▲ Training for Interdisciplinary Health Research

Defining the Required Competencies

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Although interdisciplinary research is becoming the dominant model for understanding complex health issues, little is known about the competencies required for successful interdisciplinary collaboration. Published research has discussed attitudes about interdisciplinary work and organizational resources but not the needed competencies. This report describes the method and results of the competency specification process for health research. Based on an established definition of interdisciplinary research, a preliminary set of competencies was developed from expert opinion of key informants and a review of the interdisciplinary research literature. A Delphi panel of interdisciplinary researchers then reached consensus on 17 competencies necessary for interdisciplinary research. J Allied Health 2008; 37:65–70.

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INTERDISCIPLINARY health studies are increasingly essential to the development and application of new knowledge among the allied health professions.[1] While there has been much attention focused on interdisciplinary work, a meaningful definition of interdisciplinary research has only recently been developed and published, finding that:

> Interdisciplinary research is any study or group of studies undertaken by scholars from two or more distinct scientific disciplines. The research is based upon a conceptual model that links or integrates theoretical frameworks from those disciplines, uses study design and methodology that is not limited to any one field, and requires the use of perspectives and skills of the involved disciplines throughout multiple phases of the research process.[2]

Given this definition, it is essential that a scholar participating in interdisciplinary work develop skills beyond his or her core discipline. The purpose of the research reported here is to identify a set of core competencies for interdisciplinary research, with these competencies applicable to any collaborative health research project.

Background

Despite consensus on the need for interdisciplinary research on a wide variety of health issues,[3,4] the individual skills necessary for researchers to work across disciplinary boundaries have been largely intuited or assumed.[5] Experience suggests, however, that many otherwise exemplary scholars have not worked successfully when pushed beyond the boundaries of their own discipline.[6] Further, the extent to which the ability to perform interdisciplinary research is a function of inherent personality traits—traits that are difficult to modify—or are skills that can actually be learned is not known.[7] Traditional academic approaches have reinforced the segregation of disciplines, further reducing

opportunities to develop competency for interdisciplinary research.[8,9] Identifying the essential elements that enable a scholar to break out of this rigid disciplinary mold—understanding the competencies necessary for interdisciplinary research—will allow those interested in developing a new generation of scholars competent in interdisciplinary efforts to work in such health research settings throughout their careers.[10] Once these competencies are identified, it may be possible to plan learning opportunities and develop curricula to enhance the interdisciplinary abilities of trainees and scholars and to evaluate the extent to which individuals acquire such abilities.[11]

Knowledge alone is not a sufficient measure of ability to perform in any area, because performance requires the mastery of a set of competencies, each of which is

> a cluster of related knowledge, skills, and attitudes that affect a major part of one's job (a role or responsibility), that correlates with performance on the job, that can be measured against some accepted standards, and that can be improved via training and development.[12]

Behind observable competencies are varying combinations of knowledge, attitude, and skills, all of which must be included in a competency-based curriculum. Competency statements written for curriculum, training, or development purposes are often much more narrow than those used in a practice setting, written in such a way that they may be measured hierarchically and in short time increments.[13]

Methods

The method of specifying competencies used in this research is the Delphi-based approach described elsewhere for the identification of competencies in an emerging field.[14] The Delphi method is a qualitative research technique, typically used in a topic area in which there is little previously documented knowledge,[15] that uses a panel of experts who are surveyed on a subject in successive rounds of judgment and feedback to develop a consensus of opinion.[16] The necessary steps for the initial Delphi approach are as follows:

1. drafting candidate competencies based on local expert opinion and review of relevant literature, testing them for face validity
2. establishing an external expert review panel by invitation to other interdisciplinary centers, seeking a mix of disciplines and experience
3. obtaining feedback from the panel, incorporating feedback from each round into subsequent rounds
4. drafting a final statement of competencies for review by an expert panel and research team.

Search for Candidate Statements

Twenty directors of funded interdisciplinary research centers who were participants in a conference on interdisciplinary research convened at Columbia University provided preliminary answers to the following question: "What are the three most important individual competencies needed for successful interdisciplinary research centers?" To complement these data, a literature review, using search terms "interdisciplinary," "research," "training," and "competencies," of MEDLINE, JSTOR,[17] and Google Scholar[18] identified 46 references. Each competency statement was constructed to include an observable action (verb) and a focus of action (the object of the verb) and, in several cases, to include a description of context.[12] Combining scholar descriptions from the conference and published articles with verbs derived from Bloom's *Taxonomy of Cognitive Domains*,[19] the researchers drafted 21 candidate competencies, each of which was reviewed for consistency with the aforementioned definition of competency. Review for face validity by six additional scholars (identified from the literature review and by networking for their expertise in interdisciplinary research) led to the 19 initial statements included in Table 1.

Selection and Composition of Expert Panel

Concurrent with the development of candidate competencies, the researchers selected and solicited expert panelists for the Delphi-based research. The selection process for key informants drew upon (1) participants in the Columbia University conference on interdisciplinary research; (2) scholars throughout the nation participating in interdisciplinary research in the allied health professions, including the National Institutes of Health Exploratory Centers for Interdisciplinary Research Directory[20]; and (3) authors of publications identified through the literature search as experienced interdisciplinary scholars and practitioners. From an initial field of 49 potential experts, the final panel of 30 scholars represented research disciplines including medicine and health sciences (11), public health and environmental sciences (12), and the natural (3) and social sciences (8). The prospective panelists were informed that their participation on the expert panel would require up to three rounds of an online Delphi-type survey, with each round taking approximately 20 minutes. Of the 30 invitees, 27 agreed to take part in the Delphi process, with each discipline continuing to be represented.

Rounds I and II

In round I, the 19 candidate statements were distributed to the expert panel electronically (SurveyMonkey LLC, Portland, OR), with two weeks to respond and a reminder at the midway point. The survey included definitions of "individual competency" and "interdisciplinary research." Panel members were asked the following:

> For each candidate statement:
> - "Should this competency statement be included?"
> - "If it is kept, it should be reworded as . . ."
> - "Are there additional competencies that should be included?"

For the second Delphi round, one month later using the same survey software, the expert panel was provided with all responses from the first round without identifying individual respondents. For each competency, the panelists were informed of the percentage of respondents who opted to keep the statement and the suggestions for editing from the first Delphi round. The panelists then were then asked, "Based upon these suggestions, should this competency statement be included?" with the following three possible responses and room for additional comments:

- Yes. Retain original statement.
- Yes. Retain an altered statement based on one or more of the suggestions above (specify suggestion[s] in additional comments space below).
- No. Eliminate statement.

In addition, panelists were provided with three additional competency statements suggested in the first Delphi round, with each prospective competency followed by the questions that followed competency statements in the first round. The second round concluded with the following question: "Based upon these suggestions and additions, should any additional competency statements be included?"

Final Review

The final draft of competencies included those receiving support from more than two thirds of respondents, either as submitted to the panel or in some slightly modified form. For those statements that received plurality approval from the panel, the researchers attempted to modify the competency statement to reflect both the original statement and the consensus modified suggestion. This final draft was circulated to the expert panel for comments, and no substantive changes were suggested. In the final presentation, the researchers replaced numbering with bullet points to eliminate any perception of hierarchy in the competencies.

Results

Eleven participants completed the first Delphi round and 10 completed the second Delphi round, a response rate consistent with reported response rates for Web-based surveys and consistent with the researchers' previous experience, although somewhat lower than is preferred for a Delphi process.[15] While anonymity prevented tracking of the identity or overlap among respondents in the first and second Delphi round, e-mail feedback outside of the survey process suggested substantial overlap in respondents in the two rounds. Nonrespondents provided no feedback on their failure to respond despite their initial agreement, and e-mail reminders during each round.

All those who responded to the surveys provided extensive qualitative feedback in their responses in addition to the requested "yes or no" responses, including more than twice the number of comments in the second round as compared with the first. Three additional competency statements were suggested through the first Delphi round, with the language of the suggestions formatted to competency specifications and submitted to panelists for review:

- Modify your own work or research agenda as a result of interactions with colleagues from fields other than your own.
- Demonstrate competency in the fundamentals of cognitional theory and be able to articulate and defend their own epistemology.
- Demonstrate the necessary philosophical tools to understand methodologies and epistemologies of other disciplines.

In the second Delphi round, a panelist suggested that the competencies include "actively seek out colleagues from other disciplines to gain their perspectives on research problems," which was included in the final draft. An example of modification across the Delphi rounds is included in Table 2.

Table 1. Candidate Competencies in Interdisciplinary Research

The scholar who has completed doctoral work with an emphasis on interdisciplinary research is able to:

1. Advocate interdisciplinary research through interdisciplinary research centers in developing initiatives within the substantive area of study
2. Express intellectual curiosity for the perspectives of other disciplines
3. Read journals outside of his or her discipline
4. Communicate regularly with scholars from multiple disciplines
5. Attend scholarly presentations by members of other disciplines
6. Employ theories and methods of other disciplines in developing integrated theoretical and research frameworks
7. Generate hypotheses developed through interdisciplinary research
8. Devote time and effort to research and teaching outside his or her discipline
9. Share research from his or her discipline in language meaningful to an interdisciplinary team
10. Interact in training exercises with scholars from other disciplines
11. Collaborate respectfully and equitably with scholars from other disciplines to develop interdisciplinary research frameworks
12. Draft funding proposals for interdisciplinary research programs in partnership with scholars from other disciplines
13. Integrate concepts and methods from multiple disciplines in designing interdisciplinary research protocols
14. Adhere to research plans developed with scholars from other disciplines
15. Employ research methods outside his or her discipline
16. Incorporate theories from at least two disciplinary viewpoints in conducting his or her individual research
17. Disseminate interdisciplinary research results both within and outside his or her discipline
18. Author publications with scholars from other disciplines
19. Present interdisciplinary research at conferences representing more than one discipline

TABLE 2. Sample of Changes to Draft Competency Across Delphi Rounds

Original candidate competency
Express intellectual curiosity for the perspectives of other disciplines
Round 1 suggested edits
Understand the synergies that perspective [sic] from other disciplines bring
Express intellectual curiosity and respect for the perspectives of other disciplines
Too vague. Doesn't everyone have curiosity about the perspectives of other disciplines (at least I hope they do and are not closed minded)
Round 2 responses
Retain the original statement (3 participants)
Retain an altered statement based on one or more of the suggestions above (6 participants)
Eliminate the statement altogether (1 participant)
Round 2 comments
I agree, "curiosity" might not be strong enough a word. The curiosity should translate into an active seeking of an exchange of ideas.
Understand, appreciate, and respect the synergies that perspectives from other disciplines bring.
I really like the suggestion of adding a comment about synergy and respect for different perspectives.
Agree that this is vague. Do not have specific suggestions. Include the respect portion.
Suggestions 1 and 2 are good points to include.
Final competency statement
Express respect for the perspectives of other disciplines

Of the original draft competencies, those eliminated altogether included the following:

- Devote time and effort to research and teaching outside of his or her discipline.
- Adhere to research plans developed with scholars from other disciplines.
- Use research methods outside his or her discipline.
- Incorporate concepts, ideas, or methods from at least two disciplinary viewpoints in performing his or her individual research.

For those not familiar with competency language, there were many suggestions to include applications or institutional factors that were either not competencies or not specific to interdisciplinary research, including strong leadership for advocacy, members who have the qualities/abilities to work as a team, commitment of the staff, flexibility and communication skills, diversity of funding sources, and community development. Items inconsistent with individual performance or not clearly related to interdisciplinary research were eliminated.

The final analysis and editing led to 17 statements that describe what a well-prepared scholar trained to participate in interdisciplinary research should be able to do. To facilitate understanding of and communication about these competencies, the final set is grouped into three domains, through which the interdisciplinary scholar can be shown to conduct research, communicate, and interact with others. These competencies are included in Table 3.

Discussion and Implications

The set of competencies described here is the first documented effort to elucidate what a scholar must be able to do if he or she is to succeed in interdisciplinary research. These competencies do not replace the range of knowledge, skills, and abilities desired for the successful scholar in any one discipline, because discipline-specific abilities are taken as foundational for interdisciplinary success. Further, any one scholar may have varying degrees of facility across these 17 activities, and any one interdisciplinary research setting or training program will make varying use of these activities.

The application of these competencies may be most immediate in training programs, but they also have implications for development of research agendas and career development for scholars. The following brief discussion highlights examples of these implications.

Use in Training Programs

Those training the next generation of scholars can be expected to make use of competency statements to develop expanded interdisciplinary learning opportunities during predoctoral and postdoctoral education. This can be started by adding an interdisciplinary component to the typical scholarly seminars for predoctoral students, assuring that the presentations come from a range of theoretical and methodological disciplines and that the presenters are themselves respectful of the interdisciplinary perspective. Mastery of these competencies will require structuring specific interactions in interdisciplinary teams, with senior participants serving as role models for the required collaborations in research design, analysis of findings, and ultimate presentation of results. In doing so, students should be expected to study under the guidance of scholars who work in multiple disciplines and who use a range of research methods. Existing interdisciplinary research centers are a likely setting for student development pursuant to these competencies.

Research Agendas

Scholars competent in interdisciplinary research can be expected to make different contributions to research efforts than those trained in more traditional, single-discipline programs. For example, 27 investigators from distinct disciplines—including medicine, dentistry, public health, social work, and various social sciences—currently receive support from the Columbia Center for the Health of Urban

Minorities (CHUM Center), a five-year National Institutes of Health–funded P60 EXPORT (Excellence in Partnerships for Community Outreach, Research on Disparities, and Training) Center. CHUM's monthly steering committee meeting is attended by all center faculty members and includes discussion of center activities as well as individual scientific presentations. Through these meetings, investigators share their work before a diverse body of investigators to gain their unique perspectives on research problems with respect to disparities. Other venues for interdisciplinary communication include jointly prepared grant proposals, a center listserv, and a monthly faculty e-newsletter in which investigators can read abstracts highlighting important research from various disciplines relevant to health disparities and minority health.

Career Development for Scholars

Scholars and agendas for interdisciplinary research must be matched in order to create a meaningful career trajectory in interdisciplinary studies. This will require institutional structures that are supportive of interdisciplinary efforts. One such structure has been developed through the Integration into an Online Collaborative Space for Interdisciplinary Research Trial (InterTrial). InterTrial, developed under a National Institutes of Health Roadmap contract, Reengineering the Clinical Research Enterprise (RM-04-23), is an online, collaborative space that brings together many different kinds of stakeholders and resources to facilitate interdisciplinary clinical and translational research at the Columbia University Medical Center. This system is intended to support enhanced communication (through document management, shared calendars, discussion lists, Web conferencing, etc.) and sharing of data (through common databases, data interchange, and data standards), acting as a portal to connect users to practical applications for interdisciplinary clinical and translational research (e.g., trial management, data analysis and decision support). Demonstration of the interdisciplinary research competencies reported in this article will be supported through various functions of this collaborative space. For example, the InterTrial directory and communication facilities will "engage colleagues from other disciplines to gain their perspectives on research problems" by linking investigators and enabling communication in different modes such as Web conferencing or online discussion. In addition, once developed, the competency-based curriculum for teaching interdisciplinary research will be integrated as a component of the InterTrial portal so that it is widely available to researchers, including graduate students, postdoctoral trainees, and faculty.

Conclusions

Given the stated interest of national research leaders in interdisciplinary scholarship, it is essential to develop a generation of scholars who are prepared to work in this challenging environment. The initial specification of competencies for interdisciplinary research sets in motion one component of the agenda for interdisciplinary health research. This preliminary set of competencies can be used by training programs at the predoctoral and postdoctoral level. As they are put into practice, it is likely that gaps will be identified or that one or more of these statements will be shown to be unnecessary. For that reason, regular review of these newly identified competencies should be instituted—following sufficient time for dissemination, application, and critical assessment—to assess the continued relevance of the specific competencies. While three to five years is a typical competency review interval, the rapidly evolving nature of interdisciplinary research and training leads the authors to recommend that initial evaluation should take place within two to three years. This periodic review of competencies would provide interdisciplinary research training programs with the evolving tools necessary to keep pace with the experiential learning taking place in centers across the academic enterprise.

Table 3. Competencies in Interdisciplinary Research

The scholar who has completed doctoral work with an emphasis on interdisciplinary research is able to:

Conduct research
- Use theories and methods of multiple disciplines in developing integrated theoretical and research frameworks
- Integrate concepts and methods from multiple disciplines in designing interdisciplinary research protocols
- Investigate hypotheses through interdisciplinary research
- Draft funding proposals for interdisciplinary research programs in partnership with scholars from other disciplines
- Disseminate interdisciplinary research results both within and outside his or her discipline

Communicate
- Advocate interdisciplinary research in developing initiatives within a substantive area of study
- Express respect for the perspectives of other disciplines
- Read journals outside his or her discipline
- Communicate regularly with scholars from multiple disciplines
- Share research from his or her discipline in language meaningful to an interdisciplinary team
- Modify his or her own work or research agenda as a result of interactions with colleagues from fields other than his or her own
- Present interdisciplinary research at venues representing more than one discipline

Interact with others
- Engage colleagues from other disciplines to gain their perspectives on research problems
- Interact in training exercises with scholars from other disciplines
- Attend scholarly presentations by members of other disciplines
- Collaborate respectfully and equitably with scholars from other disciplines to develop interdisciplinary research frameworks
- Author publications with scholars from other disciplines

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