Linking Genetic Counseling Content to Short-Term Outcomes in Individuals at Elevated Breast Cancer Risk

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Abstract Few studies have linked actual genetic counseling content to short-term outcomes. Using the Self-regulation Model, the impact of cognitive and affective content in genetic counseling on short-term outcomes was studied in individuals at elevated risk of familial breast-ovarian cancer. Surveys assessed dependent variables: distress, perceived risk, and 6 knowledge measures (Meaning of Positive Test; Meaning of Negative Test; Personal Behavior; Practitioner Knowledge; Mechanisms of Cancer Inheritance; Frequency of Inherited

Cancer) measured at pre- and post-counseling. Proportion of participant cognitive and affective and counselor cognitive and affective content during sessions (using LIWC software) were predictors in regressions. Knowledge increased for 5 measures and decreased for Personal Behavior, Distress and Perceived Risk. Controlling for age and education, results were significant/marginally significant for three measures. More counselor content was associated with decreases in knowledge of Personal Behavior. More participant and less counselor affective content was associated with gains in Practitioner Knowledge. More counselor cognitive, and interaction of counselor cognitive and affective content, were associated with higher perceived risk. Genetic counselors dominate the content of counseling sessions. Therefore, their content is tied more closely to short term outcomes than participant content. A lack of patient communication in sessions may pose problems for understanding of complex concepts.

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Introduction

Clinicians and researchers have made recommendations about the content of genetic counseling sessions. Perhaps one of the most influential groups in the United States to offer such recommendations is the National Society for Genetic Counselors (NSGC), defining the functions of genetic counseling as helping people understand (i.e., cognition) and adapt (e.g., affect) to genetic disorders NSGC (2004); (Resta et al. 2006). More specifically, the Cancer Special Interest Group of the NSGC has provided a Standard Protocol for hereditary cancer counseling sessions, which has served as a guideline for genetic counseling throughout the United States.

Others have expanded on this definition (e.g., Berliner and Fay 2007; Collins et al. 2003; Rees et al. 2006). For example, Baty et al. (1997) recommended a check-list for genetic counseling sessions: 1) intake: review of cancer family history, risk factors, cancer screening; 2) psychosocial assessment and intervention; 3) education: genetics, benefits/risks of genetic testing; 4) testing and risk analysis; and 5) follow-up regarding genetic testing. Despite these recommendations, little research has investigated what transpires during the session (e.g., Butow and Lobb 2004; Duric et al. 2003; Lobb et al. 2002a, b, 2003, 2004), leaving some to refer to it as a “Black Box” (Biesecker and Peters 2001).

Considerable information exists about the impact of cancer genetic counseling; however these studies have utilized self-report surveys, rather than the content of genetic counseling sessions. Knowledge of cancer genetics generally increases after risk education (e.g., education materials, genetic counseling) (e.g., Green et al. 2004; Kelly et al. 2004c; Wang et al. 2005). The impact of genetic counseling on perceived risk and negative affect has been variable (e.g., Butow et al. 2003; Hopwood 2005; Meiser and Halliday 2002). Overall, individuals decrease in perceived risk (Brain et al. 2002; Helmes et al. 2006), increasing in accuracy (e.g., Bish et al. 2002; Kelly et al. 2003; Matloff et al. 2006). For negative affect, some studies have found genetic counseling increased overall mental health (Cull et al. 1999) and decreased distress (e.g., Bowen et al. 2004; Brain et al. 2002; Cull et al. 1999; Helmes et al. 2006; Kelly et al. 2004b; Rimes et al. 2006), whereas others found no impact (Bish et al. 2002; Randall et al. 2001; van Dijk et al. 2003; Watson et al. 1999).

Many studies linking psychosocial factors to intentions to test have not been conducted in the context of actual genetic counseling and testing. Such studies have found that greater distress (e.g., Gwyn et al. 2003; Kelly et al. 2007, 2004b; Kinney et al. 2001; Lerman et al. 1994), as well as higher perceived risk (e.g., Andrykowski et al. 1997; Culver et al. 2001; Moslehi et al. 2000) have been associated with greater intention to test. Studies conducted in the context of actual genetic counseling and testing have found no relationship between intentions to test and perceived risk (Lee et al. 2002; Lerman et al. 1997a; Moslehi et al. 2000). Further, one study found that intentions to test for a BRCA1 mutation did not change in response to genetic counseling (Lerman et al. 1997a); however, higher pre-counseling intentions to test and greater family history predicted higher post-counseling intentions to test (Lerman et al. 1997b). Previous studies have largely ignored the relationship of actual genetic counseling content to decision-making about genetic testing.

More recent studies have made efforts to link the content and process of genetic counseling to health outcomes. Findings included: 1) tailoring by the genetic counselor did not affect distress, knowledge, and risk (Lobb et al. 2002b);

2) counselees preferences for risk communication differ (Lobb et al. 2003); 3) empathic expressions from the genetic counselor were associated with decreased depression but not anxiety (Duric et al. 2003); 4) a greater number of aspects discussed was associated with decreased distress (Lobb et al. 2004); 5) greater genetic counselor verbal dominance was associated with greater post-counseling anxiety (Dijkstra et al. 2013). Other studies have found counselors focused more on educational issues (Ellington et al. 2006; Ellington et al. 2005), while consultands/participants focused more on psychosocial issues (Pieterse et al. 2005). Although psychosocial outcomes have been assessed, it is not clear how cognitive and affective processes may interact during the session or how they might influence health behavior. In addition, these studies have used a rigorous but subjective coding scheme, such that coders review the content of counseling sessions and make decisions about how best to categorize the sessions' content.

Studies from health behavior research indicate the importance of examining the interaction of cognition and affect for health outcomes (DiGianni et al. 2003; Leventhal et al. 1965), such as with the Self-regulation model (SRM). The SRM posits that when presented with a stimulus (e.g., genetic counseling) an individual (i.e., the self-system) is motivated to self-regulate his/her behavior by: (1) forming cognitive and affective representations of the health threat (e.g., hereditary cancer) and (2) engaging in behaviors to manage the health threat (e.g., decision to test) (Cameron and Leventhal 2003; Leventhal et al. 2003) (Fig. 1). The cognitive representation, or how an individual considers the health threat, helps to predict the types of health behaviors in which the individual will engage (Shiloh 2006).

Although a key function of genetic counseling, managing affect may take a secondary role in the actual practice of genetic counseling (Ellington et al. 2006, 2005). In the SRM, the affective representation plays a key role in health behavior. Affect can serve to motivate behavior (Leventhal 1970), with affectively-laden cognitions leading the individual to engage in health behavior to manage the health threat (e.g., having genetic testing) (Leventhal et al. 2003). In the context of cancer genetic counseling (shown in Fig. 1), affect can function in 3 ways: 1) unaddressed negative affect may lead individuals to focus on managing worry, rather than information from a genetic counselor (Cameron and Leventhal 2003; Wiebe and Korbel 2003); 2) addressed negative affect and cognition may decrease negative affect, increase knowledge, decrease perceptions of risk, and motivate individuals to engage in behaviors, such as receiving genetic testing results, to manage the threat of cancer; or 3) discussion of affect by the counselor when not mentioned by the individual may lead to increases in distress and decreased knowledge (Pekrun 1992). These theorized relationships are just beginning to be explored in the context of genetic counseling (Kelly et al. 2005).

Fig. 1 The self-regulation model in genetic counseling

To date, the link between genetic counseling content and short-term outcomes has received little attention. Further, most studies employ a coding methodology, which although rigorous, is subjective, as it is determined by individual coders (e.g., Pieterse et al. 2007). The purpose of this study was to explore how cognitive and affective communication in genetic counseling affects short-term outcomes, including knowledge, perceived risk, negative affect and the decision to test for mutations associated with elevated risk of breast cancer. In particular, we wanted to explore if affective counseling content from the genetic counselor may be associated with decreased negative affect, increased knowledge, decreased perceptions of risk, and having testing by using a word count methodology.

Methods

Participants

Recruitment efforts included news reports, presentations at Jewish community centers, and letters to local physicians. Interested persons called a participating medical center ($n=2$) and spoke to a genetic counselor ($n=3$) who determined eligibility based upon self-reported and medically-documented personal and family cancer history. Of the 142 eligible participants, 120 individuals (men: $n=13$; women: $n=107$) from approximately 70 families participated in the study. Eligibility requirements for the study included being Ashkenazi Jewish, at least 18 years of age, and having a personal or family history indicating an estimated 30 % chance of finding a BRCA1/2 mutation (Neuhausen et al. 1996). The higher frequency of BRCA1/2 mutations and the predominance of three mutations (Struwing et al. 1997) made

genetic testing for BRCA1/2 mutations more feasible in the Ashkenazi Jewish population than in the general population.

Procedure

Prior to initiation of the study, approval was received from the institutional review boards (ethical review) of the universities and medical centers involved. The current study is part of a larger study investigating the impact of genetic counseling and testing for hereditary BRCA1/2 mutations (Kelly et al. 2004a, b, c), which was conducted nearly 10 years ago. Interested individuals contacted a genetic counselor who confirmed study eligibility. A packet including an explanation of the study, informed consent form, and a written pre-counseling questionnaire was mailed to eligible participants.

Upon completion, participants scheduled an appointment with a genetic counselor. Genetic counseling and testing were provided free of charge. Not all of the 120 genetic counseling sessions were audiotaped due to delayed IRB approval for audio-recording or equipment failure; however, when audiotaping was available, no participants refused audiotaping. Of the 91 participants with audiotaped sessions, 90 completed the pre- and post-counseling assessments. Hence, there was a 99 % participation rate from pre- to post-counseling. Pre-test genetic counseling sessions were 1–2 h and were guided by an outline of a standard cancer genetic counseling session from the Cancer Special Interest Group of the National Society of Genetic Counselors (NSGC 2004) and consistent with (Berliner et al. 2013). Frequency of inherited cancer, personal behavior, mechanisms of cancer inheritance, meaning of a positive result, practitioner knowledge, and meaning of a negative result were discussed (see Kelly et al. 2004c for additional detail). Variability in counseling sessions was introduced by having genetic counselors that

trained in different areas of the country and varied in age ($n=3$). Although participants may have had a blood sample drawn at the time of the genetic counseling session, the genetic counselor telephoned the participant to inquire about the final decision to have genetic testing approximately 1 to 2 days after genetic counseling. Afterwards, 24–48 h after genetic counseling, the participant completed a post-counseling telephone interview with the first author or research assistant, both of whom were blind to testing status. Telephone interviews allowed for more immediate assessment of response to counseling. Those deciding to have genetic testing signed an additional consent form. DNA from peripheral blood was analyzed for common, recurrent BRCA1 and BRCA2 mutations seen in the Ashkenazi Jewish population (Tonin et al. 1996).

Measures

Participants completed a questionnaire including demographics (e.g., income, education, and cancer history), as well as psychosocial outcomes. Psychosocial outcomes were assessed pre- and post-counseling. Knowledge of cancer genetics was assessed by a 14-item scale developed by Kelly et al. (2004c). This scale is consistent with the National Center for Human Genome Research Cancer Genetics Consortium knowledge scale (Lerman et al. 1996) and captures elements of the cognitive representation of the disease. Our scale closely reflects the content of the Standard Protocol for hereditary cancer genetic counseling of the NSGC, and our previous work discussed the rationale and established the validity and reliability of the scale (Kelly et al. 2004c). The scale contains 6 subscales (Frequency of Inherited Cancer, Personal Behavior, Mechanisms of Cancer Inheritance, Meaning of a Positive Result, Practitioner Knowledge, and Meaning of a Negative Result, internal consistencies $\alpha=0.60$ – 0.90 for subscales). Frequency of inherited cancer included 2 items asking the risk of having a familial breast cancer and the risk of having familial ovarian cancer in the general population, which had a response range of 0–100 %, with lower scores being more accurate. The remaining five subscales had five point response scales (strongly disagree–strongly agree). Personal behavior included three items about the efficacy of lifestyle interventions for those with and without hereditary BRCA1/2 mutations. Mechanisms of cancer inheritance included three items about cancer genetic inheritance and mutations. Meaning of a positive result included three items about the implications of a positive result for personal and family risk of developing. Practitioner knowledge included two items focusing on the lack of specific, personalized information that could be provided about health outcomes in those with BRCA1/2 mutations. Meaning of a negative result included two items

examining the understanding of informative and uninformative negative results.

Perceived risk of having breast and ovarian cancer were assessed, another measure of the cognitive representation. Six questions assessed the chance of a woman developing breast/ovarian cancer with/without BRCA1/BRCA2 mutations with a percentage (0–100) (Kelly et al. 2004c). Internal consistency for the six-item scale was high ($\alpha=0.90$). To assess negative affect (affective representation), six items from the Profile of Mood States (POMS) (Lebo and Nesselroade 1978; McNair et al. 1971) were tailored to distress specific to gene status; three additional items were added to this scale: worried about disfigurement following breast cancer, afraid of dying, and concerned about pain (Kelly et al. 2004b). These nine items had the same five-point scale as in the POMS and had high internal consistency ($\alpha=0.90$). Genetic counselor-reported receipt of test results was used to assess decision to test (Kelly et al. 2004b), a measure of health behavior.

Plan for Analysis

Transcripts are qualitative by nature, however, the purpose of the analysis was to provide an overview of the content of the transcripts, and therefore, transcripts were converted into quantitative data by calculating the frequency of particular types of words. As one data source was utilized, a methodological triangulation approach was used (Morse 1991). Linguistic Inquiry and Word Count (LIWC) software and dictionary developed by Pennebaker and Francis (2001) was used to determine the word count structure. Although LIWC is perhaps best known for the analysis of expressive writing samples (e.g., Graves et al. 2005b; Pennebaker and Francis 1996), it has also been used for analyzing transcripts (Graves et al. 2005a) and spontaneous verbal communication (Mehl and Pennebaker 2003; Niederhoffer and Pennebaker 2002). The automatic system is excellently suited for providing insight into large textual data-sets, which are beyond the scope of time intensive qualitative analyses. LIWC allows for over 70 preset linguistic categories, among which are self, affective, cognitive, social dimensions. Reliability and feasibility have been established (Pennebaker and Francis 2001), as well as the construct validity (e.g., emotional expression Kahn et al. 2007).

Each transcript was divided into two different transcripts: a transcript of the genetic counselor and a transcript of the participant. LIWC analysis was conducted separately for each transcript. Thus, separate proportions of emotion (e.g., worried, sad) and cognitive content (e.g., think, believe) for the genetic counselor and participants were calculated for each session; these represent parts of the representation of emotion and the representation of cognition, respectively.

As a first step, bivariate analyses examined associations between LIWC factors (participant affective content and

cognitive content and the counselor's affective content and cognitive content) and the change scores for the genetic counseling outcomes (6 knowledge scales, perceived risk, and distress), as well as the decision to test, all using Pearson correlations. (Note: change over time was tested in a previous study.) The current analyses will examine the relationships in Fig. 1: how affect and cognition in the genetic counseling sessions impact short-term outcomes.

The change scores on the six knowledge scores, distress, and perceived risk (i.e., short-term outcomes) were then regressed on the self-system factors of age, education level (binary variable: graduate school or higher versus below graduate school), participant affective and cognitive content and the counselor's affective and cognitive content in multiple linear regressions for each of the eight short-term outcomes. Where the interaction between participant and counselor affective and cognitive content was significant ($p < 0.05$) or marginally significant ($p < 0.1$), the interaction was included. If it was not significant or marginally significant, it was excluded from the final model. The decision to test (test/no test) was also regressed using a multiple logistic regression including the same predictor variables as above.

A sample size of 90 provides 82 % power of finding a significant result ($\alpha = 0.05$) for a correlation of at least 0.3 (a medium size) (Cohen 1988). The p -values are unadjusted across the models and should be interpreted as preliminary evidence from an exploratory study rather than strict hypothesis testing.

Results

Descriptives

Demographics of the 90 participants with audiotaped sessions and pre- and post- counseling assessments are included in Table 1. A nearly equivalent number of individuals with ($n = 46$) and without ($n = 51$) a prior cancer history had audiotaped genetic counseling sessions. Few participants declined genetic test results ($n = 12$). Three of the women in one group counseling session were indistinguishable in the LIWC data, and were therefore removed from further analyses due to missing data on participant affective and cognitive content. Only the 84 subjects with complete survey data, audio data, and demographics (gender, age, education) were included in further analyses, and 7 additional individuals were lost due to missing audio content in recordings. Of these 77 participants, seven were in multi-participant sessions.

Overall, as we have described in a previous study, knowledge increased for 5 measures and decreased for the knowledge of the role of personal behavior in cancer risk, distress and perceived risk (Kelly et al. 2004c, 2005). The mean number of words for genetic counselors was 8476 ($SD =$

Table 1 Demographics of participants

	% or Mean (SD)
Gender	
Female	88.9
Age (yrs)	48.7 (13.6)
Marital status	
Married	74.4
Separated, divorced, widowed	15.6
Single, never married	10.0
Education	
High school degree	6.7
Some college or degree	43.8
Some graduate school or degree	49.5
Income	
Less than \$25,000	3.4
\$25,000–99,999	56.8
\$100,000 or greater	39.8
Personal history of cancer	48.9
Gene status	
Positive	21.1
Informative negative	6.7
Uninformative negative	61.1
Declined	11.1

2115.79) and for participants was 3528 ($SD = 1884.12$); thus clearly, genetic counselors spoke more in sessions than participants ($t(76) = 16.9$, $p < 0.001$). The mean proportion of participant affective words was 4.02 ($SD = 1.43$) and of participant cognitive words was 15.56 ($SD = 2.02$). The mean proportion of counselor affective words was 3.61 ($SD = 0.47$) and of counselor cognitive words was 18.17 ($SD = 0.94$).

Bivariate Analyses

Basic bivariate analyses, using Pearson Correlations found that participant affective content and counselor affective content were not correlated ($p > 0.1$), nor were participant cognitive content and counselor cognitive content ($p > 0.1$) (see Table 2). However, participant affective content is significantly negatively correlated with counselor cognitive content ($r = -0.33$, $p = 0.002$), and counselor affective content is significantly negatively correlated with counselor cognitive content ($r = -0.49$, $p < 0.001$). Further, participant affective content was higher than counselor affective content ($t(87) = 2.63$, $p < 0.01$), and participant cognitive content was lower than counselor cognitive content ($t(87) = -11.88$, $p < 0.001$).

Results also showed participant affective content was positively associated with gains in practitioner knowledge ($r = 0.18$, $p = 0.097$), while participant cognitive content was negatively associated with gains in knowledge of the frequency of

Table 2 Bivariate analysis - Pearson correlations

	2	3	4	5	6	7	8	9	10	11	12	13
Change in knowledge of:												
1 Meaning of positive test	-0.08	-0.04	0.11	-0.12	0.06	0.02	-0.09	0.02	0.01	0.07	0.17	-0.05
2 Personal behavior		-0.21†	0.14	-0.19†	0.07	0.01	-0.07	0.03	-0.15	0.02	0.12	-0.11
3 Practitioner knowledge			0.07	0.15	-0.03	-0.22*	0.05	-0.06	0.18†	0.02	-0.33**	0.10
4 Meaning of a negative test				0.06	-0.09	0.07	0.10	-0.04	-0.10	-0.04	-0.10	-0.03
5 Mechanism of inheritance					-0.09	0.01	0.13	0.07	0.18	-0.11	0.01	-0.02
6 Frequency of inheritance						-0.19	-0.07	0.25*	0.09	-0.22†	0.03	0.06
7 Distress							-0.11	-0.19†	0.16	-0.18	0.24*	-0.18†
8 Perceived risk								0.07	-0.17	0.15	-0.01	0.11
9 Decision to test									0.01	-0.19†	-0.00	-0.06
10 Participant affective content										-0.09	0.11	-0.33**
11 Participant cognition content											-0.07	0.16
12 Counselor affective content												-0.49***
13 Counselor cognition content												

† $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

cancer inheritance ($r = -0.22$, $p = 0.061$). Counselor affective content was negatively associated with gains in practitioner knowledge ($r = -0.33$, $p = 0.003$) and positively associated with increases in distress ($r = 0.24$, $p = 0.029$). In addition, counselor cognitive content was negatively associated with changes in distress scores ($r = -0.18$, $p = 0.094$). Further, higher participant cognitive content ($r = -0.19$, $p = 0.084$) was associated with a lower likelihood of taking the test.

Introduction of Control Variables

We then controlled for participant age and education in addition to participant affective and cognitive content and counselor's affective and cognitive content in multiple regressions for each of the eight outcomes (see Table 3 for the results). Significant or marginally significant parameter estimates were found for 5 outcomes, namely, changes in knowledge of positive test, practitioner knowledge, knowledge of the frequency as well as mechanism of cancer inheritance and perceived risk.

Specifically, higher counselor affective content was marginally significantly associated with gains in knowledge of positive test ($p = 0.075$, $\eta_p^2 = 0.041$), but significantly associated with decreases in practitioner knowledge ($p = 0.006$, $\eta_p^2 = 0.096$). Counselor cognitive content was marginally positively associated with changes in knowledge of frequency of cancer inheritance ($p = 0.096$, $\eta_p^2 = 0.043$). A higher proportion of participant affective content was related with greater change in understanding of both the limitations of practitioner knowledge ($p = 0.039$, $\eta_p^2 = 0.055$) and marginally related to the mechanism of cancer inheritance ($p = 0.089$, $\eta_p^2 = 0.038$).

The decision to test was not significantly associated with the control variables nor with the participants and counselors affective and cognitive content in the logistic regression.

Interaction Effects

Two models were found to have interactions that were marginally statistically significant: the models for personal behavior and for perceived risk (see Table 4). Counselor cognitive content has a very slight positive effect on the change in personal behavior when counselor affective content is low. When counselor affective content increases, the effect of counselor cognitive content decreases such that when counselor affective content is high, the effect of counselor cognitive content is actually associated with a loss in knowledge of personal behavior ($p = 0.062$, $\eta_p^2 = 0.046$). Further, counselor cognitive content has a negative effect on the change in perceived risk when participant cognitive content is low, but when the participant cognitive content is high, the effect of counselor cognitive content on the change in perceived risk is positive ($p = 0.056$, $\eta_p^2 = 0.064$).

Discussion and Conclusion

Discussion

The goal of this line of research is to improve cancer risk communication in genetic counseling for individuals receiving genetic counseling for familial/hereditary cancers. Guided by the Self-regulation model as described in Fig. 1, we

Table 3 Parameter estimates for Regression models (only main effects included)

	Change in knowledge:						Change in distress	Change in perceived risk	Decision to test (Logit)
	Positive test	Personal behavior	Practitioner	Negative test	Mech. of inherit.	Freq. of inherit.			
Intercept	-2.13	0.70	1.72	3.17	-1.39	-8.06	1.00	-95.36	4.82
Age	-0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.50	0.02
Graduate School (Y/N)	0.23	0.01	0.05	-0.03	0.17	0.46	-0.39	-20.10 †	0.86
Participant Affect	-0.01	-0.06	0.19 *	-0.06	0.09 †	0.15	0.12	-4.39	0.05
Participant Cognitive Mechanism	0.02	0.01	0.02	-0.02	-0.03	-0.12	-0.14	1.25	-0.28
Counselor Affect	0.33 †	0.07	-0.78 **	-0.18	0.06	0.43	0.69	2.02	-0.12
Counselor Cognitive Mechanism	0.06	-0.07	0.01	-0.09	0.07	0.41 †	-0.11	3.20	0.04
R ²	0.069	0.067	0.16	0.049	0.065	0.123	0.108	0.104	

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

explored the relationship of the cognitive and affective content of genetic counseling sessions with short-term genetic counseling outcomes (knowledge, distress and perceived risk) and the decision to test. As we described previously (Kelly et al. 2004b), the decision to test did not change as a result of genetic counseling, and this study explored these findings. Our study of cognitive and affective content in genetic counseling yielded no new information about the decision-making process.

Participant Counseling Content

One of the main themes of our results is that participant cognitive and affective content did not appear to affect gains in knowledge, lowered distress, and lowered perceived risk. In two assessments (the limitations of practitioner knowledge and mechanisms of cancer inheritance), participant affective content was associated with greater perceived practitioner

knowledge (which tended to be inaccurate (Kelly et al. 2004b)). Although these results are consistent with the SRM's conceptualization of elevated negative affect as driving knowledge gains (either through increased attentiveness/vigilance to messages communicated or through motivation to seek relevant information), the results of our small study of participant communication on short-term outcomes provide limited support of the model. From a risk counseling perspective, these results may be discouraging: participant affective and cognitive content in a clinical encounter provided little information about the extent to which the participant is learning.

Genetic Counseling Content: Cognitive

Counselor cognitive content was marginally positively associated with frequency of cancer inheritance. This finding may reflect the context in which cognitive words are used by counselors. The cognitive word category for LIWC contains words that indicate causal linkages such as “because” or “effect” and words that relay more tentative associations such as “think” or “realize.” When genetic counselors discuss population risks (i.e., frequency of inheritance), they may tend to use more conclusive language about population level findings. However, when counselors discuss a woman's personal risk, they may use words that are less definitive and may be more tentative in conveying risk implications to the woman sitting in front of them. It is plausible that women interpret the difference in counselor cognitive word choice. This difference in word usage may have led participants to more accurately interpret population risk but to be less certain, and therefore be less accurate about their own personal risk.

An interaction was also noted for perceived risk. When participant cognitive content was low, the effect of counselor cognitive content on the change in perceived risk was less.

Table 4 Parameter estimates for Regression models, with significant interactions included

	Personal behavior	Perceived risk
Intercept	-11.22	1393.60
Age	0.01	0.54
Graduate School	0.03	-19.18
Participant Affect	-0.03	-4.74
Participant Cognitive Mechanism	0.01	-92.13 †
Counselor Affect	3.28 †	1.34
Counselor Cognitive Mechanism	0.60 †	-77.70 †
Counselor Affect x Counselor Cog.Mech.	-0.18 †	
Participant Cog.Mech. x Counselor Cog.Mech.		5.07 †
R ²	0.110	0.161

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

When the participant cognitive content was high, the effect of counselor cognitive content on the change in perceived risk was greater. In other words, when participants and counselors were using more ‘thinking’ words, risk perceptions changed more, perhaps indicating that genetic counseling has more of an impact when less emotional reactivity occurs.

Genetic Counseling Content: Affective

Genetic counselor communication had a greater impact on short-term outcomes. More genetic counselor affective content was associated with greater gains in knowledge of what a positive test means, but less knowledge about how much a practitioner knows about how and when cancer will occur. Perhaps the fervor of the genetic counselor for the subject matter led participants to place less trust in the knowledge of practitioners. Further, greater genetic counselor affective content was associated with *increased* distress. There are at least three possible explanations: (1) genetic counselor affective communication increased distress, which may be the result of participants being more aware of their own emotional reaction, (2) participant distress increased in genetic counseling and counselor communication was ineffective in lowering distress, or (3) counselor communication was effective in decreasing distress but was not adequate to completely dispel distress. Any of these explanations indicates that there may have been room for improvement when dealing with affect in the clinical context. The findings that counselor affective content was associated with increased distress and with decreased knowledge on two measures may seem to pose problems for the SRM. However, we found that participant and counselor affective content was not correlated, and counselors had less affective content than participants. Thus, based on our small study, the SRM may suggest the need for affective intervention in genetic counseling to improve the match between counselor and participant affective talk.

Genetic Counseling Content: Interaction of Cognitive and Affective

Although counselor cognitive content was positively associated with personal behavior, counselor cognitive content had a slight positive effect on the change in personal behavior when counselor affective content was low. When counselor affective content increased, the effect of counselor cognitive content decreased such that counselor cognitive content was associated with a loss in knowledge of the limited role of personal behavior. It is possible that the counselor is providing less cognitive content, or conversely, the participant is more focused on distress, leading the counselor to change focus. However, as we saw no difference in participant affective content, the latter explanation is less plausible.

Limitations

Limitations of the current study should be noted. To begin, our sample size was rather small for significance testing; however, we have a very rich data set to explore relationships among communication variables and short-term outcomes. Moreover, our sample size is consistent with other research studies of this type (Butow and Lobb 2004; Duric et al. 2003). Also, we utilized two different forms of assessment: written survey and telephone interview. This may have affected response to psychosocial variables. We considered findings < 0.1 as worthy of description and potential areas of future research and intervention. Along with lowering our alpha level, we did not adjust for multiple testing, nor did we adjust for sessions with 2 participants. As this study is exploratory in nature, we wished to include all findings that may be worthy of further exploration. Yet, we did limit our analyses to those relevant to the SRM, even though the LIWC has approximately 80 linguistic word count results, and these could be multiplied by speaker (participant, counselor, etc.). In our case, we would have had 160 potential variables to explore in relation to our outcomes. In addition, our correlational study cannot fully explore the recursive nature of genetic counseling. Future research could potentially include ‘think aloud’ procedures for genetic counselors to explain their decision-making in the communication context.

Further, our sample was of a relatively high socioeconomic status at elevated risk, with an a priori risk of approximately 30 % risk of having a mutation, which was recruited nearly 10 years ago. It will be important to see if these findings will be more pronounced in more recent genetic counseling sessions with less educated and more culturally diverse samples at moderate risk. Also, only 3 genetic counselors were included, and this may not have allowed for sufficient variability in counseling practice and decreases the generalizability of our results. Future research with more genetic counselors would improve generalizability of these findings. Finally, and consistent with our previous work (Ellington et al. 2011), LIWC may be limited in the extent to which it can depict the context of interactions. Furthermore, dividing the sessions into counselor and participant content may have further decreased the context of counseling sessions. Also, Pennebaker et al. (2007) indicate that the negative emotion dictionary has a validity coefficient of only 0.31 when compared with evaluators of content. However, Kahn et al. (2007) have shown that, overall, LIWC results are not idiosyncratic to context. Future work may clarify the link between word count and in-depth qualitative analysis of genetic counseling sessions. In spite of these limitations, our study is one of the few to (1) use a model-driven approach (SRM) to analyze genetic counseling content and (2) link genetic counseling content to outcomes.

Conclusion

In sum, our small study seems to indicate that genetic counselors largely dictate the focus of counseling sessions, with participants speaking less overall. Therefore, counselors' content was tied more closely to short term outcomes. It could be that counselees were simply overloaded with information, and this can pose problems for understanding of complex concepts. It may also be true that counselees do not wish to speak in genetic counseling, and future research should examine patient preference. The Self-regulation model would suggest that affect can be used to motivate information seeking and risk appropriate behavior. Utilizing a model-driven approach and assessing satisfaction with such approaches may result in more long-term benefit to counselees.

Practice Implications

Although our findings should be interpreted with caution, our study suggests that encouraging counselee's to talk more during patient clinical counseling could provide more immediate feedback of participant affect and learning. Further, it is possible that improved discussion of affect could lead to improved outcomes in clinician risk communication, such as decreased distress and greater knowledge gains, and merits further study. These skills may require additional training, both for genetic counseling students and currently-practicing genetic counselors, in order to achieve both genetic counselor-driven and patient-driven outcomes. If replicated, these findings may indicate slight revisions to the National Practice Guidelines for Breast-Ovarian Cancer (Berliner et al. 2013), such that along with referral for psychosocial care, Recommendation 5 should also recommend exploration of psychosocial issues in the immediate genetic counseling context.

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Conflict of Interest "The authors have no conflict of interest with the content of this manuscript."

Informed Consent "All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study."

"I confirm all patient/personal identifiers have been removed or disguised so the patient/person(s) described are not identifiable and cannot be identified through the details of the story."

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