

## **An Assessment of Teratology Training Provided by Masters Level Genetic Counseling Programs**

**Great Lakes Regional Genetics Group Teratogen Subcommittee: Shari R. Baldinger,<sup>1</sup> Lola P. Cook,<sup>2</sup> Beatrice N. French,<sup>3</sup> Joanne M. Haun,<sup>4,8</sup> Carol J. Ludowese,<sup>5</sup> Amy K. Stein Schechtman,<sup>6</sup> and Wendy R. Uhlmann<sup>7</sup>**

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*The increasing demand in the clinical genetics setting for information about teratogen exposures has created a need for genetic counselors to have the capabilities to appropriately address patient concerns. In order to assess how training in teratogen counseling is currently being conducted, the GLaRGG Teratogen Subcommittee surveyed all 17 genetic counseling training programs in North America in September 1993. Information was obtained from training programs about coursework, resources, and clinical training. In addition, each training program was asked to provide information about how their teratogen training needs could better be met. While all programs responded that some information in their coursework applicable to teratogen counseling was provided, there was wide variation in the amount of time devoted to this topic. The programs also greatly differed in the provision of clinical training in teratogen counseling. For both coursework and clinical work, genetic counselors were the main trainers in teratogen counseling. In spite of this, fewer*

<sup>1</sup>Perinatal Center, Abbott-Northwestern Hospital, Minneapolis, Minnesota.

<sup>2</sup>Department of Medical & Molecular Genetics, Indiana University School of Medicine, Indianapolis, Indiana.

<sup>3</sup>Department of Pediatrics, Medical College of Ohio, Toledo, Ohio.

<sup>4</sup>Wisconsin Clinical Genetics Center, University of Wisconsin, Madison, Wisconsin.

<sup>5</sup>Department of Obstetrics & Gynecology, Hennepin County Medical Center, Minneapolis, Minnesota.

<sup>6</sup>Section of Reproductive Genetics, Department of Obstetrics & Gynecology, Northwestern University Medical School, Chicago, Illinois.

<sup>7</sup>Division of Molecular Medicine & Genetics, University of Michigan, Ann Arbor, Michigan.

<sup>8</sup>Correspondence should be directed to Joanne Haun, 347 Waisman Center, 1500 Highland Avenue, Madison, Wisconsin 53705.

*than 25% of training programs have a defined teratogen clinical rotation. Data from the survey are discussed and recommendations presented.*

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**KEY WORDS:** teratology; training; genetic counseling.

## INTRODUCTION

The provision of information about exposures during pregnancy has become an integral part of the practice of genetic counseling. The organization of responses to such inquiries has evolved into the establishment of teratogen information services around the country. Many such services are staffed by genetic counselors. This emphasizes the importance of adequate training of genetic counseling students in the principles of teratology, risk assessment and the provision of appropriate information to inquiring physicians and their patients (Stein *et al.*, 1994). Furthermore, the need for teratogen counseling skills was specified in the Asilomar guidelines (Walker *et al.*, 1990) and in the 1996 criteria for American Board of Medical Genetics and American Board of Genetic Counseling certification (American Board of Medical Genetics, 1994; American Board of Genetic Counseling, 1994).

In an effort to assess the current level of teratogen training in the master's level genetic counseling programs of North America, each program was surveyed by the Great Lakes Regional Genetics Group (GLaRGG) teratogen subcommittee. At the time, there were 17 genetic counseling training programs, 13 of which are associated with a university medical center. A list of training programs surveyed appears in Appendix A.

## MATERIALS & METHODS

The GLaRGG teratogen subcommittee formulated a questionnaire to assess how genetic counseling students were trained in teratogen counseling. The questionnaire was sent in September 1993 to all 17 master's level genetic counseling training programs in North America and the response rate was 100%. A copy of the survey appears in Appendix B.

## RESULTS

The programs vary in year of inception, the number of students and the length of time teratogen training has been part of the program (Table I). Counseling of patients whose sole indication for genetic counseling was

Table I. Program Demographics

Name of program	Year program began	Teratogen training since:	Students/yr
Brandeis University	1992	1992	7
Howard University	1980	1990	4-5
Indiana University	1991	1992	3-4
McGill University	1985	1985	5-7
Medical College of Virginia/Virginia Commonwealth University	1990	1990	4-5
Northwestern University	1990	1990	6
Sarah Lawrence	1969	?	25
UC Berkeley	1973	1983	8
UC Irvine	1973	1973	4-5
University of Cincinnati	1981	1981	7
University of Colorado	1973	1990	7
University of Michigan	1979	1988	4
University of Minnesota	1989	1989	5-6
University of Pittsburgh	1972	1985	10-15
University of South Carolina	1985	1985	6
University of Texas	1988	1988	3
University of Wisconsin	1976	1984	4-5

a teratogen exposure was a component of all 17 programs. While the total number of patients counseled by each student for this indication varied from 2 to 30, most programs reported an average of ten cases per student. Documentation of teratogen counseling by a student also varied and is summarized in Table II.

Four of the 17 genetic counseling programs had a defined, separate rotation whose sole focus was teratogen counseling. These four programs required that all students complete the teratogen rotation. The duration of the teratogen rotation ranged from 4 to 10 weeks. All programs with a separate teratogen rotation had an established teratogen information service (TIS) on site. Those programs without a separate teratogen rotation

Table II. Documentation Following a Teratogen Exposure Consultation

Letter to MD, letter to patient and chart notes	52%	(9/17)
Letter to MD and chart notes	12%	(2/17)
Letter to MD and letter to patient	6%	(1/17)
Letter to patient and chart notes	6%	(1/17)
Letter to MD	6%	(1/17)
Documentation varies within training program depending on clinic site	12%	(2/17)
No indication given about type of documentation	6%	(1/17)

indicated that teratogen counseling was part of either a prenatal or general genetics clinic rotation. Most programs indicated that their coursework included some lectures on topics related to teratogen counseling.

Questions about resources available to students for teratogen cases showed that most training programs had a combination of reference books, computer programs, and literature files. Thirteen of the 17 programs (76%) had four or more reference books available for student use. Sixteen of the 17 programs (94%) had access to the REPROTOX and/or TERIS computer programs. Other resources available for students included MEDLINE, product manufacturer information, TIS's, and consultants with specific areas of expertise. In addition, a variety of embryology textbooks were used either in coursework or during clinic rotations. Reference books and embryology textbooks cited by training programs are listed in Appendix C.

There was considerable variation in both the amount and the manner in which training on topics relevant to teratogen risk counseling was provided. Table III summarizes this variation. Principles of teratology and principles of embryology were the two topics covered most consistently in a didactic manner by training programs. The degree of coverage ranged from three lectures or less to a formal course. Five of the training programs did not provide training in principles of epidemiology. For those who provided training, all did so in a didactic lecture setting. The majority of programs did not provide training in principles of pharmacology.

Other general training with applicability beyond teratogen risk counseling, such as phone counseling skills, use of resources, and literature critique was different among programs (Table III). All programs provided training in the use of resources, but through a combination of formal lecture and clinical experience. As expected, phone counseling training was

Table III. Coverage of Teratogen Related Topics

Topic	Programs providing training	
Principles of teratology	16	(94%)
Principles of embryology	15	(88%)
Principles of epidemiology	12	(70%)
Principles of pharmacology	8	(47%)
Teratogenicity of specific agents	17	(100%)
Occupational exposures	14	(82%)
Recreational drug exposures	16	(94%)
Maternal diseases	16	(94%)
Infectious diseases	16	(94%)
Phone counseling skills	15	(88%)
Use of resources	17	(100%)
Literature critique	15	(88%)

provided through clinical rotation experiences, but only in 12 programs. One program did not provide training in either phone counseling skills or literature critique. However, some of those surveyed indicated that literature critique and phone skills could be addressed in different disciplines. All programs provided training about teratogenicity of specific agents, however, there was limited coverage of occupational exposures.

The majority of instructors involved in student training were genetic counselors. For those programs that use other health professionals, 82% involved MD/PhD geneticists, 29% had biologists/embryologists, and 53% used PhDs from other specialties. A single program involved professionals from seven different disciplines, which in addition to those listed above, included an occupational health specialist, a registered nurse, and a radiation specialist. Each of these professionals provided training through a section of a course and through clinical rotation. Among the programs, the median number of disciplines utilized in providing training was three (range 1-7). Although we attempted to assess the teratology training and continuing education of the instructors, the diversity of response precluded further analysis.

Although all the programs surveyed already provided some training in teratogen counseling, most (88.2%) indicated an interest in additional curricular material to incorporate in their program. Only four (23.5%) felt they provided good or adequate training, but two of them felt they could benefit from more material.

In answer to questions about content/form of instructional material, all programs desiring materials (15 of 17) included a selected series of individual topics or a "menu" approach. This appeared to be the most attractive option for program directors. (Table IV).

A need and desire among genetic counseling training programs to enhance teratology training are indicated by this survey. Only four of the 17 (23.5%) respondents had teratology "experts" available to provide training. On the other hand, 13 of 17 had clinical geneticists and 16 of 17 had genetic counselors available to teach prepared curricula.

## DISCUSSION

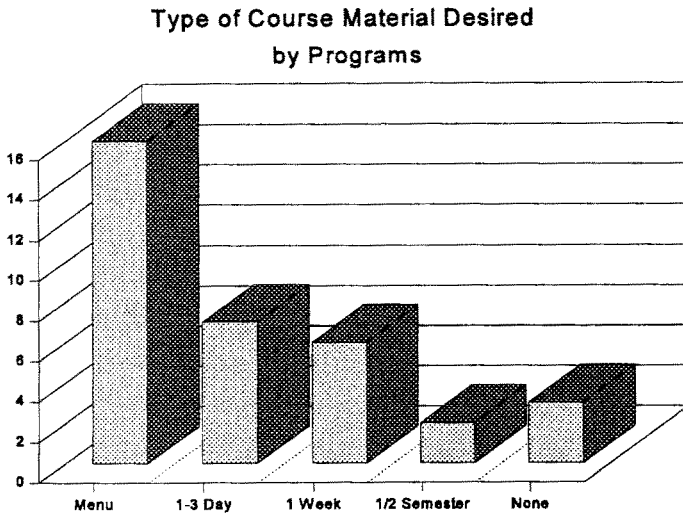
Training genetic counseling students in the area of teratogen counseling is recognized as an integral part of the curriculum by the 17 graduate programs surveyed. Although it is difficult to clearly define the exact nature and extent of the training provided by each program it is apparent that the training is delivered in a non-uniform manner. Such variation may result in significant differences in the level of expertise achieved by genetic counseling students. It is also clear that available technical and reference

resources are diverse. The training varies in lecture/course expectations as well as actual counseling experience. Programs with a TIS on site offer the most intensive and complete training.

Furthermore, while programs have a wide variety of professionals who provide teratogen training, genetic counselors often have the primary role of instruction/supervision of the students. This is not surprising, as the majority of teratogen training occurs within the context of a clinical rotation for which genetic counselors are the student supervisors. Thus, the signifi-

**Table IV.** Type of Course Material Desired by Training Programs

Selected Series of Lectures (Menu Approach)	One-Three Day Intensive Course	One Week Course	Half-Semester Course	None Requested (Adequate Coverage)
15	6	5	1	2



cant variability of teratogen training may also reflect the varied and sporadic training of the genetic counselors themselves.

The majority (88%) of programs expressed a desire for additional curriculum/training materials; most programs preferred a menu or modular approach because of limited time and lack of human resources. It is suggested that all topics listed in Table III could be part of a modular curriculum, thus allowing programs to be selective about lectures to enhance and supplement what is currently being provided. This material should be updated with advances in the field. In addition, the development of a casebook with teratogen counseling scenarios could be part of this teaching module. Its purpose would be to supplement those programs with a limited amount of clinical experience in different areas of teratogen counseling.

## CONCLUSION

As the field of genetic counseling has expanded, the need for specialized training in teratogen counseling has been recognized. Individual genetic counseling training programs have provided such training. However, the content and scope of training depended on the resources and staff available in each program. If genetic counseling students are to be trained adequately, and in a standardized manner, each training program must have access to comparable resources. We suggest that teratogen training teaching modules be developed to attain a more complete and uniform training process, perhaps create a professional standard for teratogen counseling training, and to fill some of the gaps in current programs (Koren, 1992; CORN committee, 1994). In addition, the establishment of minimum criteria or guidelines for teratogen training may be helpful in the future for evaluation of accredited genetic counseling training programs and for the development of certification standards for genetic counselors.

## ACKNOWLEDGMENTS

The authors especially thank the directors of the Genetics Counseling Training Programs for their time in completing the survey and their 100% response rate. In addition, the authors would like to thank Renata Laxova, MD, PhD, Louise Elbaum and Susan Fenton of the Great Lakes Regional Genetics Group for their support and assistance. Supported in part by Project MCJ-551004-04 from the Maternal and Child Health Bureau (Title V, Social Security Act), Health Resources and Services Administration, Department of Health and Human Services.

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## APPENDIX A. MASTER'S-LEVEL GENETIC COUNSELING TRAINING PROGRAMS IN NORTH AMERICA IN 1993 (LIST PROVIDED BY THE NATIONAL SOCIETY OF GENETIC COUNSELORS)

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| Genetic Counseling Program<br>University of California at Berkeley<br>Berkeley, California                 | Genetic Counseling Program<br>University of Minnesota<br>Minneapolis, Minnesota  |
| Genetic Counseling Program<br>Univ. of California Irvine Medical Center<br>Orange, California              | Human Genetics Program<br>Sarah Lawrence College<br>Bronxville, New York   |
| University of Colorado Health Sciences Center<br>The Children's Hospital<br>Denver, Colorado               | Genetic Counseling Program<br>Department of Environmental<br>Health/Kettering Labs University of<br>Cincinnati Cincinnati, Ohio              |
| Howard University College of Medicine<br>Division of Medical Genetics<br>Washington, D.C.                  | Genetic Counseling Program<br>Department Human Genetics<br>University of Pittsburgh<br>Pittsburgh, Pennsylvania                              |
| Northwestern University Medical School<br>Graduate Program in Genetic Counseling<br>Chicago, Illinois      | Genetic Counseling Program<br>University South Carolina School of<br>Medicine Department Obstetrics &<br>Gynecology Columbia, South Carolina |
| Department of Medical and Molecular<br>Genetics Indiana University Medical Center<br>Indianapolis, Indiana | Genetic Counseling Program<br>University of Texas-Medical School at<br>Houston Department of Pediatrics<br>Houston, Texas                    |
| Genetic Counseling Program<br>Department of Biology<br>Brandeis University<br>Waltham, Massachusetts       | Medical College of Virginia<br>Virginia Commonwealth University<br>Department Human Genetics<br>Richmond, Virginia                           |
| Genetic Counseling Program<br>University of Michigan Department of Genetics<br>Ann Arbor, Michigan         |  |



Genetic Counseling Program  
Madison, Wisconsin  
University of Wisconsin

Center for Human Genetics  
McGill University  
Montreal, Quebec  
Canada

**APPENDIX B. TERATOGEN TRAINING SURVEY, GREAT LAKES  
REGIONAL GENETICS GROUP, TERATOGEN SUBCOMMITTEE**

A. General Information

1. Number of students per class in your genetic counseling training program\_\_\_\_\_.
  2. Site:        \_\_\_HMO  
                  \_\_\_ private hospital/medical facility  
                  \_\_\_ university medical center  
                  \_\_\_ private practice  
                  \_\_\_\_\_ (other)
  3. Staff involved in training of your genetic counseling students.  

# on site	# off site	
_____	_____	BC/BE genetics counselor
_____	_____	MD/PhD - clinical
_____	_____	MD/PhD - molecular
  4. When was your genetic counseling training program established?  
\_\_\_\_\_
  5. Does your clinical genetics program provide teratogen counseling? Y N  
Do you provide counseling: a) by phone b) in clinic c) both  
Do you have a formal, established Teratogen Information Service? Y N  
if yes, how many inquiries does the service handle per year?\_\_\_\_\_
  6. Is teratogen training provided to the genetic counseling students?  
Y N  
Was this part of the training when your program began? Y N  
Is teratogen training required? Y N
- B. Genetic Counseling Training Program Teratogen Training
7. What, if any, embryology text is used as part of your program?  
\_\_\_\_\_
  8. What resources do your students have access to regarding teratogens?  
\_\_\_\_\_  
Which teratogen database?\_\_\_\_\_

Which texts? \_\_\_\_\_  
 Do you have teratogen literature files? \_\_\_\_ How extensive are they?  
 \_\_\_\_\_

9. Do your students see patients whose sole reason for a clinic visit is due to a pregnancy exposure? \_\_\_\_ Is this a requirement? Y N  
 How many patients of this type are students required to see?  
 \_\_\_\_\_

How many patients of this type do students generally see? \_\_\_\_

10. Are students required to write letters to physicians, patients or to write chart notes regarding exposures?  
 \_\_\_\_\_

11. To whom else besides your genetic counseling students is this course/rotation offered? \_\_\_\_\_  
 Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

12. Please provide the following information regarding the teratogen training of your genetics counseling training program.

Topic	How provided (see list)	# of hours
Principles of teratology	_____	_____
Principles of neurobehavioral teratology	_____	_____
Principles of embryology	_____	_____
Principles of epidemiology	_____	_____
Statistics	_____	_____
Literature critique	_____	_____
Use of resources	_____	_____

Topic	How provided (see list)	# of hours
Principles of pharmacology	_____	_____
Phone counseling skills	_____	_____
Teratogenicity of specific agents	_____	_____
Occupational exposures	_____	_____
Maternal disease	_____	_____
Infectious diseases	_____	_____
Recreational drug exposures	_____	_____

List

A - formal course

- B - incorporated into other courses
- C - clinical rotation
- D - assigned reading
- E - not provided
- F - other

Topic	Who teaches (see list)
Principles of teratology	_____
Principles of neurobehavioral teratology	_____
Principles of embryology	_____
Principles of epidemiology	_____
Statistics	_____
Literature critique	_____
Use of resources	_____
Principles of pharmacology	_____
Phone counseling skills	_____
Teratogenicity of specific agents	_____
Occupational exposures	_____
Maternal disease	_____
Infectious diseases	_____
Recreational drug exposures	_____

List

- A - genetic counselor
- B - medical geneticist
- C - toxicologist
- D - pharmacologist
- E - embryologist
- F - occupational health specialist
- G - developmental biologist
- H - nurse
- I - MD
- J - other

C. Staff Training

13. If teratogen counseling is provided at your clinical center, what training does the person providing that counseling have?

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14. Have the staff had formal training in teratology? Y N

If yes, briefly describe \_\_\_\_\_

15. Are staff required to take the Human Teratology course offered by Massachusetts General Hospital and Harvard Medical School? Y N
16. Do the staff participate in continuing education for teratology? Y N  
If yes, briefly describe \_\_\_\_\_
17. Are there courses available in your academic community? Y N  
Are staff encouraged/required/financially assisted to attend? Y N
18. Are there "experts" available for consult? Y N  
From what specialities? \_\_\_\_\_  
Are they paid/formally affiliated with your center? \_\_\_\_\_

#### D. Program Needs

19. Would you be interested in curricular material to incorporate teratogen counseling into your program? Y N  
If so, which would best suit your needs?  
 a select series of individual lectures/topics (menu approach)  
 1-3 day intensive short course  
 one week course  
 one term course
20. Check among the following which personnel could be available for your program/instructors:  
 teratogen counselor  
 embryologist  
 Pharm. D.  
 teratologist  
 interested clinical geneticist
21. If you currently provide teratogen training to genetic counseling students in your training program, would you be willing to provide us with a summary of topics presented and requirements?  
 \_\_\_\_\_  
 \_\_\_\_\_

### APPENDIX C. RESOURCES

Berkowitz RL, Couston DR, Mochizuki TK (1986) *Handbook for Prescribing Medications During Pregnancy* (2nd Ed). Boston: Little, Brown and Company.

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