1 | 3 | 5 | 19 | 16 | 75 | 6 | 28 |
| Growth | 3 | 10 | 3 | 10 | 1 | 4 | 2 | 8 | 6 | 29 |
| Cancer | 7 | 23 | 3 | 10 | 5 | 20 | 5 | 25 | 8 | 38 |
| Cardiovascular disease | 5 | 17 | 5 | 17 | 9 | 35 | 3 | 15 | 6 | 30 |
| Education | 8 | 26 | 7 | 23 | 5 | 21 | 8 | 39 | 6 | 28 |
| Theoretical constructs | 3 | 11 | 1 | 3 | 8 | 33 | 12 | 56 | 11 | 53 |
| Dietary methodology | 1 | 2 | 2 | 7 | 0 | 0 | 1 | 5 | 2 | 10 |
| Anthropometrics | 1 | 5 | 1 | 3 | 0 | 0 | 1 | 6 | 7 | 35 |
| Dietary habits | 3 | 11 | 4 | 13 | 8 | 32 | 7 | 34 | 13 | 61 |
| Malnutrition/nutritional status | 4 | 12 | 8 | 26 | 6 | 24 | 2 | 10 | 1 | 5 |
| Exercise | 4 | 12 | 3 | 11 | 6 | 23 | 3 | 15 | 4 | 19 |
| Obesity/weight loss | 3 | 9 | 5 | 18 | 4 | 17 | 3 | 16 | 1 | 6 |
| Hypertension | 2 | 7 | 2 | 7 | 1 | 3 | 0 | 0 | 2 | 9 |

[a]Proportions and absolute values are presented. Proportions are rounded to whole numbers. Co-codes are subject identifiers selected by authors; up to 3 codes could be chosen to describe content area of dissertation. Human nutrition was a code for all dissertations included in this sample; co-code groups provide additional information about content of dissertation. Proportion of topic variable does not sum to 100% as group labeled "other" was excluded. Years of dissertation research were grouped for simplicity of comparison.

constituents; genes, food, and chronic disease; determinants of food intake; improving food and nutrition policies; and enhancing the food supply. As seen in Table 3, many of the topics of dissertation work during the past decade embody these 5 themes. Nevertheless, it appears that there has been an increase in applied topics (eg, dietary habits, education) and a decrease in basic science topics (eg, micronutrients). This inference may, however, reflect the selection process of abstracts for this review; basic scientists may not use a human nutrition subject code, despite this application for their work. On the other hand, the trend toward a decrease in basic science topics may be real and could reflect gender changes within this area of research during the past 3 decades (14).

Despite the apparent increase in applied research, the investigation of nutrition and disease conditions continues to be a minor part of the research focus of graduate students. This may be due to several factors. Dietetics graduates are less likely than nutrition scientists to attend graduate school (2). There may be inadequate contact between therapeutic environments and universities or biases in funding agencies that traditionally support nutrition research. The Institute of Medicine has suggested that clinical nutrition research is undervalued and underfunded (2). Several recommendations to promote a closer link between dietetics practice and graduate-level research have been suggested: develop and support research programs for clinical nutrition; work with universities to develop doctorate-level research programs focused on clinical and community service needs; foster collaboration between universities and teaching hospitals; determine barriers to scientific careers in clinical nutrition; and develop clinical research fellowships (6).

In 1976 there were equal numbers of male and female graduate students in nutrition and food sciences (14). Between 1976 and 1992, a shift occurred toward 2 times as many female graduate students (14). We found that female students predominated in doctoral dissertation work in human nutrition conducted from 1986 through 1995. The predominance of women may have influenced the change in emphasis to applied research from basic science research as female students tend to study applied topics in human samples (Table 1). The differences between male and female graduate students, especially in regard to topic area and type of sample studied, are notable. In general, female students focused on human samples and applied science topics (eg, education, theoretical constructs). Male students studied biochemical markers and exercise and preferred to use in vitro and animal samples. These findings may reflect salient differences in male and female students or their advisers; male students were more likely to have male advisers than female students. Previous work has also identified differences in area of study by gender of graduate student (14).

The decrease in proportion of dissertations focusing on micronutrients and malnutrition/nutritional status may reflect excess costs in using the complex methodologies required, a change in emphasis by funding agencies, or less interest in these more basic areas of research by students or advisers. The decrease in dissertations in the area of obesity/weight loss is of concern. As obesity continues to be a major health problem in

**Table 4**
Universities producing most doctoral dissertations from 1986 through 1995[a]

| Variable | Cornell University (n=144) | | University of California, Davis (n=73) | | University of Illinois (n=70) | | University of Arizona (n=56) | | Pennsylvania State University (n=56) | | University of Nebraska (n=54) | | Texas Woman's University (n=52) | | Ohio State University (n=51) | | University of California, Berkeley (n=50) | | University of Connecticut (n=47) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. |
| **Author gender** | | | | | | | | | | | | | | | | | | | | |
| Female | 54 | 77 | 59 | 43 | 54 | 38 | 27 | 15 | 54 | 30 | 46 | 25 | 89 | 46 | 51 | 26 | 62 | 31 | 57 | 27 |
| Male | 21 | 30 | 27 | 20 | 24 | 17 | 27 | 15 | 25 | 14 | 6 | 3 | 2 | 1 | 16 | 8 | 20 | 10 | 23 | 11 |
| **Sample type** | | | | | | | | | | | | | | | | | | | | |
| Human | 63 | 91 | 22 | 16 | 24 | 17 | 34 | 19 | 63 | 35 | 57 | 31 | 63 | 33 | 61 | 31 | 38 | 19 | 75 | 35 |
| Animal | 22 | 32 | 66 | 48 | 53 | 37 | 43 | 24 | 25 | 14 | 39 | 21 | 37 | 19 | 31 | 16 | 40 | 20 | 17 | 8 |
| In vitro | 8 | 12 | 7 | 5 | 10 | 7 | 14 | 8 | 9 | 5 | NA[b] | | NA | | 2 | 1 | 12 | 6 | 6 | 3 |
| **Age of sample** | | | | | | | | | | | | | | | | | | | | |
| Infant | 13 | 19 | 4 | 3 | 6 | 4 | 2 | 1 | NA | | NA | | NA | | 2 | 1 | 2 | 1 | NA | |
| Child | 17 | 24 | 3 | 2 | 1 | 1 | 5 | 3 | 9 | 5 | NA | | 8 | 4 | 4 | 2 | 2 | 1 | 11 | 5 |
| Senior | 3 | 4 | NA | | NA | | 2 | 1 | 7 | 4 | 6 | 3 | 4 | 2 | 4 | 2 | NA | | 11 | 5 |
| **Co-codes** | | | | | | | | | | | | | | | | | | | | |
| Health | 24 | 35 | 7 | 5 | 11 | 8 | 23 | 13 | 11 | 6 | 4 | 2 | 29 | 15 | 14 | 7 | 16 | 8 | 17 | 8 |
| Family | 1 | 1 | 3 | 2 | NA | | 2 | 1 | 9 | 5 | 2 | 1 | 4 | 2 | 6 | 3 | 6 | 3 | 9 | 4 |
| Agriculture | 15 | 22 | 11 | 8 | 20 | 14 | 13 | 7 | 4 | 2 | 13 | 7 | NA | | 12 | 6 | NA | | 4 | 2 |
| Anthropology | 1 | 2 | 1 | 1 | NA | | 4 | 2 | 2 | 1 | NA | | NA | | NA | | 6 | 3 | 13 | 6 |
| Biology | 4 | 6 | 11 | 8 | 21 | 15 | 16 | 9 | 21 | 12 | 2 | 1 | 8 | 4 | 16 | 8 | 16 | 8 | 6 | 3 |
| Education | 3 | 4 | NA | | 1 | 1 | NA | | 13 | 7 | NA | | 8 | 4 | 12 | 6 | 2 | 1 | 2 | 1 |
| None | 33 | 48 | 51 | 37 | 23 | 16 | 25 | 14 | 23 | 13 | 76 | 41 | 40 | 21 | 24 | 12 | 38 | 19 | 34 | 16 |

[a]Proportions are rounded to whole numbers and do not sum to 100% within cells due to omission of "unknown," "other," and categories that varied minimally among universities. Frequencies are given in parentheses. We assumed a proportionate distribution of men and women in the unknown and missing categoreis for gender of author.
[b]NA=not applicable.

North America, further research by nutrition specialists should be promoted. The increase in dissertations that focus on education or theoretical constructs is noteworthy; this may indicate an appreciation of how the basic science of nutrition is transferred to human populations.

As identified by the Institute of Medicine, a key strength of nutrition and food science as an area of research is its interdisciplinary nature (2). Although co-codes were not used extensively until about 1989 (Table 3), this review demonstrates that human nutrition research is indeed interdisciplinary and viewed by researchers as such. The increasing use of co-codes in the 10-year period reviewed may even indicate that nutrition research is becoming more interdisciplinary.

In 1989 the American Institute of Nutrition estimated that there were approximately 600 nutrition doctoral candidates in American universities (2). Between 1970 and 1992 a steady increase occurred in the number of doctoral dissertations related to nutrition (14). This review suggests that the peak of productivity in the area of human nutrition research has yet to be reached. There are more than 120 departments of nutrition in North America (2). Universities conduct a wide variety of nutrition research, although each of the top 10 universities appears to focus on a few key areas. Such diversity in research can lead to an identity crisis within this discipline (2). The Institute of Medicine has suggested that the infrastructure of educational institutions be examined to ensure that they are keeping abreast of research needs as the science of nutrition continues to advance, and that institutions continue to encourage interdisciplinary research and develop medical-nutrition curriculums (2).

## CONCLUSIONS

Trends in doctoral human nutrition research conducted in North America over a 10-year period suggest an increased proportion of female graduate students in nutrition sciences, an increase in applied research, and a decrease in basic science research. Most graduate advisers continue to be men, although female graduate students are more likely than male students to have female advisers. Although health-related topics appear to have increased during the years 1986 through 1995, disease-specific research continues to be a minor component of dissertation research in human nutrition in North America. ■

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# Applied research: Clinicians driving dietetics forward

Remember when nutrition investigators shied away from research topics like dietary habits, considering applied research somehow softer than research focused on basic science? Yes? So does **Nancy Lewis,** PhD, RD, FADA, associate professor in the Department of Nutritional Science and Dietetics at the University of Nebraska, Lincoln, and chair of the Research dietetic practice group (DPG), who did her postdoctoral research in a laboratory. Now she is witnessing many exciting changes in the field of applied dietetics research: "Today there is much more recognition that important information can be gained from research carried out in the practice setting." Acknowledgment of the value of applied research is encouraging for established dietetics professionals and graduate students just striking out into their careers.

### When Researchers and Clinicians Collaborate

This attitude shift in the academic community about the viability of applied research has helped put all nutrition scientists on more equal footing, according to Lewis. This development ultimately means more dynamic and powerful collaboration between researchers and clinicians. Lewis points out the potential for bridging the gap that too often isolates the university from the clinical setting. For example, she is currently partnering with 2 other dietitians in private practice. Together, they are writing a grant to study childhood obesity. Lewis gives expert assistance with the literature review and statistical analyses, and the clinicians offer their field experience in treating this disease and provide access to the necessary study population. Creative partnerships like this one are important for moving dietetics research forward.

### Networking Works

Lewis recalls her early involvement with the Research DPG. When she was still a student, they gave her a travel grant to attend The American Dietetic Association's Annual Meeting and Exhibition and present her research, a gesture that made her feel her work was "legitimate" and gave her the confidence to take the next step in her education. Lewis urges dietetics professionals to become more involved with each other and within their specialty. Becoming active in a DPG, alumni group, or other professional association helps keep dietitians involved in the direction their field is taking and opens doors to opportunity. It also positions them to provide support to colleagues and aspiring students. "It is so important to encourage presentations at Annual Meeting," says Lewis. Even simply establishing an E-mail interchange with a person regarded as a mentor, protege, or colleague can be supportive and professionally refreshing.

### Finding Funding

Besides needing the enthusiasm, ingenuity, and scholarship of talented investigators, research projects require funding. How does an eager dietetics researcher find the monetary support needed to become involved in research? Lewis recommends keeping current on published studies, paying attention to the names of authors and the institutions where a topic of interest is being explored, and actually contacting authors to find if they have funding and if they need help. Locating and securing research monies does not have to be a mysterious phenomenon. At the University of Nebraska, Lewis's students are required to write their own research grant as part of their graduate studies.

### The Future of Applied Research

Lewis is excited about the ongoing development of a so-called "common language" that will help standardize an approach to conducting clinical research. Using *minimum data sets* (the name for this new study design protocol) as a basis for clinical investigations requires much painstaking research. Researchers focus and report on 5 areas: evidence (eg, body weight and intakes), diagnosis (eg, altered body composition), etiology (eg, consumption), intervention (ie, the clinical plan), and outcomes (ie, results or changes). Although these areas are not themselves new elements of nutrition research, it is only with minimum data sets that all are required simultaneously. This regimented protocol raises the bar on practice-based research.

Lewis sees great promise for the future of applied research in dietetics: in the new spirit of collaboration between researchers and clinicians; in increasingly available funds for research in the practice setting; in broader opportunities for graduate students to become involved with clinical research projects; and in a universal application of a common language for clinical researchers. The interplay between these positive developments will further invigorate applied research and propel it forward.