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ORIGINAL RESEARCH

Where are the Males? Gender Differences in Undergraduates' Interest in and Perceptions of the Genetic Counseling Profession

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Abstract Genetic counseling is a female-dominated field, with women comprising about 95% of the profession (Smith et al. 2009). Greater patient choice and satisfaction may be achieved by increasing the number of male counselors, but empirical evidence about the reasons for this gender imbalance is limited. In this study 190 undergraduates (110 females, 79 males, 1 unknown) in upper division bioscience courses completed a survey assessing their knowledge and perceptions of and interest in genetic counseling as a career. There were only two significant gender differences. Females indicated significantly greater interest than males in pursuing a genetic counseling career, and they rated interpersonal skills as more integral to genetic counseling than males. Multiple regression analyses of knowledge and perceptions as possible predictors of male and female interest in pursuing a genetic counseling career yielded no significant predictors of male interest. For females, there were four significant predictors: estimated salary, career characteristics, perceptions of genetic counseling as interpersonally focused, and whether they had already chosen a career. Implications for recruiting males to the profession, and research recommendations are presented.

Keywords Genetic counseling · Perceptions of genetic counseling career · Student recruitment · Genetic counselor diversity · Genetic counselor gender diversity

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Overview

Since its inception, genetic counseling has been a female-dominated profession. A review of the relatively brief, but storied, history of genetic counseling reveals it is a field essentially developed by women, for women. In 1969 the first specialized graduate level training program was established at Sarah Lawrence College in Bronxville, NY (slc.edu) (2009). The first classes recruited for the program were comprised entirely of females. The first male student did not enter the program until six years later. The field itself seemed to be developed for the purpose of creating an avenue for females who wanted to pursue a career that would be intellectually stimulating, but would also allow them to have a family. As Melissa Richter, Director of the first graduate level training program, stated "I watched two or three women a year, who had begun pre-med training, change their minds because they were contemplating marriage and having children. But these women who were highly intelligent and who had their minds set on medicine found themselves at a loss to choose an alternate profession" (slc.edu).

The gender imbalance present so many years ago persists today. According to a recent National Society of Genetic Counselors (NSGC) Professional Status Survey, males comprised just 5% of all survey respondents (Smith et al. 2009). Furthermore, slightly less than 8% of graduate program applicants for the past three academic years were

male (Yashar 2008, 2010). These data suggest the gender imbalance among genetic counseling professionals is due to the small number of males pursuing the career, rather than to their attrition from the field. In order to better understand and address the under-representation of males in the genetic counseling profession, it is important to investigate why they are less likely than females to pursue a career in genetic counseling. The purpose of the present study was to identify possible reasons by assessing male and female undergraduates' interest in and knowledge and perceptions of genetic counseling as a career.

Importance of Gender Diversity within Genetic Counseling

A growing body of literature supports the importance of diversifying health professions. Greater diversity among health professionals is associated with increased access to care, greater patient choice and satisfaction, and better patient-provider interactions (IOM 2004; Mittman and Downs 2008). The field of genetics is expanding into many different areas of medicine, and genetic counselors are in the forefront of these areas. In 2008, genetic counseling encompassed at least 14 different sub-specialties, including cancer genetics, pediatrics, neurogenetics, and cardiology (Smith et al. 2009). Many of the genetic disorders associated with these subspecialties affect males and females equally. Greater patient choice and satisfaction might be achieved if male patients have an option to receive services from male genetic counselors, especially when discussing sensitive subjects that can surround genetic conditions. A diverse workforce also has been shown to enrich the educational experience of all parties as it challenges stereotypes, enhances cultural competence, and fosters lasting relationships (Cohen et al. 2002; Friedman 2007; Lee and Coulehan 2006; Mittman and Downs 2008).

Factors Potentially Influencing Male Interest in Genetic Counseling

Literature in genetic counseling and other fields offers possible explanations for why so few males pursue a career in genetic counseling. First, males simply may not be aware the field exists and/or that it is a legitimate career choice. Oh and Lewis (2005) surveyed 233 high school and college students to examine their awareness and perceptions of genetic counseling. Although they were primarily interested in understanding the under-representation of racial/ethnic minority counselors, they also analyzed sex differences. These researchers found that although males who had previous knowledge of genetic counseling were equally as likely as females to indicate they would consider it as a career, they were less likely to have heard about genetic counseling. These findings suggest one reason males may not pursue a genetic counseling career is their lack of familiarity with the profession. As Oh and Lewis (2005) discussed, however, it is unlikely that females were selectively exposed to information regarding genetic counseling, while males were not. Therefore, additional factors probably contribute to their lack of familiarity with the profession.

In addition to lack of familiarity with genetic counseling, the profession is a non-traditional career choice for males. According to the U.S. Department of Labor, non-traditional careers are those in which one gender comprises less than 25% of the workforce (JTPA 1998). Various theories describe how individuals are socialized toward or away from certain careers. In his Circumscription and Compromise Theory (CCT), Gottfredson (1981) postulates the formation of self-concept and occupational preferences begins in early childhood. Central to this formation are perceptions of and preferences for gender roles. According to CCT theory, circumscription occurs as young people eliminate occupations because they are incompatible with their developing self concepts. Compromise occurs as they rule-out their preferred choices because they perceive them to be inaccessible (e.g., the job is the wrong gender type) (Gottfredson 1981; Gottfredson and Lapan 1997; Simpson 2005).

Witt (1997) similarly argues that, "Children learn at a very early age what it means to be a boy or a girl in our society. Through myriad activities, opportunities, encouragements, discouragements, overt behaviors, covert suggestions, and various forms of guidance, children experience the process of gender role socialization" (p. 253). Males and females typically are socialized to fulfill different expectations. Traditional gender role expectations assume females are more nurturing and emotionally expressive, while males are more stoic and competitive. Some researchers who study gender role expectations and gender role conflict have found male gender role conflict is greater in the areas of work and family; this conflict manifests as a drive for success, power, and competition, and as restrictive emotionality and strained interpersonal relationships (Cournoyer and Mahalik 1995; Leadbeater et al. 1995). According to gender role theory and research, recruitment of males into a non-traditional field may be challenging since they are socialized to fulfill their duty as a male by pursuing a career choice that allows them to gain prestige and power. Genetic counseling may conflict with most males' gender identity if they view it as a female profession and one with limited prestige and power.

Research has identified a number of barriers for males who pursue non-traditional careers. La Rocco (2007) described three barriers for men who pursue nursing: low salary and status, a widely-held perception that nursing is a female

profession, and a belief that there are limited opportunities for advancement. Additional barriers involve stigma, specifically questions regarding the sexual identity of men who pursue "female" careers (Cross and Bagilhole 2002; Lupton 2000; Whittock and Leonnard 2003). Rolfe (2006) similarly identified low status and salary as barriers for males in early childcare occupations. She also hypothesized that men feel uncomfortable working with predominantly female colleagues. La Rocco (2007) argued that negative stereotypes about men who do "women's work" may deter males from pursuing certain jobs and careers.

Schoonveld and colleagues (Schoonveld et al. 2007) provide evidence of these barriers in genetic counseling. They interviewed ethnic and gender minority genetic counseling students and recent graduates about their experiences in the genetic counseling profession. The male student participants perceived genetic counseling primarily as a female career choice and one that may be financially unattractive. They speculated that because the field was founded by females, it may be grounded in principles more likely to appeal to women. Although these findings are based on only three males, they are concerning as they represent the experiences and perceptions of individuals who were actually pursuing a career in genetic counseling. Such perceptions might be even stronger among males who do not consider genetic counseling to be a viable career option.

In contrast to research on barriers, some investigations identified reasons men join non-traditional careers in human service professions (e.g., nursing, elementary education, childcare, and elementary school counseling). These reasons include: opportunities for less stressful occupations, increased options for other life choices, personal fulfillment, greater economic stability of those jobs, and increased opportunities for advancement to authority positions that might not be available in male-dominated occupations (Cross and Bagilhole 2002; Lease 2003; Lupton 2000; Simpson 2004, 2005; Whittock and Leonnard 2003). Many of these reasons are incompatible with a traditional socialized gender role for men. Indeed, men who enter non-traditional careers appear to hold less traditional gender-role attitudes (Dodson and Borders 2007).

Lega and colleagues (Lega et al. 2005) surveyed genetic counseling graduate students about their sources of support for pursuing a genetic counseling career, their career motivations, and their career choice certainty. Their respondents reported numerous reasons for becoming a genetic counselor including personal fulfillment. This reason seems to be compatible with those mentioned by men in other non-traditional careers (cf. Simpson 2005). Thus, genetic counseling may be particularly attractive to those men searching for a non-traditional career choice.

It is important to assess whether men in the general population view genetic counseling as a non-traditional career choice and, if so, whether their views affect their interest in pursuing a career in this field. It also is important to identify other factors that may be supports or barriers with respect to their interest in genetic counseling.

Purpose of the Present Study

The purpose of this study was to examine gender differences in college undergraduates' knowledge and perceptions of and interest in genetic counseling as a career. An anonymous survey was distributed to students enrolled in upper division bioscience courses at a major Midwestern university. Four major research questions were investigated: (1) What do undergraduates in bioscience majors generally know about genetic counseling? (2) What aspects of a genetic counseling career are attractive to students? (3) Is there a significant gender difference in knowledge and perceptions of and interest in genetic counseling as a career? and (4) Are knowledge and perceptions significant predictors of male versus female interest in pursuing a career in genetic counseling? This is the first study that specifically and comprehensively investigated possible reasons for the gender imbalance in genetic counseling. It was hoped the findings would contribute to efforts to recruit more males to the profession.

Methods

Participants and Procedures

Upon receipt of approval from a University of Minnesota institutional review board, a survey was distributed to students in 7 sections of upper-division undergraduate bioscience courses at a major Midwestern university. These included 2 sections of a cell biology lecture course, 1 section of a genetics lecture course, and 4 sections of a genetic laboratory course. The first and third authors attended these classes to invite students to participate in the study and to administer the survey. They described the study as an investigation of undergraduate students' perceptions of and interest in genetic counseling as a career. There was no incentive given for participation.

A total of 209 surveys were distributed between December 1, 2008 and December 9, 2008. All surveys were completed in class, and completion time ranged from 10 to 25 min. One-hundred ninety-two surveys were returned (a 91.2% response rate). Two of the returned surveys were excluded from data analysis because they did not contain usable data. One individual did not answer the

item about gender. That respondent's data were included in analyses involving the entire sample and excluded for analyses of possible gender differences. Thus, the final sample consisted of 190 student respondents.

Instrumentation

The survey was developed by the research team (an advanced genetic counseling student, a licensed psychologist, a counseling psychology doctoral student, and an experienced genetic counselor). A draft of the survey was piloted with 20 undergraduate students enrolled in an introductory biology course. Based on their feedback, minor revisions were made to improve clarity.

The survey consisted of 3 sections. Section 1 (Demographics section) contained 10 questions asking about respondents' personal demographic information including gender, race/ethnicity, age, major/minor, whether they had selected a career to pursue and what career they had selected, parents' education level, whether the respondents were considering advanced education, and current grade point average. Section 2 (Pre-survey section) asked whether respondents had heard of genetic counseling prior to taking this survey (Yes/No/Not Sure), how they had heard of genetic counseling (checklist) and how familiar they were with genetic counseling (Scale:1 = Little or no familiarity, 2 = Somewhat familiar, 3 = Familiar, 4 = Very familiar). A final item asked respondents to provide a definition of genetic counseling in their own words.

Section 3 (Survey section) began with this description of genetic counseling provided on the National Society of Genetic Counselors (NSGC) website (NSGC.org) (2009):

> Genetic Counselors are health professionals with specialized graduate degrees and experience in the areas of medical Genetics and Counseling. Most enter the field from a variety of disciplines, including biology, genetics, nursing, psychology, public health, and social work.
>
> Genetic Counselors work as members of a health care team, providing information and support to families who have members with birth defects or genetic disorders and to families who may be at risk for a variety of inherited conditions. They identify families at risk, investigate the problem present in the family, interpret information about the disorder, analyze inheritance patterns and risks of recurrence and review available options with the family.
>
> Genetic Counselors also provide supportive counseling to families, serve as patient advocates and refer individuals and families to community or state support services. They serve as educators and resource people for other health care professionals and for the general public. Some counselors also work in administrative capacities. Many engage in research activities related to the field of medical genetics and Genetic Counseling.
>
> (Adopted by the National Society of Genetic Counselors, Inc. 1983)

Respondents were then asked to indicate how informative this description was (Scale: 1 = Not very informative, 2 = Somewhat informative, 3 = Informative, 4 = Very informative). Next they were instructed to respond to 25 items assessing their perceptions of genetic counseling as a career. These items were developed based in part on a combination of results from the Oh and Lewis (2005) and Lega et al. (2005) studies. Examples of items are: Genetic counseling is a career that involves too much responsibility; It is difficult for a person to get accepted into a genetic counseling training program; Genetic counselors have strong interpersonal skills; and Genetic counseling raises moral dilemmas for patients. Respondents indicated how strongly they agreed with each item (Scale: 1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree).

Section 3 also contained two open-ended items asking respondents to identify the most and least attractive aspect(s) of a career in genetic counseling. Respondents were then asked to provide an estimation of the percentage of males and females that comprise the field of genetic counseling as well as an estimation of the average annual salary for a full time genetic counselor. Next they indicated their interest in pursuing a career in genetic counseling (Scale: 1 = Little or not at all interested, 2 = Somewhat interested, 3 = Interested, 4 = Very interested). Respondents were then asked to provide comments explaining their level of interest. A final question asked if they believed they would make a good genetic counselor and to provide a reason for their answer.

Data Analyses

Quantitative Analyses

Descriptive statistics (number of participants, percentages, means, and standard deviations) were calculated for survey responses by the total sample, and separately for male and female respondents. A series of two sample t-tests were performed to assess possible significant gender differences in major study variables. Bonferroni correction was used to control family wise error rate due to conducting multiple t-tests. The researchers aimed for a power of .80 at the alpha level of .01 to detect a medium effect size (.50) when assessing gender differences; to reach this power, a total number of 186 participants is needed (supposing an equal number of male participants and female participants). All statistical analyses were performed using SPSS statistical analysis software.

For the 25 items assessing student perceptions of genetic counseling, the first author and two other members of the research team worked together to categorize them into categories (factors) based on their conceptual similarity. They identified 5 categories (factors) *Moral Challenges (4 items)*, *Interpersonal Aspects* (5 items), *Basic Science Aspects* (4 items), *Career Aspects* (8 items) and *Difficulty* (3 items). One item (*Genetic Counselors are a culturally-diverse group)* could not be included in any of the categories and therefore was not included in subsequent analyses. Factor analysis was used to confirm the authors' conceptualization of these categories. Principle axis factoring was used as the extraction method. Items with a factor load whose absolute value is less than .3 were removed from the factor. Mean differences between the male sample and female sample for the five factors were calculated and analyzed with two sample t-tests to identify significant gender differences in perceptions of genetic counseling. Bonferroni correction was used to control family wise error rate when multiple t-tests were conducted.

Based on the assumption that males and females may become interested in genetic counseling as a career for different reasons, separate stepwise multiple regression analyses were conducted to identify significant predictors of male and female respondents' interest in pursuing a career in genetic counseling. The dependent variable, interest in genetic counseling, was regressed on four possible predictors: perceptions of genetic counseling (the five conceptual factors determined from the factor analysis), whether respondents had already selected a career, estimated genetic counselor gender ratio, and estimated genetic counselor salary.

Qualitative Analysis

Responses to five open ended questions which asked respondents to: describe genetic counseling in their own words, identify the most and least attractive aspect(s) of a career in genetic counseling, explain their level of interest in pursuing a career in genetic counseling, and explain why they would or why they would not make a good counselor were analyzed using an interpretive content analysis method (described in Giarelli and Tulman 2003, p. 951). This method allows responses with similar conceptual themes to be categorized. This process began with the first author analyzing the content of responses to each question and grouping them based on their conceptual similarities. Next, he reviewed each grouping and labeled it with a name that represented the major theme underlying the responses in that grouping. After the themes were identified, coding was done inclusively, allowing a response to be coded under multiple themes. The second author served as data auditor, reviewing themes and response classifications. Any disagreements were discussed to reach consensus.

Results

Sample Demographics

Table 1 contains a summary of respondents' demographic information. There were more females (58.2%, $n=110$) than males (41.8%, $n=79$), and about three-fourths of the sample identified themselves as Caucasian. They ranged in age from 17 to 52 years (mean=22.3 years; SD=3.3 years). The great majority (91.5%) reported either a genetics or bioscience major. Their average GPA was 3.3 (SD=0.41; Range: 2.0–4.0). At the time of the survey, almost 80% had selected a career to pursue. Most of the respondents' parents had obtained a bachelors degree or higher (55.6% of mothers, 62.7% of fathers), and most (88.3%) were considering post-baccalaureate education.

Respondent Familiarity, Knowledge, and Interest

Table 2 contains a summary of students' responses to questions concerning their familiarity with and knowledge about genetic counseling as a career. Most reported having previously heard the term genetic counseling (87.3%), with the most common source being a college level course (41.4%). Most respondents were also familiar with the genetic counseling field, as 69% indicated they were *somewhat* or *very familiar*. Male and female respondents did not differ significantly in their familiarity with genetic counseling, $t(185)=1.726$, $p=.089$. About 90% rated the NSGC description of genetic counseling as *informative* or *very informative*.

Table 2 also contains respondents' estimations of the percentage of males and females in the field of genetic counseling, and the annual salary for a full time genetic counselor. Across the sample, mean estimates of the percentages of female and male genetic counselors were 63.4% (SD=15.9%) and 36.6% (SD=15.9%), respectively. There were no statistically significant differences in male versus female respondents' estimates of percentage of males in the profession, $t(173)=1.429$, $p=.155$. The mean estimated annual salary was $65,546 (SD=$20,529). There were no statistically significant differences in male versus female respondents' salary estimates, $t(168)=.699$, $p=.485$.

There was a statistically significant difference due to gender in interest in pursuing a career in genetic counseling. Females ($n=106$) reported significantly greater interest in pursuing a career in genetic counseling than did males (n=73), $t(178)=4.01$, $p \leq .001$ (mean=2.20; SD=0.90 vs. mean=1.68; SD=0.78, respectively). There was a small but statistically significant correlation between familiarity and interest ($r=2.57$, $p<.001$). Across the sample, respondents who reported greater familiarity with genetic counseling tended to express greater interest in pursuing a career in this field.

Table 1 Respondents' demographics (N=190)

Variable	n	%	Mean	SD
Gender				
Female	110	58.2		
Male	79	41.8		
Race/Ethnicity				
Caucasian	140	75.3		
Asian/Pacific Islander	26	14.0		
African American/Black	6	3.2		
Bi-Racial	3	1.6		
Chicano/Hispanic/Latino/a	3	1.6		
Other	8	4.3		
Age (years)			22.3	3.3
<21	28	14.9		
22–23	130	69.1		
>23	30	16.0		
Current major				
Miscellaneous Biology	110	58.2		
Genetics	63	33.3		
Other (Non-Biology)	16	8.5		
Chosen a career?				
Yes	149	79.7		
No	38	20.3		
Mother's highest degree attained				
High school diploma	49	26.5		
Associate of Arts degree	22	11.9		
Bachelors degree	69	37.3		
Masters degree	24	13.0		
Doctoral degree	8	4.3		
MD	3	1.6		
Other: Degree outside U.S., lawyer, less than high school diploma, RN, tech degree	10	5.4		
Father's highest degree attained				
High school diploma	40	21.5		
Associate of Arts degree	18	9.7		
Bachelors degree	66	35.5		
Masters degree	29	15.6		
Doctoral degree	13	7.0		
MD	8	4.3		
Other: 2 yr. degree/tech degree, DDS, GED, lawyer, no/some high school, some college, none or N/A	12	6.5		
Considering advanced education?				
Yes	166	88.3		
Not Sure	16	8.5		
No	6	3.2		
Current GPA (4.0 scale)			3.3	0.41
>3.0	151	81.6		
<2.9	34	18.4		

n's vary slightly because not all respondents answered every item

Table 2 Respondents' knowledge of and familiarity with genetic counseling

Variable	*n*	%	Mean	SD	Range	
					Min	Max
Had you heard the term *genetic counseling?*						
Yes	165	87.3				
No	18	9.5				
Not Sure	6	3.2				
How did you hear of genetic counseling?						
Class (College)	24	41.4				
Friend	9	13.8				
Media (TV, magazines, etc...)	7	10.8				
Academic Advisor	5	7.7				
Professor	5	7.7				
Family member was a GC patient	1	1.5				
Class (High School)	1	1.5				
Co-worker	1	1.5				
Family member	1	1.5				
Other (n=11): Internet (n=3), Mentor program (n=2), Babysit for children who have CF, Ethics question somewhere, Friend's sister is genetic counselor, Information for prenatal Class, Shadowed a genetic counselor, Family member is genetic counselor						
How familiar are you with genetic counseling?			1.96	0.83	1	4
Little or no familiarity (1)	58	31				
Somewhat familiar (2)	90	48.1				
Familiar (3)	28	15				
Very familiar (4)	11	5.9				
How informative is the description of genetic counseling provided?			3.24	0.68	1	4
Not very informative (1)	3	1.6				
Somewhat informative (2)	16	8.6				
Informative (3)	68	36.4				
Very informative (4)	100	53.5				
What is your estimate of % of male & female genetic counselors?						
Females			63.4	15.9	10	99
Males			36.6	15.9	1	90
What is your estimate of annual salary for a full-time genetic counselor?			$65,546	20,529	$30,000	$175K

n's vary slightly because not all respondents answered every item

Respondents' Perceptions of a Genetic Counseling Career

Factor Analysis

Factor analysis with principle axis factoring was conducted on 24 of the 25 items assessing student perceptions of genetic counseling. As described in the Methods section, these items were grouped by the research team into 5 factors based on their conceptual similarity. As shown in Table 3, the 5 factors are: *Moral Challenges* (3 items), *Interpersonal Aspects* (4 items), *Basic Science Aspects* (3 items), *Career Aspects* (6 items) and *Difficulty* (2 items).

The Moral Challenges factor consists of items indicating genetic counseling is associated with inherent challenges (e.g., Genetic counseling raises moral dilemmas for patients). The *Interpersonal Aspects* factor consists of items indicating genetic counseling involves helping or working with others (e.g., Genetic counseling is a career that allows a person to help others). The *Basic Science Aspects* factor consists of items indicating genetic counseling is associated with scientific concepts and research (e.g., Genetic counselors are strong in science). The *Career Aspects* factor consists of items indicating genetic counseling has certain advantages (e.g., Genetic counseling is a prestigious career). The

Table 3 Factor analysis with principal axis factoring for items concerning respondents' perceptions of genetic counseling

Factor	Items	Factor loadings
Moral challenges	Genetic counseling can cause distress for the Counselor.	**.318**
	Genetic counseling raises moral dilemmas for patients.	**.803**
	Genetic counseling raises moral/ethical issues for the genetic counselor.	**.777**
	Genetic counseling is a career that involves too much responsibility.	.120
Interpersonal Aspects	Genetic counseling is a career that allows a person to help others.	**.577**
	Genetic counseling combines science and working with people.	**.573**
	Genetic counselors primarily educate patients.	**.317**
	Genetic counselors have strong interpersonal skills.	**.567**
	Genetic counselors primarily provide patients with psychosocial support.	.130
Basic Science Aspects	Genetic counselors are strong in science.	**.613**
	Genetic counseling is intellectually stimulating.	**.520**
	Genetic counselors do not do much research.	**−.389**
	Genetic counselors engage in a great deal of lab work.	.190
Career Aspects	The number of job opportunities for genetic counselors will be limited in the future.	**−.356**
	Genetic counseling is a "stepping stone" before applying to medical school, law school, etc…	−.061
	Genetic counseling is too limited.	**−.450**
	Genetic counseling is a prestigious career.	**.574**
	There are a lot of job opportunities for genetic counselors.	**.547**
	Genetic counselors do not receive high salaries.	**−.307**
	Genetic counseling is a meaningful career.	**.481**
	Genetic counselors have the option to work part-time.	−.009
Difficulty	The type of training required of genetic counselors is too difficult.	**.877**
	Genetic counseling is too difficult.	**.545**
	It is difficult for a person to get accepted into a Genetic Counseling training program.	.236

Items with a factor load between .3 and −.3 were removed from the factor. Items with a factor load >.3 were retained in the factor. Items with a negative factor load value <−.3 were reverse coded and retained in the factor. Numbers in bold font refer to retained items

Difficulty factor consists of items indicating genetic counseling is a demanding field (e.g., Genetic counseling is too difficult).

Mean Differences in Male vs Female Perceptions

Mean ratings for items comprising the five factors were calculated separately for males and females, and they are reported in Table 4. Means are based on composite scores (the sum of responses to individual items for each factor). Gender differences in ratings were assessed with two sample t-tests, also summarized in Table 4. There was only one statistically significant gender difference. Females rated the Interpersonal Aspects factor as more integral to genetic counseling than did males, $t(180)=-3.41$, $p\leq.001$(mean= 13.59; SD=1.50 vs mean=12.85; SD=1.35).

Multiple Regression Analyses

Step wise multiple regression analyses were conducted to identify significant predictors of male and female students' interest in pursuing a career in genetic counseling. Interest was regressed on these predictors: perceptions of genetic counseling (the five conceptual factors determined from the factor analysis), whether students had already selected a career, estimated genetic counselor gender ratio, estimated genetic counselor salary, and their familiarity with the genetic counseling profession. Separate regression analyses were conducted for females and males.

For each regression analysis, an ANOVA test of significance of the overall regression model was conducted to determine whether the combination of variables significantly predicted interest in pursuing a career in genetic counseling. None of the variables were significant predictors of male respondents' interest in the career. For females, the multiple regression was significant, $F(5, 81)=9.451$, $p<.001$. As shown in Table 5, there were five significant predictors: the Career Aspects factor, the Interpersonal Aspects factor, whether respondents' had already chosen a career to pursue, their estimated genetic counselor salary, and their familiarity with genetic counseling. These factors together accounted for 36.8% of the variance in female

Table 4 Means, standard deviations, standard errors, and t-tests of significance for male vs. female respondents' perceptions of genetic counseling career factors

Factor	*n*	Mean	SD	St. Error	t	df	*p*
Moral challenges					−2.55	178	0.012
Female	105	8.89	1.56	0.152			
Male	75	8.24	1.82	0.210			
Interpersonal aspects					−3.41*	180	≤0.001
Female	106	13.59	1.50	0.146			
Male	76	12.86	1.35	0.155			
Basic science aspects					−1.10	181	0.274
Female	108	9.83	1.30	0.125			
Male	75	9.63	1.18	0.137			
Career aspects					−1.02	172	0.309
Female	103	17.60	2.30	0.226			
Male	71	17.27	1.84	0.219			
Difficulty					−0.01	181	0.991
Female	106	3.75	0.89	0.085			
Male	77	3.75	0.75	0.087			

n's vary slightly because not all respondents answered every item

*$p<.01$. Alpha level was set to .01 according to Bonferroni correction

students' interest. Specifically, female students who reported a greater interest in pursuing a career in genetic counseling tended also to perceive the career as having advantages and as requiring strong interpersonal skills, they

Table 5 Stepwise multiple regression analysis of significant predictors of female respondents' interest in genetic counseling career ($n=87$)

Variable	R	R^2	R^2 change	F change	Model *p*	beta (β)[f]	*B*[f]	*p*
Model 1	.376[a]	.141	.141	13.990	<.001			
Career Aspects						.151	.376	≤.001
Model 2	.493[b]	.243	.102	11.276	<.001			
Career Aspects						.131	.328	.001
Familiarity with GC						.301	.322	.001
Model 3	.529[c]	.280	.037	4.296	<.001			
Career Aspects						.147	.367	≤.001
Familiarity with GC						.291	.311	.001
Chosen a Career						−.433	−.197	.041
Model 4	.571[d]	.326	.046	5.617	<.001			
Career Aspects						.121	.303	.003
Familiarity with GC						.262	.280	.003
Chosen a Career						−.497	−.226	.018
Interpersonal Aspect						.140	.231	.020
Model 5	.607[d]	.368	.042	5.401	<.001			
Career Aspects						.116	.289	.003
Familiarity with GC						.263	.281	.003
Chosen a Career						−.554	−.252	.007
Interpersonal Aspects						.156	.257	.009
Estimate of Salary						3.97E−006	.208	.023

[a] Predictors: (Constant), Career Aspects

[b] Predictors: (Constant), Career Aspects, Interpersonal Aspects

[c] Predictors: (Constant), Career Aspects, Interpersonal Aspects, Chosen a Career

[d] Predictors: (Constant), Career Aspects, Interpersonal Aspects, Chosen a Career, Salary estimate

[e] Dependent Variable: Females' interest in becoming a genetic counselor

[f] β—unstandardized regression coefficient; *B*—Standardized regression coefficient

tended to not have chosen a career, they estimated a higher annual genetic counselor salary, and they reported more familiarity with the genetic counseling profession.

Analysis of Open-Ended Responses

Responses to the five open-ended questions were grouped into themes. Some responses were multifaceted and therefore were classified into more than one theme. There were no discernible patterns in responses due to respondent gender, so data are reported for the sample as a whole.

Definition of Genetic Counseling

Respondents were asked, "Regardless of how familiar you are with genetic counseling, in your own words, please explain what you think genetic counselors do." One-hundred seventy-eight students commented, and their responses were classified into 6 themes: 1) Patient population (description of the types of patients served by genetic counselors); 2) Determine risk (of a genetic disorder); 3) Counseling (assisting in decision making); 4) Patient education; 5) Treatment [some respondents erroneously thought genetic counselors treat genetic conditions (e.g., "Providing gene therapy")]; and 6) Miscellaneous (e.g., "Help woman get pregnant").

Most Attractive Aspects

Respondents were asked, "What do you consider to be the most attractive aspects of a career in genetic counseling?" One-hundred seventy-one students provided comments that were classified into four themes: 1) Genetic counselor role/responsibility [counseling/education, combination of genetics and counseling, interpersonal aspects (e.g., "Working with people and having patients that you get to know—if that happens," and scientific aspects)]; 2) Extrinsic career features (job opportunities, job stability, prestige, and/or salary); 3) Meaningful work (satisfaction due to the impact genetic counselors have on patients, and 4) Miscellaneous (e.g., "Being informed yourself about family planning options").

Least Attractive Aspects

One-hundred sixty-two students responded to the question, "What do you consider to be the least attractive aspects of genetic counseling?" Their responses were categorized into 4 themes: 1) Genetic Counselor Role/Responsibilities [giving bad news, difficult situations, power and influence, research/lab work (e.g., "Little to no lab work," and "Too much lab work,") working with people, limited patient care options, and science/genetics aspect]; 2) Personal Challenges (ethical/moral dilemmas, and counselor personal bias); 2) Extrinsic Career Features [poor employment outlook, educational requirements, lack of challenges (e.g., "Sounds like it would be kind of monotonous"), and low prestige/public recognition)]; and 4) Miscellaneous (e.g., "Mathematical calculations").

Student Interest

Respondents were asked to "Explain your level of interest in pursuing a career in genetic counseling." One-hundred fifty-two students provided comments that were categorized into 5 themes: 1) Not interested [due to other career interests, perceived features of the career (e.g., "I want to achieve something very novel with my biological research. Not just the simpler way to determine how to help people who have bad genes in a sense, so they do not pass them on")]; 2) Interested ("It would be interesting to be always informed in the area of genetic conditions. I would also enjoy the patient contact and giving support"); 3) Tentative interest (Some indicated they needed more information in order to make a decision, and others indicated they were considering genetic counseling at the time of this study); 4) Mixed interest (e.g., "It is my alternative career choice if medicine does not work out. However, I am also interested in learning more about it even after receiving my M.D."); and 5) Miscellaneous (e.g., "Something I never thought of, always seemed like it was for those 'smart' people").

Goodness of Fit

One-hundred sixty-three students commented on, "Do you think you would make a good genetic counselor? Please explain why or why not," Their responses were classified into three themes: 1) Enjoyment of activities (Good fit because they would enjoy: counseling, science/genetics, teaching/educating, general interest, and/or lab work; Poor fit because they would not enjoy: counseling, science/genetics, and/or lab work); 2) Possession of requisite personal qualities (Good fit because they have: care and empathy, relevant skills, and/or non-judgmentalness. Poor fit because they lack: interpersonal skills, or an ability to manage ethical/moral dilemmas); and 3) Miscellaneous [Some students thought they "might" be good genetic counselors; others were not specific about why they would/would not be good genetic counselors, or their reasons could not otherwise be classified (e.g., "Wouldn't be much room for empathy")].

Discussion

This study investigated differences in 190 male and female undergraduates' knowledge, perceptions, and interest regarding genetic counseling as a career, and whether their

knowledge and perceptions were significant predictors of their interest. Major findings are discussed next, followed by study strengths and limitations, recruitment implications, and research recommendations.

Males and Females Reported Different Perceptions and Interest

Although most male and female students had some familiarity with genetic counseling, and they had very similar perceptions of the profession, there were two statistically significant gender differences. Compared to males, females reported greater interest in pursuing a career in genetic counseling, and they rated interpersonal aspects as more integral to genetic counseling work. The gender differences in interest level are consistent with the current gender imbalance in the profession and with the small percentage of males applying for genetic counseling graduate programs (Smith et al. 2009; Yashar 2008, 2010). There was a non-significant trend for females to perceive genetic counseling as involving more moral challenges than males; possible gender differences regarding this factor should be investigated in future research.

Oh and Lewis (2005) found that males had less familiarity with genetic counseling than females, but those with prior knowledge were equally as likely as females to say they would consider it as a career. Similar to Oh and Lewis, in the present study greater familiarity was correlated with interest in the career for both males and females. Nevertheless, the males as a group expressed less interest than females. Since Oh and Lewis' sample was younger on average, their participants likely had less well-developed career self-concepts and interests. In contrast, the present sample consisted primarily of bioscience majors, many of whom had already chosen a career.

Particularly noteworthy, females in the present study rated interpersonal aspects more highly. Genetic counseling is a field in which interpersonal skills are a necessary component, as evidenced by their inclusion as one of the American Board of Genetic Counseling's 26 competencies required for entry-level genetic counselors (abgc.net) (Practice-Based Competencies 2009). While it cannot be determined from this study why males' perceptions of interpersonal aspects differed from those of female respondents, one possibility involves the depth of the sample's familiarity with the field. Only about 20% reported being familiar or very familiar with genetic counseling. Thus, responses by a majority of students may have been based primarily on the definition provided on the survey. Perhaps females were more attuned to the interpersonal aspects implied in that definition and rated them more highly. Regardless, this finding suggests males have certain incorrect ideas about genetic counselors' skills and activities. It is unknown, however, whether their interest in pursuing a career in genetic counseling would change if they had more accurate perceptions.

As discussed in the introduction, one possible explanation for the gender imbalance is that genetic counseling is a non-traditional field [as defined by the U.S. Department of Labor, 25% or less of the workforce is one gender (JTPA 1998)]. Yet, there was no significant gender difference in the sample's estimated gender breakdown of genetic counselors. As a group, they estimated the profession to be comprised of approximately 60% females and 40% males. Since neither the male nor female students generally viewed genetic counseling as a female dominated-profession, this explanation is not supported by the present findings. Given the inaccuracy of their gender estimates, perhaps once most males realize the actual gender composition, they become even less interested in pursuing a genetic counseling career.

In this study there were no other significant gender differences in familiarity with the field, salary estimations, and perceptions of various others aspects of the career. For instance, status, prestige, and salary did not appear to be issues as almost no one identified low status or prestige as unattractive aspects, and most respondents' salary estimates were reasonable. Although the mean salary estimate did not differ for male and female students, perhaps the amount would be considered insufficient if one is the sole income provider. Some participants in the Schoonveld et al. (2007) and Lega et al. (2005) studies questioned the adequacy of genetic counselors' earning potential. Finally, although not studied explicitly, it is possible females are socialized to a greater extent than males to pursue nurturing/care-giving careers (e.g., Gottfredson and Lapan 1997; Rolfe 2006; Simpson 2005; Witt 1997), and thus genetic counseling is more compatible with females' gender role expectations. The males in this study were less interested in genetic counseling and less attuned to its interpersonal aspects, suggesting they might be drawn to less "feminine" professions. Future researchers should provide participants with actual genetic counselor gender percentages, annual salary figures, and requisite skills and then assess their interest.

Variables Predicted Interest Only for Females

For the male respondents, their level of interest in pursuing a career in genetic counseling could not be predicted by their perceptions of the field, their estimation of the gender breakdown of genetic counselors, their estimation of genetic counselors' salary, or whether they had already chosen a career. These factors alone and in combination were unrelated to either enhanced or diminished interest. In contrast, four variables significantly predicted interest for female students. Interested females were more likely to have a higher estimation of genetic counselor salary, to

perceive genetic counseling as having positive career aspects (e.g., more job opportunities, prestigious career), to perceive genetic counseling as involving an interpersonal component (e.g., good interpersonal skills), and to be undecided about a career. These findings may be useful in understanding characteristics of the career that are attractive to females.

Comments Provide Clues About Male Interest

Responses to open-ended items suggest a number of male (and female) students lacked more than a superficial understanding of what genetic counselors do (e.g., they described the profession only by the types of patients seen). Some held inaccurate perceptions about the nature of the work (e.g., too much lab work, providing gene therapy) and/or its complexity (e.g., monotonous, or simple and straight-forward). Correcting these misperceptions may be particularly critical for male students if they are to be recruited in larger numbers.

On a more positive note, many male students identified counseling as a particularly attractive feature, suggesting they may not be deterred from the field because of the word "counselor." On the contrary, emphasis of the counseling aspects of genetic counseling might be an effective recruitment strategy. Moreover, males were as likely as females to view themselves as capable of being good genetic counselors and for reasons that are compatible with genetic counselor competencies (e.g., empathy and a nonjudgmental attitude).

Summary

Based on respondents' generally positive ratings and comments, there appear to be a number of potential supports for males to pursue a genetic counseling career. Career barriers might outweigh career supports when males actually choose a career, however (cf. La Rocco 2007). We postulate the following career barriers: inaccurate perceptions that there is limited earning potential (Schoonveld et al. 2007), limited opportunities for an advanced degree (terminal master's degree), and limited numbers of males in the profession. These factors should be studied in future research, along with barriers identified for males in other non-traditional human service careers (e.g., one prevalent barrier involves stigma about one's sexual identity).

Study Strengths and Limitations

The present study has several strengths including a high response rate (over 90%), and percentages of male and female respondents that reflect the ratio in courses in which the surveys were distributed (Dr. William Oetting, Personal Communication, March 12, 2009). Nevertheless, several limitations suggest caution in drawing conclusions about the findings. The sample, which is limited to bioscience students from one university in the Midwest, may not reflect all science students. Furthermore, although most individuals who apply to genetic counseling programs have basic science backgrounds (Lega et al. 2005), a number have other backgrounds (e.g., psychology, social work, public health). Their perspectives were not investigated in this study. Additional limitations concern the large percentage of students (approximately 80%) that had already decided on a career at the time of the survey. Their interest in genetic counseling may have been lower because they were invested in a different career. Alternatively, their reported interest may have been inflated because they were not seriously considering a genetic counseling career.

Another limitation concerns the factor analysis of items assessing students' perceptions of genetic counseling. The analysis was conducted on the entire sample because the sample size was not sufficient to conduct it separately for males and females. Additional research with larger samples is necessary in order to confirm the factor structure holds for both males and females. Finally, while respondents generally rated the definition of genetic counseling provided as informative, there are limits to the amount of information individuals can glean from a brief description. Respondents also varied in their awareness of the reality of the work (e.g., "too easy" versus "the ethical dilemmas would keep me up at night"). Thus, no conclusions can be drawn regarding the number of students that would actually be interested in a career in genetic counseling if they had more extensive knowledge and first-hand experience regarding the profession.

Recruitment Implications

Despite study limitations, the findings have implications for recruiting males to the profession. Since male undergraduates may have misconceptions about genetic counseling, especially regarding the importance of interpersonal skills, the NSGC should develop and market educational strategies that focus on males earlier in their career exploration and decision-making (e.g., during junior high or high school). Mittman and Downs (2008) recommend several strategies for recruiting ethnic minorities into the profession that may also be useful for recruiting males. Their recommendations include creating interactive websites in which genetic counselors (in this case, male counselors) discuss their career experiences, and faculty and peer mentoring programs that provide first-hand experiences for promising male students. These opportunities might include job shadowing and working as volunteers in genetic counseling settings. Genetic counseling graduate programs might offer access to certain graduate

courses for undergraduate students which they could then apply to a master's degree in genetic counseling, and faculty could participate as advisors in undergraduate honors programs.

Two additional suggestions derive from studies of men in non-traditional careers. First, genetic counseling could be advertised in settings that attract a large number of men such as athletic events (Rolfe 2006). Second, publicity about the profession could focus on the people genetic counselors serve as opposed to describing genetic counselor demographic characteristics such as gender (Whittock and Leonnard 2003).

Research Recommendations

As previously mentioned, one limitation of this study was the large number of students that had already chosen a career. Future investigations should include students that are undecided (e.g., first or second year undergraduates, high school students). The results of such studies may better indicate why such a small percentage of males are pursuing a career in genetic counseling. Studies that investigate similar questions in populations other than bioscience majors may yield results more representative of applicants to genetic counseling programs. Interview studies should be done to investigate male genetic counselors' and students' career supports and barriers and to investigate whether males viewed the career as non-traditional during their career exploration processes. Some research identified three "types" of men in non-traditional careers—*seekers, settlers,* and *finders* (Simpson 2004). Seekers "actively seek the career;" settlers "settle into the career after periods of time working in mainly male dominated professions); and finders "find the occupation in the process of making general career decisions" (Simpson 2004, p. 249). Research on male genetic counselors could help to determine how males decide on the profession. Finally, surveys and interview protocols could be developed to ask potential applicants whether they regard genetic counseling as a non-traditional career; whether the salary is adequate; how they would rank genetic counseling's status/prestige relative to other human service professions (e.g., medicine, nursing, psychology, social work); and whether they regard genetic counseling as focused more on basic science or counseling.

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