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Impact of Web-based Case Conferencing on Cancer Genetics Training Outcomes for Community-based Clinicians

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Abstract

Introduction—Technology and market forces are driving the demand for cancer risk assessment services in the community setting, where few clinicians are trained to order and interpret predictive genetic tests. City of Hope conducts a three-phase course in genetic cancer risk assessment (GCRA) for community-based clinicians, comprised of distance didactics, face-to-face workshops and 12 months of professional development. As designed, the course cannot meet increasing demands for GCRA training. Action research identified face-to-face workshops as a barrier to increasing course capacity. This study compared the learning effectiveness of Web-based case conferencing to face-to-face training.

Methods—A quasi-experimental design compared pre-post knowledge, skills and professional self-efficacy outcomes from 2009-2010 course cohorts (n=96). The intervention group (n=52) engaged in Web-based case conferences during distance learning; the comparison group (n=44) participated in the course as originally designed.

Results—Both groups and all practice disciplines demonstrated significant pre-to-post increases on all measures. Knowledge increases were higher for the intervention group ($p < .015$); skills and self-efficacy increases were comparable between groups ($p < .33$ and $p < .30$, respectively).

Discussion—Findings support the learning utility of Web-based case conferencing. Further studies may inform the development of tools to assess the impact of Web-based case conferencing on practice change and patient outcomes, in alignment with the highest standards of continuing professional development.

Introduction

Genetic cancer risk assessment (GCRA), which includes personalized risk assessment, counseling and predictive genetic analysis, allows healthcare providers to identify individuals with hereditary cancer risk and prescribe intensified measures to prevent cancers or detect them at an earlier, more treatable stage. Initially delivered through academic health centers, the rapid evolution of genetic and genomic technologies and direct-to-consumer marketing have accelerated the demand for GCRA services in the community setting, where clinicians are often inadequately prepared to select, apply and interpret the results of predictive genetic tests [1-4].

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In response to the national need for specialized training in GCRA, the Division of Clinical Cancer Genetics (CCG) at the City of Hope Medical Center conducts a National Cancer Institute-funded (R25 CA112486) *Intensive Course in Community Cancer Genetics and Research* for community-based clinicians. The goals of the course are to increase the number of clinicians with practitioner-level competence in GCRA and to promote community-based participation in research. The course promotes interdisciplinary learning, skills and practice development through three inter-related phases (Figure 1, *Standard Procedure*) comprised of 27 distance learning modules with weekly Web-conference updates (*Phase 1*), followed by five days of interdisciplinary face-to-face case-based workshops at the City of Hope campus (*Phase 2*), and 12 months of prescribed distance-mediated professional development activities hosted by City of Hope (*Phase 3*) centered on Web-based *Working Group* case conferencing, *Topics in Cancer Genetics Research* presentations and *Genetics Community Link* discussion board interactions, to support the integration of newly-acquired knowledge and skills into practice. Participants are awarded up to 90 hours of continuing medical education (CME) upon completion of *Phase 2* training. The course design was informed by the tenets of adult learning theory [5], evidence demonstrating the ineffectiveness of traditional, didactic-focused approaches to CME [6-9] and calls from leading stakeholders across the CME enterprise for practice-centered models of learning that enhance quality health care, support professional activities and produce measurable outcomes [10-13]. The course design, curriculum and outcomes have been previously described [14,15].

Problem Statement

The course fosters interdisciplinary learning and skills development by bringing clinicians with disparate medical training and practice backgrounds--primarily physicians (MDs), masters-trained genetic counselors (GCs), advanced-practice nurses (APNs)--for the GCRA learning experience. As designed, the course cannot meet increasing demands for cancer genetics training. Despite CCG Division efforts to increase course capacity and American Recovery and Reinvestment Act funds (#3R25CA112486) to support additional course sessions, a three-to-four fold greater number of qualified clinicians apply to each session than can be accommodated, and the escalating demand for cancer genetics training remains largely unfulfilled.

Rationale for the Study

An action research study engaging key course stakeholders revealed interdisciplinary case-based learning as the greatest strength of the course, and identified the five-day face-to-face training component as the most significant barrier to increasing course capacity [16]. However, in the current course model, the highly valued interdisciplinary case-based learning is conducted *only* during *Phase 2* face-to-face workshops, after completion of *Phase 1* distance didactic learning, so that the participants, who have disparate training and clinical backgrounds, complete the cross-disciplinary core curriculum *prior to* engaging in interdisciplinary case-based training. The challenge is to find an effective way to reduce or eliminate face-to-face case-based training time without compromising the highly valued case-based learning experience that is essential to the integration of new knowledge into practice.

Phase 2 face-to-face case-based workshops are directly modeled after weekly City of Hope Division of Clinical Cancer Genetics (CCG) Working Group Web conferences, a continuing-medical- education (CME) accredited regularly-scheduled series (RSS) for review and discussion of cases seen for cancer risk assessment. Figure 2 outlines the participants, processes and outputs of CCG Working Group Web conferencing.

Theoretical Framework

The activities that take place during Working Group Web conferences embody the co-constructed, practice-centered learning described by *situated learning theory*, which posits that knowledge and skills that contribute to development of practice proficiencies are generated through socially-mediated interactions with experts in a participatory, real-world context [17]. Situated learning takes place in *communities of practice*, where people with varied levels of knowledge and expertise engage with one another through attenuated conditions of *legitimate peripheral participation* [18]. Working from the theoretical framework of *situated learning*, a quasi-experimental study with a nested qualitative component was conducted to examine the effectiveness of Working Group case conferences as a *community-of-practice* environment for case-based cancer genetics training. If determined to be effective, Working Group Web conferences could be incorporated into a new, more accessible course model that facilitates case-based training through distance-mediated case conferencing. This paper describes the outcomes of the quasi-experimental component of the study.

Materials and Methods

Research Design

A two-group quasi-experimental design [19] was employed to compare the pre-post knowledge, case-based skills and professional self-efficacy outcomes of clinicians who engaged in case-based learning through participation in five Working Group Web conference sessions during *Phase 1* distance learning prior to initiating *Phase 2* face-to-face training (intervention group), with outcomes of clinicians who participated in the established course design, with case-based learning initiated during *Phase 2* face-to-face workshops only after completion of *Phase 1* distance learning (comparison group).

Participants, Sample Selection and Recruitment

The study employed a purposive sampling of two course cohorts from the year 2009 (comparison group) and two cohorts from 2010 (intervention group). All participants were health care professionals with prior training and experience in clinical oncology or genetics who applied to the course voluntarily and were competitively selected by CCG faculty based on established course eligibility criteria. Recruitment for the intervention arm of the study was facilitated by a written description of the requirements for study participation that was mailed with the course materials; study consent was completed by email and telephone correspondence between each enrollee and the study coordinator.

Study Procedures

The study procedure and data collection time points are summarized in Figure 1. Participants in the intervention group were mailed a *CCG Working Group Essentials Toolkit* along with the course syllabus that included the same case working materials and resources distributed during face-to-face workshops. Intervention group participants were required to participate in five of the weekly CCG Working Group case conference sessions held over the *Phase 1* distance learning segment of the course. Participation could take place in real time via *Microsoft Live™* Web conferencing on Wednesdays between 9:30 a.m. - 11:30 a.m. Pacific Standard Time, and/or by viewing recorded Working Group sessions via streaming media¹, at the discretion of the participant. Recorded sessions could be reversed or forwarded to allow participants to repeat segments of a session for further review².

¹The option of recorded sessions was included in response to feedback from course alumni who reported that the fixed mid-week timeslot for Working Group posed a barrier to participation due to conflicting clinical schedules.

Participants in both live and recorded Working Group sessions were instructed to complete a *Reflective Learning Worksheet* during each session to note case-by-case reflections, questions and points of learning. Participants could also share questions and comments verbally (live sessions only), through asynchronous discussion board communication, or during the weekly Friday Web conference review sessions. Active engagement and presentation of cases by participants was encouraged but not required.

Data Collection

Figure 1 illustrates the data collection time points for the comparison and intervention groups. Baseline knowledge, case-based skills and professional self-efficacy data were collected during the course orientation Web conference for both the comparison and intervention groups. Post-data were collected from the comparison group on the final day of *Phase 2* face-to-face training, according to the established course procedure. In order to compare the effects of case-based learning through Working Group participation during *Phase 1* with those of *Phase 2* face-to-face workshops, these data were collected from the intervention group on the final day of *Phase 1* distance learning, *prior* to initiation of the *Phase 2* face-to-face training.

Instrumentation

Data were collected using the following established course assessment instruments to allow for investigation of the impact of Working Group case conference participation on previously-defined knowledge, skills and professional self-efficacy outcomes:

Cancer Genetics Knowledge Test—A 96-item multiple choice test (coefficient α of .70 for internal consistency reliability) covers eight GCRA content domains: basic genetics, basic oncology, recognition of hereditary cancer patterns and features, cancer risk assessment process, differential diagnoses, genetic testing and interpretation, ethical, legal and social issues, and human subjects protection (60 minutes to complete).

Case-based Skills Scenarios—The integration of cancer genetics knowledge into case-based problem solving was assessed using distinct pre and post case-based scenarios comprised of brief cancer genetics case synopses that are parallel in complexity and content, followed by seven open-ended questions addressing: *Pedigree preparation, assessment of history/differential diagnoses, genetic mutation probability estimation/genetic testing strategy*. Scenarios were completed and submitted electronically as email attachments to the course coordinator (45 minutes to complete).

Professional Self-Efficacy Survey—A 34-item Likert scale survey measuring participant perceptions about knowledge and skills in six GCRA competency domains: genetics/oncology, hereditary cancer risk assessment, genetic testing strategy/test interpretation, risk management, counseling/ethical, legal and social issues, and research collaboration. Internal consistency reliability of the domains ranged from coefficient α = .77 to .97, and .97 for the overall composite score. Respondents selected from five response choices representing degrees of sense of confidence ranging from 0 = No Experience/Can't Assess, to 5 = Very Confident for each item (15 minutes to complete).

²In compliance with the Health Insurance Portability and Accountability Act (HIPAA) requirements for patient privacy and confidentiality, all patient-related materials and discussion conducted during Working Group are completely anonymized, and recorded sessions are delivered as password-protected streaming media that cannot be downloaded, copied or disseminated to non-participants.

Statistical Analyses

A unique identifier number (UIN) replaced individual identifying information on all instruments. All data were imported into SPSS v18.0 (Statistical Package for the Social Sciences, SPSS, Inc., Chicago, IL, USA) for statistical analysis. Comparisons of demographic variables were calculated using Chi-square and Fisher's Exact tests. Knowledge tests and professional self-efficacy survey data were collected online during specified, pre-announced timeframes, stored and scored via *SelectSurvey.Net*, a ClassApps.com 2006 survey software program. Case scenarios were scored independently by two course faculty members who participated in a norming session to calibrate scoring values for each domain. Each rater scored the scenarios independently. Twelve cases were used to provide a preliminary estimate of inter-rater agreement. Coefficients of intra-class correlations (ICCs) for baseline and post scores were high (Baseline ICC=.98; Post ICC=.99) and significantly different than zero ($p < .001$). Descriptive statistics were computed for all scores. Percent differences in the pre-post scores were calculated for each participant, cohort and group. Comparative analyses were conducted on overall, overall by-discipline (MD, GC, and APN), cohort, and group comparisons of knowledge, case-based skills and professional self-efficacy outcomes. Mean differences between pre-post scores for the intervention and comparison groups were compared using a t-test for independent samples and two-way repeated measures ANOVAs. Pairwise comparisons were conducted to analyze within and between-group differences in pre-post scores. A Bonferroni correction was used to adjust for experiment-wise inflation error.

Results

Participant Demographics

Ninety-six clinicians participated in the study. Demographic characteristics and results of demographic variable analyses are summarized in Table 1. The comparison group ($n=44$) and the intervention group ($n=52$) were each comprised of two cohorts who participated in the course in the years 2009 and 2010, respectively. The majority of participants in both groups were female (86 and 89 percent, respectively), Caucasian (82 and 73 percent, respectively) and had some GCRA practice experience (84 and 94 percent, respectively). No statistically significant differences were found between cohorts or between groups in composition of practice discipline (MDs, GCs and APNs), practice setting, years in clinical practice, previous GCRA experience, number of patients seen for GCRA services over the year prior to participating in the course, or in baseline knowledge, case-based skills or professional self-efficacy scores. These findings support the rationale for pre-post comparative analysis.

Comparative Analysis

All 96 participants completed *Phase 1* and *Phase 2* segments of the course. Among the 52 participants in the intervention group, seven (13.46 percent) participated only in live Working Group sessions, 12 (23.08 percent) participated only in recorded Working Group sessions, and 33 (63.46 percent) participated in a combination of live and recorded sessions.

Results of comparative analysis (summarized in Figure 3) revealed statistically significant pre-to-post increases ($p < .000$ for each variable) in both comparison and intervention group mean scores cores on knowledge (16 and 22 points, respectively), case-based skills (9 and 12 points, respectively) and professional self-efficacy scores (one Likert-scale point increase in both groups). Between-group comparisons were statistically significant for percent change in knowledge ($p < .015$) and post-knowledge score ($p < .000$); percent changes in case-based skills and professional self-efficacy scores were comparable between groups, with no statistically significant differences ($p < .33$ and $p < .30$, respectively). Overall by-

discipline comparisons of percent changes in knowledge, case-based skills and self-efficacy demonstrated statistically significant pre-to-post increases for MDs, GCs and APNs on all three assessments ($p < .000$ for each). Results support (and in knowledge outcomes, exceed) the hypothesis that intervention group outcomes would be equivalent to comparison group outcomes on established course assessments.

Discussion

Despite priorities set forth by national policy and leadership stakeholders emphasizing the need for cancer genetics education [20-26], professional GCRA training resources remain limited. To date, 223 community-based clinicians from 47 U.S. states and 7 countries outside the U.S. have completed GCRA training through the *Intensive Course in Community Cancer Genetics and Research* that was the focus of this study, but the dearth of clinicians with adequate knowledge and skills in GCRA remains a significant barrier to the efficient identification and risk management of patients with hereditary cancer predisposition, and to the accrual of high-risk patients into cancer prevention and control research protocols.

Toward the goal of increasing course capacity and accessibility, this study set out to examine the effectiveness of participation in CME-accredited CCG Working Group Web conferences for distance-mediated case-based GCRA learning. For more than a decade, Working Group participation has been an essential source of ongoing evidence-based clinical support and professional development for practicing clinical affiliates of the City of Hope *Cancer Screening & Prevention Program*. Despite observations by CCG faculty that newly-trained clinicians who participate regularly in Working Group Web conferencing improve their proficiency in several domains of the GCRA process, prior to this study, formal examination of the learning value of Working Group participation had not been conducted.

Results of the comparative analysis provides quantifiable evidence that gains in scores on knowledge, case-based skills and professional self-efficacy (a recognized surrogate for actual performance) [27,28], by the intervention group, who engaged in case-based learning through participation in Working Group concurrently with didactic distance learning, were significant and comparable to or better than those of a comparison group, who participated in the established course model, with case-based learning conducted only through five days of face-to-face workshops.

Case conferencing is a long-standing tradition that facilitates the integration of evidence into patient care [29]. In an effort to maximize professional learning during case conferences and other RSS activities (such as tumor boards and grand rounds), the Accreditation Council for Continuing Medical Education (ACCME) criteria for awarding CME accreditation for RSS promote activities that: addresses identified knowledge gaps, foster collaborations, demonstrably improve clinical competence, performance and patient outcomes, and identify and overcome barriers to practice improvements [30]. While participation in RSS is required for maintenance of certification for a number of medical specialties, and RSS activities now represent more than 40 percent of the accredited CME activities conducted in the U.S. [30], few studies have explored the learning and practice change outcomes associated with participation in RSS activities [31-33,29,12]. To our knowledge, the comparative analysis described in this study is one of the first studies to employ quantitative analyses of learning and skills outcomes associated with RSS participation.

The self-directed, socially-constructed learning that takes place during case conferences and tumor boards inherently embodies the characteristics of *situated learning* in communities of practice. While communities of practice have thrived in the business and education sectors

for decades, their development in the health care sector has only gained momentum in recent years. A systematic review of the literature revealed wide variation in the definition, structure, facilitation, and monitoring of communities of practice in health care settings, and none of the 13 studies identified used a quantitative methodology, such as that employed in this study, to examine the effectiveness of community of practice participation on learning, practice change or patient health outcomes [34].

This study was conducted at a time of unprecedented change in the enterprise of continuing education for healthcare professionals. The Conjoint Committee on Continuing Medical Education, the American Board of Medical Specialties, the ACCME, and most recently, the Institute of Medicine (IOM), have initiated sweeping reforms to promote CME and professional development activities that are interactive, directly relevant to the learning needs of each clinician, and purposefully designed to improve practice-based competencies and patient health outcomes [12,35-38]. While this reform agenda is guided by evidence from the extant literature on adult learning and CME, the body of CME research is fragmented, with no unifying standards of quality or grounding in learning or behavioral theory [12]. The IOM outlines a comprehensive CME research agenda to identify theoretical frameworks, investigate effective education delivery models, define outcome measures, and determine what influences learning and practice change (IOM, 2010). Distance-mediated communities of practice such as that modeled by the CCG Working Group intervention have great potential to bring evidence-based learning and resources directly to the point of practice, and are closely aligned with the goals of CME reform.

Study Limitations

The curriculum, faculty and data collection procedures were the same for both comparison and intervention groups, and between-group comparisons of baseline assessment scores were conducted to address the potential impact of external threats to the validity of comparative analyses in the study. However, the composition of course participants and the dynamics and content of faculty-participant interactions vary with each session of the course, and may have had an impact on course outcomes. The study did not control for mode of participation in the Working Group intervention, so it was not possible to compare differences in outcomes based on participation in live, recorded, or a combination of live and recorded sessions. Finally, as the participants in this study represent a subset of highly motivated, self-selected group of healthcare providers, findings cannot be generalized to the larger population of medical professionals.

Implications and Directions for Further Research

The findings from this study suggest that Web-based case conferencing is an effective patient-centered learning and skills development resource for practicing clinicians. Additional near-term investigation within the context of the course is warranted to more rigorously test the effectiveness, strengths and limitations of Working Group as a community-of-practice learning forum by comparing the differences between comparison and intervention group outcomes based on practice discipline (MD, GC, APN) and mode of participation in the intervention (live versus recorded), and through triangulation of the findings from this quantitative analysis with the robust findings generated by the qualitative component of the study. These efforts will inform the development of a more accessible new course design that incorporates Working Group Web conferencing as a key source of case-based training aligned with the highest standards of accountability in CME. Further research to examine the effectiveness of this and other Web-based case conference and tumor board environments will enhance the learning potential of CME-accredited distance-mediated case conferencing and contribute to the body of theoretically-grounded approaches to CME and professional development.

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Fig 1.

Standard (established) Course and Study Intervention Procedures, Instruments and Data Collection Time Points. The *Community Cancer Genetics and Research Training* course model is delivered in three phases over a 14-month period through nine weeks of interdisciplinary distance didactics (*Phase 1*), five days of face-to-face case-based workshops (*Phase 2*) and 12 months of prescribed Web-based professional development activities (*Phase 3*). The comparison group participated in the standard (established) course procedure, with initiation of case-based learning *after* completion of *Phase 1* distance learning, during the five-days of face-to-face training in *Phase 2* of the course. The intervention group engaged in case-based learning through participation in Working Group Web conferences *concurrent with* the established *Phase 1* distance learning curriculum. Both the comparison and intervention groups completed pre-knowledge tests, case scenarios and professional self-efficacy surveys as a baseline measure prior to course orientation. The comparison group completed post-tests on the final day of *Phase 2* face-to-face training, as prescribed in the original course design. In order to compare the effectiveness of the Working Group Web conference intervention as a case-based learning forum, the intervention group post-tests were collected upon completion of *Phase 1* distance learning, prior to initiation of *Phase 2* face-to-face training at City of Hope.

Fig 2.

Participants, activities and outputs of Clinical Cancer Genetics (CCG) Working Group Web Conferencing (Study Intervention). CCG Working Group Web conferencing is a regularly-scheduled CME-accredited case conference series hosted each week by the City of Hope Division of Clinical Cancer Genetics (CCG). Sessions are co-moderated by CCG clinical faculty to facilitate interdisciplinary case discussion among face-to-face and distance participants. Participants include City of Hope and visiting physicians, cancer risk counselors, oncology and cancer genetics fellows, and molecular genetics laboratory staff. Affiliated clinicians and intensive course alumni across the U.S. and internationally participate in Working Group by distance from their clinical settings via *Microsoft Live™* (Microsoft Corporation, Redmond, WA) Web conference interface. During Working Group sessions, clinicians present challenging cases from their practices for interdisciplinary discussion and recommendations for patient care and best practices in cancer risk assessment and counseling, genetic testing strategy, test results interpretation, cancer risk management, and patient research and support resources.

Fig 3.

Comparisons of pre-post knowledge, case-based skills and professional self-efficacy assessment outcomes. Statistically-significant differences were demonstrated overall in pre-to post-knowledge, case-based skills and professional self-efficacy scores ($p < .000$ for each variable). Knowledge increases were higher for the intervention group ($p < .015$); skills and self-efficacy increases were comparable between groups ($p < .33$ and $p < .30$, respectively). Note: Overall by-discipline comparisons (not shown here) revealed statistically-significant increases for all disciplines ($p < .000$ for MDs, GCs and APNs).

Table 1
Descriptive Demographics, Cohort and Group Comparisons of the Study Participants

Characteristic/Variable	Comparison Group	Intervention Group	p values 2009 Winter vs Summer	p values 2010 Winter vs Summer	p values Comparison vs Intervention
Total N	44	52			
Practice Discipline					
Physician (MD)	17 (38.6%)	19 (36.5%)	.782	.307	.866
Advanced-Practice Nurse (APN)	13 (29.5%)	18 (34.6%)			
Genetic Counselor (GC)	14 (31.9%)	15 (28.9%)			
Gender					
Male	6 (13.6%)	6 (11.5%)	.662	.668	.767
Female	38 (86.4%)	46 (88.5%)			
Race					
Asian	1 (2.7%)	10 (19.2%)	.170	.259	.047*
Black/African American	3 (6.8%)	4 (7.7%)			
White	36 (81.8%)	38 (73.1%)			
Ethnicity					
Hispanic/Latino	6 (13.6%)	5 (9.6%)	.557	.632	.489
Practice Setting					
Academic Institution/University	7 (15.9%)	13 (25%)	.787	.276	.489
Community Based Hospital	21 (47.7%)	26 (50%)			
Community Based Private Practice	16 (36.4%)	13 (25.0%)			
Years in Clinical Practice					
Less than 1 year	2 (4.5%)	1 (1.9%)	.980	.562	.904
1 to 5 years	10 (22.7%)	15 (28.8%)			
5 to 10 years	6 (13.6%)	11 (21.2%)			
More than 10 years	26 (59.1%)	25 (48.1%)			
Experience in Practice of GCRA ^a					

Characteristic/Variable	Comparison Group	Intervention Group	p values 2009 Winter vs Summer	p values 2010 Winter vs Summer	p values Comparison vs Intervention
Yes	37 (84.1%)	49 (94.2%)	.402	1.00	.178
No	7 (15.9%)	3 (5.8%)			
Number of patients provided GCRA ^a services in past year ^b					
None	11 (25.0%)	4 (7.7%)	.316	.564	.148
1 to 25	7 (15.9%)	18 (34.6%)			
26 to 50	10 (22.7%)	8 (15.4%)			
51 to 100	10 (22.7%)	12 (23.1%)			
More than 100	6 (13.6%)	10 (19.2%)			

Note: P values based on Chi-square analysis; Fisher's Exact tests

^a GCRA = Genetic cancer risk assessment

^b Taken at baseline, measures GCRA patient count for the one-year period prior to course participation

* <.05 Between-group differences in race were at the threshold of significance and were not anticipated to impact outcomes among trained health professionals