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based on setting (clinical, educational, and clinical/educational)
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collaboration. Five tables are included. (Contains 14 references.)
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Describing the Nature of Interdisciplinary Collaboration within an Educational Center

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ABSTRACT
This paper provides an easy to use methodology describing the composition and setting of interdisciplinary activities within a gerontological education center. For 147 activities, investigators determined the number of people, number of disciplines, number of people per discipline, and the different disciplines that collaborated together. Seventy-three percent of the activities were interdisciplinary. The activities were divided into three categories based on setting (clinical, educational, and clinical/educational) and analyzed. Information is provided to assist others in conducting similar research and includes discussion of the characteristics that foster successful interdisciplinary collaboration.

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Describing the Nature of Interdisciplinary Collaboration within an Educational Center

Perspective: Many professional educational activities strive to be interdisciplinary. An interdisciplinary activity involves two or more people from different disciplines who exchange, share, and integrate their skills and knowledge concerning a common issue[1]. The authors use the term discipline to identify either a profession or occupation that offers, based on its own disciplinary knowledge, skills, values, and experiences, a unique perspective to group functioning[2]. Interdisciplinary group members have flexible roles and responsibilities[3] and engage in a process of interdependent collaboration[4].

A review of the gerontology literature stresses the need for interdisciplinary collaboration to address the broad range of services required by the elderly[1,2,4,10,11]. However, we found that there was limited information in the interdisciplinary literature which provided practical methodologies to determine the nature and composition of such activities. As a result, we turned to other social science methodologies. This paper will provide one approach to describing interdisciplinary activities within a gerontological education center.

Documenting the nature of collaborations is analogous to describing social support. The metaphorical concept of social support applied to represent complex interrelationships in interpersonal systems was not an analytical concept that could be used in rigorous research[5]. However, when social networks or connections were defined as a specific set of linkages among a set of individuals, this concept could be quantified and reliably measured[5,6]. The methodology on the structural variables used to measure social support is useful for our purposes in mapping interdisciplinary collaborations. Structural variables, such as the number of common connections and the pattern of connections, examine the patterns of interactions and not the content or quality of the relationships[5,7].

Objectives: 1. To develop and describe various topologies concerning the nature of collaborative linkages, including comparisons between interdisciplinary and unidisciplinary activities, 2. To apply this methodology to the activities of an educational center, 3. To identify possible reasons for successful interdisciplinary collaboration and, 4. To discuss which activities are appropriate for these analyses and how others can apply this methodology and results to their own settings.

Methodology

Data Source: The Educational Centre for Aging and Health (ECAH), McMaster University, is a complex network consisting of clinical faculty, administrators, and staff[8]. Through professional education, the Centre's goals strive to increase the number and proportion of health professionals who are committed to promoting health and providing excellent care for aging individuals. Another goal emphasizes the importance of fostering interdisciplinary programs in education and clinical service.

A program evaluation of ECAH, focused on goals and outcomes, revealed that ECAH was

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involved in 147 activities which included projects, committees, conferences, workshops, and courses. Data on these activities were derived from questionnaires developed by the authors, and completed by 75 participants within the Centre. One questionnaire asked participants to describe each of their relevant activities, provide the names and disciplines of all collaborators, and specify start and stop dates.

Data organization and analyses: The various professions and occupations were defined and the number and percentage of people per discipline were determined. A computer spread sheet was created listing the number of people and their disciplines. Next, all activities with unidisciplinary collaboration were compared to those with interdisciplinary collaboration.

Another analysis divided the unidisciplinary and interdisciplinary activities into 3 categories based on the type of setting in which they occurred: 1. clinical (a clinical care site without learners), 2. educational (a classroom type situation) and, 3. a clinical and educational combination (a practicum learning situation in which students were involved in patient care).

Further analyses on interdisciplinary activities included two, three, and four way matrices to illustrate who collaborated with whom according to discipline and to determine the number of people involved from each discipline. Using a statistical package (e.g., SAS), the computer was programmed to tabulate the number of interactions between disciplines for each activity, eg., the total number of nurses that collaborated with social workers on the same activities. Then the means and standard deviations were calculated. A two way matrix can be used in two different ways: a) It can document all activities in which only two disciplines were involved, e.g., only those activities with interactions between occupational therapists and physicians and; b) It can document all activities with interactions between two disciplines, e.g., physiotherapists and administrators, as well as those activities with at least one more discipline in addition to the physiotherapist-administrator interactions. Three and four way matrices can also be used in two ways. Table 1 outlines two way interactions documenting the number of activities in which each discipline was involved, the number of activities that had these interdisciplinary collaborations, and the average number of people and standard deviation per activity. Three and four way interactions would be set up in a similar manner. Figure 1 graphically depicts two and three way interactions. The number on the first line in the center of the triangle is the total number of activities between the three disciplines, the number on the second line is the average number of people and the standard deviation. The numbers on the outside of the triangle between each discipline represent the total number of activities, the average number of people, and the standard deviations for these two way interactions. Pie charts can also be used to represent all interdisciplinary interactions.

If it was hypothesized that certain disciplines were key to the functioning of many activities, then similar comparisons can be made between the interdisciplinary activities with these disciplines versus those without the presence of these disciplines.

Results
Thirty-two different disciplines were identified: eleven were health professions (see table 2).

At this educational center a total of 405 different people participated in the various activities. There were almost three times the number of interdisciplinary activities (N =108) as compared to unidisciplinary activities (N = 39). Table 3 provides further summary information comparing the unidisciplinary to the interdisciplinary activities.

Sixty-three percent of the interdisciplinary activities involved three or more disciplines who worked together. Thirty-five percent of the activities involved at least four different disciplines. The first cell in the upper left corner of Table 4 identified that medicine interacted with nursing, administration, and social work 11 times and that there were an average of 10 people working on these activities. The remaining cells are read in the same way. As shown in Table 4, the most common four-way interactions were medicine-nursing-administration-social work (n=11); nursing-administration-social work-physiotherapy (n=7); medicine-nursing-adminstration-physiotherapy (n=6); medicine-nursing-social work-physiotherapy (n=6); medicine-nursing-social work-education (n=6); and medicine-nursing-adminstration-education (n=5).

Analysis by setting revealed that four activities took place in clinical settings, 95 occurred in educational settings, and 37 were in clinical/educational settings. Eleven activities could not be classified because their focus was pure research or government policy setting. Consistently, there were more interdisciplinary activities than unidisciplinary activities across the three types of settings.

Within the educational settings, many activities focused on the development or revision of undergraduate, graduate, and continuing education courses. Usually one major discipline (such as nursing which planned educational activities for nursing students) consulted with other health professionals (such as physicians and social workers) and relied on the expertise of others: 22 activities involved professional educators; another 22 included research assistants; 13 involved administrators; 9 included administrative assistants; and 15 employed the services of educational technicians (e.g., an instructional designer or a simulated patient trainer)

For example, problem-based courses on aging were developed in the occupational therapy (OT) and the second year medical (MD) curricula. The OT course was developed by a unidisciplinary team whereas the MD course was planned by an interdisciplinary team composed of five different disciplines. A review of the curricular materials used in both courses illustrated some differences in implementation. Both courses strove to provide students with the skills to work as part of a health care team. All tutors in the OT course were from within that discipline, whereas 21 percent of the tutors in the MD course were non-physicians. In the OT course, 31 percent of the lectures/discussions were interdisciplinary and there were no other interdisciplinary resources listed in the OT course student guidebook. In contrast, the MD course provided 50 percent of lectures on aging by non-physicians, gave a one day interdisciplinary workshop, and the MD course student guidebook identified numerous interdisciplinary resources (see table 5).

As expected, a post-hoc review of the data showed that the health professions in which McMaster University offers degree programs are the same disciplines most involved in ECAH's

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activities (see table 2 and 4). In addition, a group of specific non-health professionals participated in many of ECAH's activities. Administrators, administrative assistants, educators, educational technicians (e.g., instructional designers), and research assistants participated in seventy-eight activities. There were 23 interdisciplinary activities which did not have at least one of these disciplines involved. In comparison to the number of health professionals who participated, there were fewer individuals within each of these non-health disciplines, yet these few individuals participated in more activities. Two professional educators were involved in 31 activities and four educational technicians participated in 27 activities. Nineteen research assistants took part in 37 activities, eleven administrators participated in 21 activities and four administrative assistants participated in 11 acitivities.

Discussion
This methodology provides an easy way to define the nature of existing collaboration, allows for comparisons between interdisciplinary and unidisciplinary activities, and identifies key disciplines. The application of this methodology maps the types of collaborative linkages and describes structural variables of collaboration such as the composition and setting of interdisciplinary and unidisciplinary activities. It is most useful for documenting numerous activities in large centers. If one goal of a centre is to foster interdisciplinary activities, as ECAH did, this type of analyses provides the objective data to determine the achievement of this goal. For example, by using this methodology, administrators or program evaluators could determine if specific programs, such as gerontological studies, promoted interdisciplinary research activities among faculty and students.

The analyses which separated out one or more groups to determine the number of activities in which they were involved and who they collaborated with provides an analyses which would be helpful in identifying the role that departments played in the total activities of a center. Such data might be useful for financial recognition of contributions made by various departments within a university, or for budget planning. One could also use this analysis to determine the roles played by individual people within an organization. For example, for the purpose of performance appraisals, educators and educational technicians might use the data to confirm that they were involved in numerous projects. Their supervisor might use this data to argue for continued partial support of these educators and educational technicians from the program's budget. When centers are recruiting for new positions, they might use such data to determine if certain disciplines were over or under represented in activities.

Our data are limited to self-reports and we do not have adequate information to assess the effectiveness or success of these reported activities.

The literature identifies many challenges and problems to establishing and maintaining interdisciplinary collaboration[9-12]. However, our results indicate that one of ECAH's goals, to foster interdisciplinary collaboration, was successfully met. We hypothesize several reasons for the occurrence of this interdisciplinary collaboration. First, an organizational culture helps to facilitate the development of certain types of groups[13]. ECAH is based in a university where the Faculty of Health Sciences promotes an interdisciplinary approach to education. This Faculty,

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which is organized on a matrix principle, encourages all programs to cut across and draw from the resources of the academic departments[14]. Second, the interdisciplinary collaboration within the educational settings often employed the expertise of different disciplines. The reliance on professional educators, research assistants, administrative assistants, and educational technicians created products that were more consistent with current pedagogical thinking in the field of gerontology and geriatrics. Third, these interdisciplinary collaborations provided many opportunities for faculty and staff to learn new concepts from each other and to acquire educational skills.

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Table 1. Who Collaborates with Who by Discipline: Two Way Interdisciplinary Collaboration

	discipline #1	discipline #2	discipline #3	discipline #4	discipline #5
discipline #1	■				
discipline #2	◆ **	■			
discipline #3	◆ **	◆ **	■		
discipline #4	◆ **	◆ **	◆ **	■	
discipline #5	◆ **	◆ **	◆ **	◆ **	■

■   Diagonal is the number of activities in which the discipline was reported.

◆   Number of activities that had interdisciplinary interactions.

**   Average number of people per activity and standard deviation.

Cells are not mutually exclusive.

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Figure 1. Two and Three Way Interdisciplinary Collaboration

discipline #1

activities
(x̄, S.D.)

activities with 3 way
collaboration
(x̄, S.D.)

activities
(x̄, S.D.)

discipline #3

activities
(x̄, S.D.)
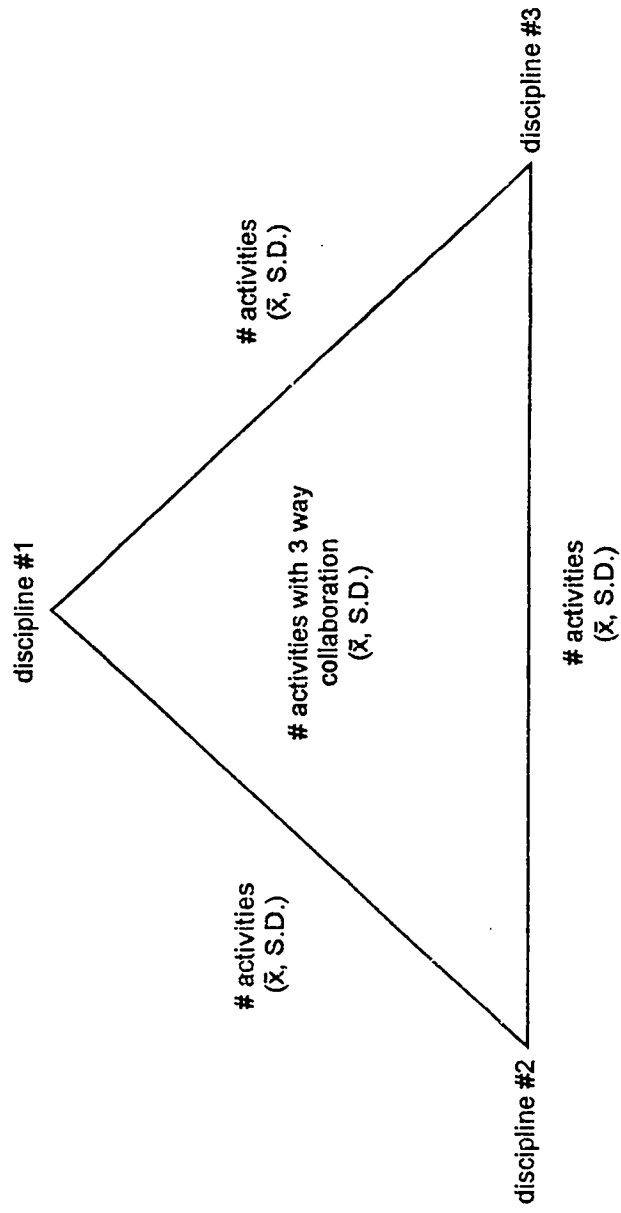
discipline #2

x̄ = average number of people per collaborative activity

11

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Table 2. The Number of Activities Per Discipline and the Number of People Per Discipline
for All Activities

Discipline[1]	Number of Activities[*] /Discipline	Number of People/ Discipline	Percent of People/ Discipline
Nursing	76	96	29.8
Medicine	67	74	23.0
Social Work	44	39	12.1
Research Assistants	37	19	5.9
Education	31	2	0.6
Administration	21	11	3.4
Administrative Assistants	11	4	1.2
Education Services	21	4	1.2
Epidemiology/Statistics	19	8	2.5
Occupational Therapy	16	11	3.4
Social Sciences	13	7	2.2
Physiotherapy	12	10	3.1
Psychology	9	5	1.6
Other Health Professions[2]	9	5	1.6
Other Professions[3]	8	12	3.7
Ethics	5	1	0.3
Basic/Hard Sciences	4	3	0.9
Business/Health Economics	4	5	1.6
Information Services	3	6	1.9

[1] Discipline: refers to e profession or occupation that offers, based on its own knowledge,
skills, values, and experiences, a unique perspective to group functioning.

[2] Other Health Disciplines: dentist, dietitian, speech & language pathologist,
public health employee.

[3] Other Disciplines: lawyer, police officer, physical education instructor, municipal/community
government position, housekeeper.

[*] Activities: ere not mutually exclusive because many were interdisciplinary (73%).

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Table 3. Unidisciplinary versus Interdisciplinary Collaboration

Type of Collaboration	Number of Activities	Average Number of Disciplines (range)	Average Number of People	Average Number of People/Discipline
Unidisciplinary	39	1	4.5 ± 6.1 (1 - 20)	4.5 ± 6.1 (1 - 20)
Interdisciplinary	108	3.4 ± 1.6 (2 - 9)	6.5 ± 4.5 (2 - 23)	1.9 ± 1.1 (1 - 7)
Total	147	2.8 ± 1.7 (1 - 9)	6.0 ± 5.0 (1 - 23)	2.6 ± 3.4 (1 - 20)

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Table 4. Number of Activities with at Least Four Way Collaboration Among Specific Disciplines

	MD				NSG			AD	
	NSG				AD			SW	
	AD	SW	OT	PT	SW	OT	PT	OT	PT
SW	11" (10.1 ± 3.3)♦								
OT	3 (14.3 ± 2.9)	5 (11.4 ± 4.7)			3 (10.0 ± 0.6)				
PT	6 (12.5 ± 1.9)	6 (13.0 ± 2.0)	3 (12.7 ± 5.8)		7 (9.9 ± 3.3)	2 (10.0 ± 0)		2 (6.0 ± 0)	
ED	5 (7.2 ± 1.1)	6 (8.0 ± 2.4)	1 (5.0 ± 0)	2 (8.5 ± 3.5)	4 (7.3 ± 3.3)	0	1 (12.0 ± 0)	0	1 (11.0 ± 0)

" Number of activities with specific interdisciplinary interactions.

♦ Average number of people per activity and standard deviation.

Cells are not mutually exclusive.

Acronyms:

AD: administration
ED: education
MD: medicine
NSG: nursing
OT: occupational therapy
PT: physiotherapy
SW: social work

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Table 5. Educational Setting Example: Comparison of Curricular Materials/Resources

	Unidisciplinary (%)		Interdisciplinary (%)	
	OT	MD	OT	MD
Small group discussion leaders	100	79	0	21
Lectures/workshops	69	50	31	50
Faculty/staff available for consultation	100	50	0	50

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