A Delphi Study to Update the American Dental Hygienists' Association National Dental Hygiene Research Agenda

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Abstract

Objective: The American Dental Hygienists' Association (ADHA) National Dental Hygiene Research Agenda (NDHRA) is a working document that guides research efforts of the dental hygiene profession. The purpose of this study was to update the NDHRA to reflect current research priorities aimed at meeting national health objectives and to systematically advance dental hygiene's unique body of knowledge.

Methods: Forty-nine dental hygiene experts and key opinion leaders representing all domains of the profession participated in the Delphi study to update and gain consensus on the NDHRA. The study was carried out electronically in 3 phases: a development phase, 2 rounds of mailed questionnaires to gain consensus on topics during the second phase, and a third phase to prioritize topics. Responses were analyzed using descriptive statistics and instrument reliability was analyzed using the Pearson Product Moment Correlation Coefficient and Cronbach's Alpha for internal consistency.

Results: One hundred twelve topics reflecting the research agenda categories were identified during Phase I. Through Phase II, 36 topics were eliminated and consensus was reached on 42 of the remaining 76 topics. Return rates of 95% and 100% were achieved for the 2 survey rounds. Instrument reliability was established at .76 and internal consistency at .87. During Phase III participants attempted to rank the 42 topics as to their level of priority, however results of this phase were not usable.

Each category comprising the NDHRA was represented by the 42 topics. Thus, consensus on the national agenda was achieved. Ideally, identified priorities on the revised NDHRA will be used to direct future research efforts, identify research funding initiatives, and guide education and practice. This project was funded by the ADHA.

Key words: dental hygiene research agenda, Delphi study, research

Introduction

In 1993, the ADHA Council on Research (COR) conceptualized the ADHA National Dental Hygiene Research Agenda (ADHA NDHRA), a working model that serves as a fundamental tool for guiding research efforts to purposefully expand the profession's body of knowledge (Appendix 1). In addition, the Agenda was created to encourage collaborative research, and to guide education and practice.[1] Development of a national research agenda is a strategy other health professions have used successfully to create their own unique body of knowledge and thus establish themselves as primary care providers in the health care arena.

Consensus on 37 specific research topics for the NDHRA was reached in 1995.[2] Using the Delphi technique, investigators from the National Center for Dental Hygiene Research (NCDHR) surveyed 48 dental hygienists nationwide with expertise in research, education, and practice to identify those topics deemed appropriate for testing the ADHA National Dental Hygiene Research Agenda. Through 3 extensive study phases, the panel initially identified 66 of 141 topics for investigation, and achieved consensus on 37 of these topics (Appendix 2). The investigational team from the NCDHR reported that each of the 5 categories from the ADHA agenda "was well represented by the 37 topics."[2] This landmark study was the first and only published study of its kind to identify research priorities for the dental hygiene community that can be used to test and validate the ADHA agenda.

In 2000, participants attending the Fourth ADHA National Dental Hygiene Research Conference were charged by the ADHA COR to discuss the prioritization of the existing agenda.[3] Participants reached con-

Appendix 1. The National Dental Hygiene Research Agenda (1994)

The ADHA National Dental Hygiene Research Agenda was created to address 5 primary objectives:

1. To give visibility to research activities which enhance the profession's ability to promote the health and well-being of the public;
2. To enhance research collaboration among the dental hygiene community and other professional communities
3. To communicate research priorities to legislative and policy-making bodies;
4. To stimulate progress toward meeting national health objectives; and
5. To translate the outcomes of basic science and applied research into theoretical frameworks which form the basis for education and the practice of dental hygiene.

Five categories were created under which research priorities were to be identified:

HEALTH PROMOTION/DISEASE PREVENTION – priorities concerned with health maintenance, disease prevention, public health policy, advocacy and legislation
EDUCATION – priorities concerned with theory development, educational models, curricula, students and faculty
CLINICAL/PRIMARY CARE – priorities addressing dental hygiene intervention, decision-making, dental hygiene diagnosis, quality of care, practice settings and interdisciplinary collaborative practice models
INDIVIDUALS/POPULATIONS – priorities which focus on the special needs of ethnic groups, children, the elderly, the poor and other target groups
BASIC/APPLIED SCIENCES – priorities which establish new knowledge and/or test existing theory in laboratory, field, clinical and educational settings

sensus that the 5 broad categories outlined in the 1994 agenda were still relevant and representative of the entire scope of dental hygiene research. After reviewing the information obtained from participant working groups and a review of *Healthy People 2010* and *Oral Health in America: A Report of the Surgeon General*, several specific topic areas were identified as priorities for future dental hygiene research efforts.[4,5] The 2000-2001 COR put forth a recommendation to ADHA that priority should be given to research related to 1) health services, 2) access to care/underserved populations, and 3) health promotion/disease prevention.[3]

However, identifying research priorities is only the first step in the process of building the body of knowledge. Long-range planning is needed to guide research efforts and to promote the purposeful development of a unique body of knowledge for the profession. A long-range plan must be broad enough in scope to address the multiple needs of the dental hygiene community, and serve as a means for securing the data necessary for accomplishing the goals of the ADHA Strategic Plan. To this end, dental hygienists must work together to gather information in a logical and structured manner in order to have the database capability to answer important questions related to the profession.

The establishment of a common research orientation is essential in order for the dental hygiene profession to systematically advance its scientific base and stimulate national research efforts.[2] Given that over a decade has passed since the only formal study was conducted to validate the priorities of the existing NDHRA, the present study was conducted to re-examine the categories and topics to determine whether these priorities reflect current global health care issues as well as issues that impact the profession today.

Limitations of the Existing Agenda

After careful examination, the investigators determined that the existing agenda appears to adequately address the needs of the profession and the needs of the community, as it targets national health issues. This focus is both relevant and appropriate. The majority of work efforts should be aimed at meeting national health objectives. However, the agenda fails to address characteristics of the profession, dental hygienists' own personal needs, and other relevant people issues. These issues extend beyond the contributions to the profession itself and to clients and communities. Specifically, these research issues address how dental hygienists are promoting their own health and well-being in terms of their personal and occupational safety and wellness. Further, research priorities identified outside of the profession for evaluating women's health needs apply directly to dental hygienists, who are predominately female. Dental hygiene investigators should also study how significant health issues affect the population of dental hygienists, and the quality of their personal and professional lives.

These issues are directly relevant to the recruitment and retention of dental hygienists in the workforce. It is important to note that there are many existing studies that have focused upon characteristics, attitudes, and behaviors of dental hygienists. However, little documentation that links these study results to recruitment and retention issues has been derived from this body of re-

Appendix 2. ADHA National Dental Hygiene Research Agenda 37 Topics (initial Delphi Study Results, 1995)

Health Promotion/Disease Prevention

Priorities concerned with health maintenance, disease prevention, public health policy, advocacy and legislation.

1. Assess the effectiveness of the communication process between the client and dental hygienist that leads to oral wellness.
2. Assess the effectiveness of dental hygienists in counseling patients regarding prevention and cessation of tobacco use.
3. Explore public policy issues related to oral health care.
4. Identify, describe and explain ways to promote equitable access to oral health care.
5. Assess the cost-effectiveness of various oral health interventions (fluorides, sealants) in promoting oral health.
6. Develop and test easy to use self-assessment instruments to assist individuals of all ages in learning the signs and symptoms of oral diseases.
7. Investigate ethnic/cultural group differences as they relate to the promotion of oral health and preventive behaviors.
8. Investigate legislative initiatives on issues such as those that promote autonomy and decision-making by dental hygienists.
9. Investigate the concept of oral health self-care among all age, social and cultural groups.
10. Describe, explain or predict the relationship between environmental factors (culture, society, income, education) and oral health behaviors.
11. Explain or predict client oral health attitudes, knowledge and behavior.
12. Assess the impact of third parties on access to and utilization of oral health care services.
13. Identify ways in which the unique role of the dental hygienist in the health care delivery system can be effectively communicated. .

Education

Priorities concerned with theory development, educational methods, curricula, students and faculty.

1. Develop a predictive model for future needs/demands for dental hygiene personnel.
2. Identify the factors leading to curriculum modification and reform in dental hygiene academic programs.
3. Investigate the extent to which new research findings are incorporated into the dental hygiene curriculum.
4. Investigate the extent to which students are taught critical thinking and decision-making skills.
5. Investigate the extent to which students are taught self-assessment and evaluation skills.

Clinical/Primary Care

Priorities addressing dental hygiene intervention, decision making, dental hygiene diagnosis, quality of care, practice settings, and interdisciplinary collaborative practice models.

1. Investigate the impact and effectiveness of alternative dental hygiene practice settings.
2. Assess methods of evaluating competency in dental hygiene.
3. Develop valid and reliable measures to be used in oral health research.
4. Assess the impact of emerging technology used by dental hygienists on the health outcomes of clients.
5. Design and evaluate alternative models for the delivery of oral health care.
6. Assess client compliance with recommended oral health care regimens.
7. Examine the extent to which knowledge derived from basic science and clinical research is used in clinical reasoning.
8. Assess compliance with established standards of practice by dental hygiene practitioners.

search. The dental hygiene research community is cautioned that while additional research is needed in the areas described above, the majority of dental hygiene research effects should remain focused on identified priorities that address national health objectives that improve the oral health of the public.

Other limitations included the repetition of topics under one or more categories of the agenda. This redundancy has contributed to difficulty in using the agenda by researchers, academicians, students, and clinicians. In addition, many new areas of global interest to the oral health care community are not represented on the existing agenda. Some specific examples include issues related to cultural competency, oral health literacy, technology use in practice, and occupational health and safety.

In order to align the NDHRA with those of other professional organizations, the existing agenda was updated and validated using the Delphi study technique. The Delphi technique was selected as an appropriate strategy to use, as it is a well accepted scientific method for obtaining group consensus in education, medicine, nursing, allied health, business, and the social sciences.[6-17]

The Delphi Technique

The Delphi study technique was developed by the RAND Corporation in the 1950s as a tool to predict short-term future events and technology in government and industry.[18,19] This method relies on the convergence of expert opinion to arrive at insights into a subject when empirical evidence is not

number of rounds, usually 2 to 4, depends upon the time needed to reach consensus or to agree that consensus is not possible.[23,24] If not achieved by the fourth round, consensus may not be reached, although the majority and minority opinions will typically be clear by that time.

The Delphi technique offers a number of advantages. The method is well-accepted for reaching consensus on complex, controversial, and abstract content.[25,26] The anonymity provided permits the involvement of individuals who might not work together under different conditions.[19,23] Anonymity also allows respondents to express their views freely and minimizes the possibility of one individual influencing the opinion of others.[23] The technique is cost-effective because the investigator may work with individuals located in different geographic areas.[19] Finally, the process encourages reflective thinking, openness to new ideas and opinions, and sharing of responsibility for the outcome.[19,23,26]

The Delphi technique also has some weaknesses, including the process being slow and time-consuming.[25,26] Expert opinion used as the basis for forecasting is not always distinguishable from non-expert opinion.[27] However, "for findings to be accepted, members should be representative of their profession, unlikely to be challenged as experts, and have the power to implement the findings should they choose."[24]

The Delphi technique has been used in education, medicine, dentistry, nursing, and allied health as a method for determining curriculum content, developing skill sets and competencies for health care providers, establishing health policy and identifying research priorities for the health professions.[3,7,9,10-15,17,21,26,28] In nursing, the Delphi technique has been used by several investigators to determine research priorities that were later used in the development of the National Nursing Research Agenda (NNRA).[13,15,29] Because these priorities had been identified through group consensus and expert opinion, they were considered representative of the highest priority items for nursing research. This technique also was used in 1995 to validate the first ADHA NDHRA and again in this study to reach consensus on the importance of topics reflecting each of the 5 categories of the NDHRA.[2] Consensus was defined in terms of the mean, median, and mode.

Individuals/Populations

Priorities which focus on special needs of ethnic groups, children, the elderly, the poor and other target groups.

1. Develop and test methods of primary prevention in adult populations at risk for primary and secondary enamel and root caries, with special attention to compromised, handicapped and institutional groups.
2. Develop and test methods for early diagnosis and screening of oral diseases for individuals at high risk for dental caries, periodontal diseases, and oral cancer.
3. Evaluate the efficacy of various oral hygiene regimens with institutionalized, handicapped, or otherwise compromised patients.
4. Develop and test preventive measures to reduce the incidence of oral disease in special at-risk populations.
5. Examine the prevention, diagnosis, and treatment of oral disease in underserved and at-risk populations.

Basic/Applied Sciences

Priorities which establish new knowledge and/or test existing theory in laboratory, field, clinical and educational settings.

1. Explore the effects of dental hygiene therapy on pathogenesis, wound healing and tissue repairs.
2. Test new products for use in dental hygiene practice.
3. Develop valid and reliable measures of quality dental hygiene care.
4. Test theoretical concepts in dental hygiene.
5. Assess the outcomes of client oral health self-care behaviors.
6. Develop assessment tools which provide indicators of dental hygiene care outcomes.

available.[20] The Delphi technique is adaptable to a variety of research questions, and has been used in formative evaluation, needs assessment, goal identification, priority setting, and policy formulation.[20-22]

The technique consists of a series of questionnaires with a group of experts, usually 50 or fewer, who evaluate the importance of specified items. The overall response of the group along with the individual's response is provided as feedback in subsequent rounds. Respondents are asked to reconsider their previous responses and to revise them if they choose. When an individual's response differs greatly from the group response, he/she is asked to state the reason for the variation from the judgment of the majority. Thus, the onus of justifying relatively extreme responses is placed on the respondent through a process of informed decision making. The

Methodology

Study Design

Study approval was obtained through the USC Institutional Review Board. The research study was carried out in 3 phases. Phase I addressed instrument development and pilot-testing, as well as identifying the sample population. Phase II included 2 rounds of surveys during which subjects were asked to evaluate proposed

research topics in an effort to reach consensus as to the research priorities for the profession. Phase III asked subjects to rank each of the final research topics in order of priority under each of the 5 categories.

During Phase I, a preliminary survey was sent to all subjects in the sample population to assess their knowledge and use of the ADHA NDHRA. This preliminary survey also was used as the invitation to participate in the Delphi study. Completion and return of this preliminary survey served as consent to participate.

Surveys utilized throughout the study, were completed online and submitted electronically to the database developer and manager (a non-investigator in the Office of Academic Affairs, USC School of Dentistry) who maintained the master list of participants. Survey results were imported directly into a statistical program for ease of analysis (SPSS version 13). Participants were assigned a unique study identification number to maintain anonymity and an electronic password to enable access to the surveys online. The identification number allowed the data manager and the investigators to group participants by type of position held within the dental hygiene community while still maintaining confidentiality of the subjects. This identification number also allowed the data manager to track how many subjects had completed each survey round and send specific follow-up requests to those participants who had not submitted their survey by the due date.

Phase I – Sampling, Instrument Design, Pilot-Testing, Content Validity

Sample Population

Consistent with the purpose of the Delphi technique, the study utilized a purposeful sample, whereby individuals in the sample were specifically selected based on their expertise and positions of influence in the dental hygiene community. Careful attention was paid to invite participants representing all aspects of the profession, as well as representation from all geographic regions of the United States and 2 Canadian provinces, for a total of 51 dental hygiene experts and key opinion leaders. Of the 51, 49 agreed to participate, representing 26 states and 2 Canadian provinces. Experts included clinicians, graduate program directors, undergraduate program directors and faculty, hygienists employed in public health and government, dental hygiene researchers, independent educators, hygienists employed in private industry, and ADHA officers and trustees (Table 1).

Instrument Design

First, the investigators conducted a thorough review of the dental hygiene literature, research priorities and agendas from other health professions, and reports from major government agencies and foundations, to identify specific research topics that reflect current issues facing the profession and national health objectives.[30-55] Key health issues affecting the American public, particularly those related to oral health, were identified, resulting in 141 potential research topics for study. Each topic was then systematically evaluated for appropriateness for dental hygiene research and to determine the extent to which it had already been addressed by the research community. Those topics that had been examined extensively or were not considered relevant to developing a scientific base for dental hygiene were deleted. This process resulted in a final list of 112 topics for inclusion in the first survey round.

At the same time, the investigators reviewed the existing NDHRA to identify areas of redundancy, overlap of topics within one or more of the 5 categories, and omissions. Based upon their reviews, the 112 potential research topics for study were categorized according to 5 broad areas. It is important to note that these 5 categories were edited from the existing NDHRA to more accurately reflect current issues (Table 2). The investigators assigned each of the 112 potential topics to 1

Table 1. Representation of Dental Hygiene experts in the Delphi Study.

Position	Number of Invited Participants	Actual Number of Participants
Clinicians: pediatrics, periodontal, general practice, geriatrics	5	5
Graduate Dental Hygiene Program Directors	7	7
Undergraduate Dental Hygiene Program Directors and Faculty	9	9
Public Health, Government Employees	11	11
Dental Hygiene Researchers and Independent Educators	7	6
Private Industry: education, research, marketing/sales	9	9
ADHA Officers/Members of the Board of Trustees	3	2
Total	**n = 51**	**n = 49**

of 5 five categories of the agenda to ensure that each topic was mutually exclusive.

The 5 categories used for this Delphi study were listed and defined as follows:

Health Promotion/Disease Prevention: Studies in this category include those that are concerned with health maintenance and disease prevention; public health policy, advocacy and legislation; and development, validation and testing of instruments, strategies and mechanisms that demonstrate effectiveness.

Health Services Research: Studies in this category are designed to improve the quality of health care, reduce its cost, address patient safety, and medical errors, and broaden access to essential services. These include evidence-based information on health care outcomes, quality, cost, use, and access.

Professional Education and Development: Studies in this category are concerned with educational methods, curricula, students and faculty; recruitment and retention of students and faculty; and promoting graduate education and career path options.

Clinical Dental Hygiene Care: Studies in this category address the dental hygiene process of care (assessment, diagnosis, treatment planning, implementation and evaluation); decision-making and clinical reasoning; and data management systems.

Occupational Health and Safety: Studies in this category focus on the practitioner as well as the patient exposure to risks, compliance and prevention issues; behavioral issues; and, workforce recruitment and retention.

Pilot-Testing of the Instrument and Content Validity

The initial survey instrument containing the 112 topics was posted in an electronic format and was pretested by 3 expert dental hygienists representing higher education, clinical practice and private industry. They evaluated each topic for appropriateness for dental hygiene research and relevance to the category under which it had been placed. Panelists also rated the importance of each topic to the advancement of the dental hygiene research mission using a scale of 1 to 4 with 1 = "unimportant" and 4 = "very important". A 4-point scale rather than a 5-point scale w as used to force respondents to make a decision about an item. A 5-point scale normally provides a neutral category. Since the Delphi technique relies on convergence of expert opinion, the intent was to reach a decision about a topic. Panel members were asked for suggestions for additional topics, clarification about the wording of items, and to actually rate each research topic using the electronic submission procedure. As a result of this process, all of the 112 topics remained for inclusion in the first survey round, with no omissions or additions suggested, no changes made to the 5 categories, and with only minor edits to the wording of the topics. Content validity of the overall instrument was established through all of these Phase I activities.

Phase II

The first Delphi survey instrument was constructed by the investigators. Two versions of the survey were constructed, one form with the questions in reverse order of the other. The 2 versions were used to determine if fatigue affected reliability of the survey.

Participants were electronically sent 1 of the 2 versions of the first survey instrument along with a cover letter explaining the purpose of the study and the Delphi technique. They were asked to rate each topic in terms of its importance to advancing the research mission of the profession. Rating was on a sca le of 1 to 4, with 1 being "unimportant" and 4 being "very important" (**Figure 1**). In addition, participants were given the opportunity to provide comments regarding any of the topics or suggest other topics of importance that were not included. Criteria used for retaining a topic for the second survey round were a mean, median, and mode of 3 or greater (see Statistical Analysis). Topics that did not meet these criteria were eliminated from the second survey.

For the second survey round, respondents were given the modal scores for each topic and their individual rating of each topic **(Figure 2).** They were asked to again rate each topic using the same scale after considering the group response. The respondents were asked to provide a rationale for their decision when their response on the first survey was more than one number away from the modal score and they still chose not to change their response. Criteria for retaining topics follow-

Table 2. Edits made to the five categories found on the ADHA NDHRA.

Existing ADHA NDHRA Categories (1994; 2000)	New ADHA NDHRA Categories in Delphi Study (2007)
Health Promotion/Disease Prevention	Health Promotion/Disease Prevention
Education	Health Services Research
Clinical and Primary Care	Professional Education and Development
Individuals/Populations	Clinical Dental Hygiene Care
Basic/Applied Sciences	Occupational Health and Safety

National Dental Hygiene Research Agenda
Delphi Survey - I

DIRECTIONS: The following questionnaire describes 5 broad categories of research. Included under each category are a number of possible research topics related to this broad category. We would like to solicit your opinion regarding the importance of each topic to the National Dental Hygiene Research Agenda. Also, after reviewing the entire survey, we would like to get your suggestions regarding additional topics not identified and the category under which they belong.

Please rate each of the topics on a scale of 1-4 in terms of its importance to advancing the research mission of the dental hygiene profession. In addition, if you believe any of the topics are not descriptive of the broad research category under which it is currently placed, please indicate a more appropriate category to the right of the question. Thank You!

1	2	3	4
Unimportant	Slightly Important	Important	Very Important
No Relevance	Some Relevance	Relevant	Most Relevant
No Priority	Tertiary Priority	Secondary Priority	Top Priority
			Major Issue

A. Health Promotion / Disease Prevention: Studies in this category include those that are concerned with health maintenance and disease prevention; public health policy, advocacy and legislation; and development, validation and testing of instruments, strategies and mechanisms that demonstrate effectiveness.

Examples of topics that relate to this category include, but are not limited to:
1. Assess strategies for effective communication between the dental hygienist and client.

1 2 3 4

Figure 1. Delphi Survey First Mailing

- Respondents were given their individual rating of the topic from Round 1 and the modal score for each topic. They were asked to again rate each topic on a scale of 1 to 4 after considering the group response. Also, they were asked to provide a rationale for their decision when the response on the first survey was more than one number from the modal score, and they chose not to change their response

1	2	3	4
Unimportant	Slightly Important	Important	Very Important
No Relevance	Some Relevance	Relevant	Most Relevant
No Priority	Tertiary Priority	Secondary Priority	Top Priority
			Major Issue

Studies which:
1. Assess strategies for effective communication between the dental hygienist and client.

Your Score	Modal Score	Your New Rating
3	4	1 2 3 4

Figure 2. Phase II: Round 2 Mailing and Format

ing the second round were similar to those used in the first survey round, but were more stringent. Topics had to have a median score of 4 and a mode of 4. This allowed the investigators to identify those topics with the strongest level of agreement among the experts.

As indicated on both survey rounds of Phase II, participants rated each of the research topics on a scale of 1 to 4, according to the following criteria:

- a score of "4" indicates "very important" (most relevant, top priority, major issue)
- a score of "3" indicates "important" (relevant, secondary priority)
- a score of "2" indicates "slightly important" (some relevance, tertiary priority)
- a score of "1" indicates "unimportant" (no relevance, no priority)

Phase III

During Phase III, subjects were asked to consider each of the final research topics on which they had

gained consensus as to the level of priority in which they should be investigated. Subjects were instructed to use their judgment using the following 2 criteria:

- How important is this topic to improving the health of the public and advancing the profession of dental hygiene?
- How reasonable is it to address this topic given the experience and expertise available in the field of dental hygiene?

Subjects were to consider these criteria when assigning a priority ranking to each of the topics, using the following definitions of priority:

Immediate Priority: Those topics, given their importance and the current level of experience and expertise in dental hygiene, which could reasonably be investigated in the next 1-2 years.

Intermediate Priority: Those topics, given their importance and the current level of experience and expertise in dental hygiene, which could reasonably be investigated in the next 3-5 years.

Long Range Priority: Those topics, given their importance and the current level of experience and expertise in dental hygiene, which would reasonably require over 5 years to be investigated.

Statistical Analysis

Responses on the surveys were analyzed using measures of central tendency: mean, median, and mode.

- **Mean**: arithmetic average; sum of the scores divided by the number of scores
- **Median**: the middle score; half of the scores fall above and half fall below
- **Mode**: the most frequency occurring score

Reaching consensus during the first survey round was defined by those topics with a mean, median, and mode of 3 or greater. Although the mean is not the appropriate statistic to use with ordinal data, the investigators requested it be calculated for examining results for borderline or questionable findings. During the second survey round, reaching consensus was defined as at least half of the participants agreeing that an item was "very important" (median score of 4) and having the most frequent response or an item being "very important" (mode of 4). Instrument reliability was analyzed using the Pearson Product Moment Correlation Coefficient and Cronbach's Alpha for internal consistency.

Results

The results of the preliminary survey sent to invite members of the sample population to participate in the Delphi study are summarized in **Table 3**. Note that some chose not to answer all questions.

Survey Round One

A 100% return rate for the first electronic survey round was obtained. Responses were analyzed by computing the median, mode, and mean distribution. Of the 112 topics, 76 met the criteria of having a median and mode of at least 3 and were retained for the second survey (Table 4).

In addition, the alternate forms of the survey were analyzed using the Pearson Product-Moment Correlation Coefficient to determine differences in response patterns. The alternate form reliability was .76 and the instrument had an internal consistency of .87 using Cronbach's Alpha. Thus, an acceptable level of reliability for the instrument was established, and it was clear that fatigue did not affect the reliability of the survey. Thus, only one form of the survey was developed for the second survey.

Survey Round 2

A 95% return rate for the second electronic survey round was obtained. Again, responses were analyzed by computing the median, mode, and mean; however, for this round the requirements for keeping a topic were more stringent by requiring a median and mode of 4. Of the 76 topics, consensus was reached on 42 topics. See Table 5 for the results of second survey analysis and Appendix 3 for the list of the actual topics.

Table 6 illustrates how the results of the analyses were presented to the investigators. From this table, the modes and medians from both rounds can be seen along with the actual summary of Round 2 scores from all groups. In addition, the overall mean was calculated; however for ordinal data, the median and mode were more appropriate statistics for use.

Phase III Results

Subjects attempted to rank the remaining 42 topics as to their level of priority. Results of this phase were not usable, as the priorities were not clearly delineated during this process. Subjects expressed confusion with ranking prioritization due to the need for consideration of multiple criteria versus a single criterion, as well as how "immediate," "intermediate" and "long-range" were defined. The investigators feel that should establishing priorities be deemed important, this aspect of investigation will require a separate study.

Discussion

Reaching consensus on the dental hygiene research agenda is a prerequisite to any national program to advance the research efforts of the profession. Using a systematic approach to updating the agenda on

Table 3a. Preliminary Survey Results Assessing Knowledge and Use of the existing NDHRA

ITEM	Response	# of Respondents who answered Yes	Response	# of Respondents who answered No
1. Do you know that ADHA has a National DH Research Agenda?	Yes	41	No (if no, please skip to question #7)	2
2. Are you familiar with the content of the Agenda?	Yes	33	No	10
3. Have you ever used the Agenda?	Yes (if yes, how have you used it? Check all that apply)	29	No	14
	• Preparing a grant	6		
	• Incorporating into a course?	14		
	- Type of Course			
	- Research Methods	12		
	- Professional Issues	12		
	• Manuscript preparation	8		
	• Research planning for your division, department, program or work setting	5		
	• Research planning for your own self-development, projects or programs	10		
	• Research planning for faculty development, projects or programs	7		
	• Research planning for students or in mentoring	15		
	• Research planning for an association	8		
4. Have you ever experienced any barriers to using the Agenda?	Yes (If yes, check all that apply)	15	No	28
	• Agenda format	4		
	• Scope of how your work fits within the agenda, or how the categories are defined	10		
	• Utility of the Agenda – sense of how to incorporate it into your work/ how helpful	3		
	• Language or taxonomy used	3		
	• User friendliness	4		
5. Have you ever cited or referenced the Agenda in a paper or presentation?	Yes	20	No	23
6. Have you ever seen the Agenda used by others?	Yes (If yes, how has it been used – check all that apply)	25	No	18
	• Preparing a grant	9		
	• Incorporating into a course:	14		
	- Research Methods	12		
	- Professional Issues	10		
	• Manuscript preparation	7		
	• Research planning for your division, department, program or work setting	4		
	• Research planning for your own self-development, projects or programs	5		
	• Research planning for faculty development, projects or programs	4		
	• Research planning for students or in mentoring	10		
	• Research planning for an association	6		

an ongoing basis allows it to remain viable and responsive to changing needs. In the present study, this was achieved through an extensive review of the health-related literature and major governmental and foundation reports resulting in 112 topics, which were pre-tested by an external panel of dental hygiene experts prior to conducting the actual study. As the result of these procedures, content validity was established and consensus reached on 42 topics representing the 5 categories of the ADHA NDHRA.

Table 3b. Preliminary Survey Results Assessing Knowledge and Use of the existing NDHRA

Please rate the perceived value of a National Dental Hygiene Research Agenda using the following criteria:

1 = Greatest Value (GV) 2 = Valuable (V) 3 = Somewhat Valuable (SV) 4 = Not Valuable (NV) 5 = Not Applicable (NA)

ITEM	GV	V	SV	NV	NA
7. Developing a body of knowledge	25	16	1		1
8. Directing research priorities	26	12	3		2
9. Establishing funding priorities	16	16	8		3
10. Professional development or career enhancement	3	23	15		2
11. Enhancing ADHA's image	13	18	9		3
12. Achievement of ADHA's goals	9	25	7	1	1
13. Creating RFPs (requests for funding)	16	18	5	2	2
14. Directing student research	15	18	7	1	2
15. Establishing dental hygiene as a true profession	24	13	3		3
16. Indexing dental hygiene as a true profession	7	12	16	5	3

Table 4. Results of Delphi Survey Round I

Category	Original Number of Topics	# Cut (did not meet criteria)	# Remaining Topics for the 2nd Survey
Health Promotion/Disease Prevention	13	2	11
Health Services Research	28	4	24
Professional Education and Development	23	7	16
Clinical Dental Hygiene Care	29	10	19
Occupational Health and Safety	19	13	6
Total	**112**	**36**	**76**

Table 5. Results of the second survey analyses.

*Consensus on 42 Topics – approved for the NDHRA by the 2006-07 ADHA BOT

Category	# Remaining Topics for the 2nd Survey	# Topics for Which Consensus was Reached
Health Promotion/Disease Prevention	11	7
Health Services Research	24	14
Professional Education and Development	16	9
Clinical Dental Hygiene Care	19	9
Occupational Health and Safety	6	3
Total	**76**	**42***

Appendix 3. National Dental Hygiene Research Agenda Delphi Study Results - Consensus on 42 Topics (2007)

A. Health Promotion / Disease Prevention: Studies in this category include those that are concerned with health maintenance and disease prevention; public health policy, advocacy and legislation; and development, validation and testing of instruments, strategies and mechanisms that demonstrate effectiveness.

1. Assess strategies for effective communication between the dental hygienist and client
2. Identify, describe and explain mechanisms that promote access to oral health care, e.g., financial, physical, transportation
3. Validate and test assessment instruments/strategies/ mechanisms that increase health promotion and disease prevention among diverse populations
4. Investigate how diversity among populations impacts the promotion of oral health and preventive behaviors.
5. Investigate the effectiveness of oral self-care behaviors that prevent or reduce oral diseases among all age, social and cultural groups
6. Investigate how environmental factors (culture, socio-economic status-SES, education) influence oral health behaviors
7. Identify optimal time periods for interventions that influence pathology, function and oral wellness.

B. Health Services Research: Studies in this category are designed to improve the quality of health care, reduce its cost, address patient safety and medical errors, and broaden access to essential services. Includes evidence-based information on health care outcomes, quality, and cost, use and access.

1. Identify how public policies impact the delivery, utilization, and access to oral health care services.
2. Investigate how alternative models of dental hygiene care delivery can reduce health care inequities.
3. Evaluate strategies dental hygienists use to effectively influence decision-makers involved in health care legislation (e.g., to provide direct access to dental hygiene care, autonomy and self-regulation of dental hygienists).
4. Assess how third parties influence access to and utilization of dental hygiene services.
5. Evaluate strategies that position and gain recognition of dental hygienists as a primary care providers in the health care delivery system.
6. Determine the cost-effectiveness of various oral health interventions (e.g., fluorides, sealants, mouth guards), in reducing or preventing oral diseases/conditions.
7. Determine the cost-benefit of various oral health interventions (e.g., fluorides, sealants, mouth guards), in reducing or preventing oral diseases/conditions.
8. Determine if differences exist in patient outcomes and costs for a given oral condition when services are provided by dental hygienists vs. others.
9. Identify factors that predict supply, demand and need for dental hygiene services.
10. Determine the effect of availability, cost and payment source of dental hygiene services on patient outcomes.
11. Develop valid and reliable measures of quality dental hygiene care.
12. Assess the impact of dental hygiene services on the outcomes of care for patients with special needs.
13. Assess the impact of increasing access to dental hygiene services on the oral health outcomes of underserved populations.
14. Determine the extent to which dental hygienists working in collaborative practice settings with other health professionals or organizations improves the cost-effectiveness and quality of health care outcomes.

C. Professional Education and Development: Studies in this category are concerned with educational methods, curricula, students and faculty; recruitment and retention of students and faculty; and, promoting graduate education and career path options.

1. Evaluate the extent to which current dental hygiene curricula prepare dental hygienists to meet the increasingly complex oral health needs of the public
2. Investigate how other health professions have established the masters and doctoral levels of education as their entry level into practice
3. Identify the factors that affect recruitment and retention of faculty
4. Assess how educators are socializing students to research
5. Investigate the extent to which new research findings are incorporated into the dental hygiene curriculum
6. Validate and test measures that evaluate student critical thinking and decision-making skills
7. Investigate curriculum models for training and certification of competency in specialty areas (e.g., anesthesiology, developmentally disabled, forensics, geriatrics, hospital dental hygiene, oncology, pediatrics, periodontology, and public health)
8. Critically appraise current methods of evaluating clinical competency (dental hygiene graduation competencies, standardized national board testing, clinical board examinations)

The procedures developed and implemented in this study were consistent with other studies using the Delphi technique. For example, the sample selected was comprised of well-respected leaders, experts, and practitioners in the profession who are in positions to promote, support, and conduct research. In addition, many are in positions to foster ongoing development of faculty and clinician researchers, re-

9. Validate measures that assess continued clinical competency

D. Clinical Dental Hygiene Care: Studies in this category addresses the dental hygiene process of care (assessment, diagnosis, treatment planning, implementation and evaluation); decision-making and clinical reasoning; and data management systems.

1. Assess the use of evidence-based treatment recommendations in dental hygiene practice.
2. Assess how dental hygienists are using emerging science throughout the dental hygiene process of care.
3. Investigate the links between oral and systemic health.
4. Investigate how dental hygienists identify patients who are at-risk for oral/systemic disease.
5. Investigate how dental hygienists use emerging science to reduce risk in susceptible patients (risk reduction strategies).
6. Develop and test interventions to reduce the incidence of oral disease in special at-risk populations (diabetics, tobacco users, cardiac patients and genetically susceptible)
7. Assess which combinations of patient examination data can best be used to guide clinical decision-making.
8. Monitor the effectiveness of preventive measures (e.g., sealants, fluorides) in different patient populations.
9. Identify effective strategies for educating hygienists in how to evaluate research studies used to guide evidence-based practice.

E. Occupational Health and Safety: Studies in this category focus on the practitioner as well as the patient; exposure to risks, compliance and prevention issues; behavioral issues; and, workforce recruitment and retention.

1. Investigate the impact of exposure to environmental stressors on the health of the dental hygienist (aerosols, chemicals, latex, nitrous oxide, handpiece/instrument noise)
2. Investigate how work-force stressors influence career satisfaction (ethical dilemmas, interpersonal relationships, communication, time management, etc.)
3. Investigate methods to decrease errors, risks and or hazards in health care and their harmful impact on patients.

vise curriculum, and influence policy and the delivery of healthcare services. As a result, the NDHRA and topics for the study reflect a consensus among leaders from major groups of dental hygienists and not any one particular segment of the profession. This strengthens the likelihood that the agenda and study topics will serve as a framework that can be used in different practice environments to systematically advance dental hygiene research and practice. However, findings from the preliminary survey on the knowledge and use of the former NDHRA indicate that work is needed to better promote, coordinate, and integrate its use by dental hygienists. For example, although almost everyone who answered the question if they knew that ADHA has a national research agenda, only 77% were familiar with the content and 67% had ever used it (Table 3). When asked to rate the perceived value of a NDHRA, the greater majority rated the survey items as either 'greatest value' or 'valuable' yet almost 40% did not rate it valuable for professional development or career enhancement, and 54% rated its value as somewhat or not valuable for indexing dental hygiene as a true profession.

Findings from this study were consistent with those identified in the current literature and the focus of dental hygiene. Unlike the first Delphi study conducted over a decade ago where the categories with the largest number of topics for study were Health Promotion/Disease Prevention and Clinical/Primary Care, the largest number of topics in this study were found in the category of Health Services Research (HSR) (n=14). This is not surprising, given the research that has been conducted over the past 10 years, and the current emphasis on evidence based practice where the focus is on effectiveness and outcomes of care. Following the HSR category was Professional Education and Development (n=9) and Clinical Dental Hygiene Care (n=9), both representing an increase in the number of topics from the first Delphi study. Health Promotion/Disease Prevention (n=7) and Occupational Health and Safety (n=3) had the fewest number of topics.

Although the number of topics may have changed within the 5 categories of the agenda, topics now reflect current issues previously not included. Some of these topics relate to cultural competence and health literacy, which are now found within the category of Health Promotion/ Disease Prevention (e.g., Topics 1, 4 and 6); whereas other topics, such as technology, are implicitly part of emerging science, which is addressed in Clinical Dental Hygiene Care (e.g., Topics 2, 4 and 5).

Interesting to note is the low number of topics reached on Occupational Health and Safety, which is one of the main reasons dental hygienists leave or reduce their time in practice. This was the one new category added to the agenda that has direct relevance to the dental hygienists' own personal needs or characteristics of the profession and is part of the broad definition of this category. Although the major emphasis should remain focused on improving the oral health of the public, research on recruitment and retention re-

Table 6. Delphi study Results: Round Two

ALL Groups

Industry Clinic Educators Educators/MSProgDir UnivResearch/OtherEduc PubHealth/Gov/PtAdvocacy

Count of Responses: 45

A. Health Promotion/Disease Prevention: Studies in this category include those that are concerned with health maintenance and disease prevention; public health policy, advocacy and legislation; development, validation and testing of instruments, strategies and mechanisms that demonstrate effectiveness.

	MOD_1	MOD_2	Med_1	Med_2	*Round 2 Scores*				AVG
					1	*2*	*3*	*4*	
1. Assess strategies for effective communication between the dental hygienist and client.	4	4	3	4	*0*	*6*	*14*	*25*	3.42

lated to this category should receive attention, especially when others outside the dental hygiene profession are proposing new practice models with varying training definitions for "dental hygiene" practitioners.

This study used a Delphi technique to achieve consensus on the topics of importance to the ADHA NDHRA. Forty-nine dental hygiene experts representing different work environments participated in the study. Through 2 rounds of mailings, consensus was gained on 42 topics, which were distributed among the 5 categories comprising the national agenda. If there had not been a substantial number of questions rated "very important" for a category, then that particular category would need to be re-examined to determine whether it belonged as part of the agenda.

Conducting this Delphi study was a significant step in the process to continuously monitor and update the ADHA NDHRA to reflect contemporary issues that are relevant to advancing the body of knowledge for dental hygiene. As a result, some categories were modified or dropped and new ones added. These categories and specific topics should be used to guide research efforts that will improve clinical decision making and ultimately the quality of care provided to the public.

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