Simulation Training Increases Dietetic Students' Self-Efficacy Prior to Clinical Supervised Practice

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Authorization to Submit Thesis

This thesis of Loren Oden, submitted for the degree of Master of Science with a Major in Family and Consumer Sciences and titled "Simulation Training Increases Dietetic Students' Self-Efficacy Prior to Clinical Supervised Practice," has been reviewed in final form. Permission, as indicated by the signatures and dates below, is now granted to submit final copies to the College of Graduate Studies for approval.

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Abstract

Simulation has rarely been used or studied in the dietetics profession, despite its beneficial effects on students and its widespread usage in other healthcare disciplines including nursing and medicine. This study examined the effect of simulation training on dietetics students' self-efficacy before supervised clinical practice. A pretest-posttest design was conducted during the fall of the 2015-2016 (n=20) and 2016-2017 (n=22) academic years. Students completed 120 hours of simulation training with manikin (SimMan) under the supervision of a panel of three Registered Dietitians. Ten previously validated case studies were used for the simulation training. Using the Wilcoxon signed-rank test, a statistically significant increase in students' median self-efficacy, following the simulation course, was observed. This study supports the use of simulation training with dietetics students to prepare them for supervised clinical practice.

Acknowledgments

I would like to thank Dr. SeAnne Safaii, Dr. Katie Brown, and Dr. Michael Kroth for their endless support, words of encouragement, and timeless wisdom. The wounds left by your critiques will eventually heal, but my gratitude for your guidance and fellowship will undoubtedly prevail.

A special acknowledgment is also in order for Dr. Ling- Ling Tsao. Thank you, Dr. Tsao for explaining statistics to me as if I were five years old.

Dedication

I dedicate this work to my 1986 Trek Elance. Family, friends, and spouses may come and go, but my bike will always be there to support me (literally).

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Chapter 1: Introduction

Purpose and Statement of Problem

In order to be eligible for clinical supervised practice rotations, dietetic students must fulfill class requirements in subjects, including mathematics, science, research, and counseling skills. However, aside from written case studies, computer-based simulations, and standardized patients, dietetic students are rarely given the opportunity to transfer their knowledge to settings outside of the classroom (Henry, Duellman, & Smith, 2009; Turner, Evers, Wood, Lehman, & Peck, 2000; Schwartz, Rothpletz-Puglia, Denmark, & Byham-Gray, 2015). Due to the limited experience before clinical supervised practice rotations, students often encounter difficulties in applying their classroom knowledge to their patients (Chau et al., 2001). Furthermore, researchers have found that students' self-confidence towards completing tasks related to medical nutrition therapy (MNT) and working within a clinical setting is low (Henry et al., 2009; Thompson & Gutschall, 2014).

Self-efficacy, defined by Bandura (1997), is the belief in one's own ability to perform a certain task in a given situation. An increase in self-efficacy results in an increase in self-confidence (Bandura, 1977). In practice, individuals with high self-efficacy are more likely to attempt a task because they view the task as challenge rather than a threat (Bandura, 1997).

Simulation has rarely been studied or reported on in dietetics (Safaii-Fabiano & Ramsay, 2011; Thompson & Gutschall, 2014). Research in simulation has largely focused on the training of students in medicine and nursing (Aronson, Rosa, Anfinson, & Light, 1997; Cant & Cooper, 2010; Reising, Carr, Shea, & King, 2011).

The purpose of this study was twofold: (1) to determine the effect of simulation training on dietetic students' perceived ability to overcome a hypothetical, clinical situation,

and (2) to investigate the impact of simulation training on dietetic students' self-efficacy in performing MNT-specific tasks.

Research Questions and Hypotheses

What effect does simulation training have on dietetic students' perceived ability to overcome hypothetical, clinical situations?

Null Hypothesis 1: Following simulation training, there is no difference in dietetic students' perceived ability to overcome hypothetical, clinical situations.

Alternative Hypothesis 1: Following simulation training, there is a significant, positive increase in dietetic students' perceived ability to overcome hypothetical, clinical situations.

What effect does simulation training have on dietetic students' self-efficacy towards performing MNT-specific tasks?

Null Hypothesis 2: There is no difference in dietetic students' self-efficacy towards performing MNT-specific tasks following simulation training.

Alternative Hypothesis 2: There is a significant, positive increase in dietetic students' self-efficacy towards performing MNT-specific tasks following simulation training.

Chapter 2: Review of the Literature

Defining Simulation

Simulation has been identified as an educational technique that facilitates learning through replication of clinical environments (Cant & Cooper, 2010). Simulation techniques reproduce real-world settings to provide students with a safe opportunity to interact within a guided experience (Gaba, 2004). Nehring and Lasheley (2009) explained that students participating in simulation "construct knowledge through gathering and synthesizing information and integrating it with general skills of inquiry, communication, critical thinking, and problem solving" (p. 421). Furthermore, the degree to which simulation techniques resemble reality have been categorized as low, medium, and high fidelity (Cant & Cooper, 2010); high fidelity simulation has been described as contributing a high degree of realism to simulated scenarios (Galloway, 2009). Standardized patients (SP), typically an actor reading a script (Galloway, 2009), and full-scale simulation, a programmable full-body manikin that responds to external stimuli, constitute medium or high fidelity depending on their contribution to realism (Cant & Cooper, 2010; Galloway, 2009). Case studies, role play, and anatomical models fall under low fidelity (Kinney & Henderson, 2008).

Simulation Benefits

Simulation has addressed a key concern identified by clinical preceptors: students encountered difficulties in transferring and applying their classroom knowledge to their patients when they begin their clinical supervised practice or internships (Chau et al., 2001); the findings reported by Sturm et al. (2008) and Park et al. (2007) suggest that simulation assists students in training transfer, thereby transferring classroom knowledge to real-world settings. A systematic review of surgical simulation found that skills obtained during

simulation training were transferrable to the operative setting (Sturm et al., 2008). Further research, evaluating virtual reality simulation for surgical residents, confirmed that residents who received training on a colonoscopy simulator performed significantly better ($p=0.04$) in their first patient-based colonoscopy than residents in the control group (Park et al., 2007). However, Sturm et al. (2008) and Park et al. (2007) reported that improvements were not seen in all measured metrics.

Moreover, researchers have reported that students receive immediate feedback and learning reinforcement through direct engagement in simulation training (Gibbons et al, 2002). Fuszard (1995) asserted that knowledge gained in simulation is retained longer than knowledge gained through traditional lectures. Research pertaining to SP simulation exercises, found that SP can enhance counseling skills (Henry & Smith, 2010), provide students with an opportunity to practice behavior change and communication skills (Schwartz et al., 2015), and allow students to receive immediate, objective feedback from instructors (Hampl, Herbold, Schneider, & Sheeley, 1999). Moreover, a systematic review of simulation methods found that medium and high fidelity manikins are valuable for teaching and learning when best practice guidelines are followed (Cant & Cooper, 2010). For dietetic students, simulation has provided a standardized exposure to a number of disease states, which ensures a homogenous experience among students (Safaii-Fabiano & Ramsay, 2011). In summary, research has shown that simulation training increases students' skill levels in critical thinking and problem solving (Nehring & Lasheley, 2009), communicating with patients (Kameg, Howard, Clochesy, Mitchell, & Suresky, 2010), counseling patients (Henry & Smith, 2010), performing health teaching (Goldenberg, Andrusyszyn, & Iwasiw, 2005), and implementing

behavior change strategies (Schwartz et a., 2015), while facilitating training transfer to address the difficulties experienced by students and identified by Chau et al. (2001).

Time in Simulation

Thompson and Gutschall (2014) have acknowledged that while the time spent in simulation is beneficial, it cannot solely take the place of supervised practice. Previous research has established that educational outcomes are equivalent when simulation replaces up to 50% of traditional clinical experience (Hayden, Smiley, Alexander, Kardong-Edgren, & Jeffries, 2014). The Accreditation Council for Education in Nutrition and Dietetics (ACEND), the Academy of Nutrition and Dietetics' accrediting agency for education programs, has specified that students must complete 1,200 hours of supervised practice (ACEND, 2013). However, researchers have concluded that there is a shortage of facilities and preceptors that are accepting dietetic students for supervised practice (Sherry, 2015; Thompson & Gutschall, 2014). Time spent in simulation training has the ability to supplement and replace time spent in supervised practice. For example, research by Safaii-Fabiano and Ramsay (2011) was able to substitute 150 hours of clinical supervised practice with 150 hours of simulation. The 150 hours of simulation, accounting for 12.5% of the required supervised practice hours, was well below the threshold established by Hayden, et al. (2014).

Time spent in simulation has provided standardized training for students. Safaii-Fabiano and Ramsay (2011) utilized 10 previously validated case studies and a medium-fidelity manikin in order to homogenize students' clinical experience. In the past, dietetic students completed coursework before starting their supervised practice hours in separate facilities, which offered unique exposures based on patients' conditions, hospital size, and facility policies. For example, students in larger hospital often experienced a supervised

practice with a wider array of disease states and conditions (ie. trauma, burns, Phenylketonuria); students in smaller hospitals have often only experienced the most common disease states and conditions (ie. pneumonia, influenza, Type 2 Diabetes). The simulation training outlined by Safaii-Fabiano and Ramsay (2011) ensured that students had a uniform exposure to 10 disease states before starting their supervised practice hours. Moreover, Thompson and Gutschall (2014) postulated that students' supervised practice time is more efficiently used due to the additional preparation provided by simulation.

High-Stakes Assessment

Researchers have identified that simulation can be employed in high-stakes assessment as a summative evaluation to determine an end-point (ie. the student is qualified to practice independently) (Maran & Glavin, 2003). Sando et al. (2013) explained that summative evaluations are focused on measuring outcomes, while formative evaluations center on personal or professional development. Simulation has expanded beyond an educational tool and has filled a need in assessing clinical competence (Levine, Schwartz, Bryson, & DeMaria, 2012). For example, physicians have utilized high-stakes simulation assessments, in part, to gain state licensure, demonstrate credentialing requirements, and maintain specialty board certifications (Feldman, Lazzara, Vanderbilt, & DiazGranados, 2012). However, Willhaus, Burleson, Palaganas, and Jeffries (2014) explained that shifting simulation to act as a summative evaluation can remove students' perception of a safe, practice environment, which partially negates simulation's purpose.

Research conducted by Safaii-Fabiano and Ramsay (2011) found a middle ground between high-stakes assessment and simulation training. Safaii-Fabiano and Ramsay (2011) administered a mock registration examination to dietetic students after they completed ten

simulated patient encounters. In this research, simulation was not the high-stakes assessment, but was instead used to prepare students for a high-stakes assessment and supervised practice.

Medical Nutrition Therapy and Self-Efficacy Theory

The Academy of Nutrition and Dietetics (2017b) has defined Medical Nutrition Therapy (MNT) as "an evidence-based application of the Nutrition Care Process. The provision of MNT (to a patient/client) may include one or more of the following: nutrition assessment/ re-assessment, nutrition diagnosis, nutrition intervention and nutrition monitoring and evaluation…" The Commission on Dietetic Registration (2016), the credentialing agency for the Academy of Nutrition and Dietetics, has listed the ability to deliver MNT as a core competency for dietetic registration.

Researchers have found that, through changing dietetic interns' understanding of patients' perspectives on counseling for behavior change, simulation assisted the dietetic interns in meeting registration requirements due to an increase in their self-confidence in delivering MNT counseling methods (Henry, et al., 2009). In this context, self-confidence was not used as a motivational perspective, but rather an evaluation of capabilities in completing a goal given a broader conceptualization of motivation (Druckman & Bjork, 1994). Self-Efficacy Theory has described one's belief in their ability to successfully accomplish a specific task in order to obtain a certain outcome (Bandura, 1977). For this reason, self-efficacy can be considered as context specific self-confidence (Bandura, 1977; Bandura, 2005; Tschannen-Moran & Woolfolk-Hoy, 2001). Self-Efficacy Theory expounded upon motivation with the following theoretical framework:

> People will generally only attempt things they believe they can accomplish and won't attempt things they believe they will fail. People with a strong sense of self-efficacy

believe they can accomplish even difficult tasks. They see these as challenges to be mastered rather than threats to be avoided (Bandura, 1997).

Moreover, research examining nursing students found that simulation increased their self-efficacy in performing health teaching (Goldenberg et al., 2005) and in communicating with patients (Kameg et al., 2010). Furthermore, a preliminary study found that high fidelity patient simulation increased dietetics students' self-efficacy before clinical supervised practice (Todd, McCarroll, & Nucci, 2016). Increased self-efficacy has also been associated with increased motivation and goal-setting (Madorin & Iwasiw, 1999).

Current Simulation Research in Dietetics

Simulation in dietetics education is rarely used or reported on (Safaii-Fabiano & Ramsay, 2011; Thompson & Gutschall, 2014). Thompson and Gutschall (2014) identified that there is a limited body of research surrounding the methodologies or the effectiveness of simulation training in dietetics. Safaii-Fabiano and Ramsay (2011) established that a lack of research exists on simulation's effect on dietetic students' self-efficacy.

Chapter 3: Journal Article

Introduction

In order to be eligible for clinical supervised practice rotations, dietetic students must fulfill class requirements in subjects, including mathematics, science, research, and counseling skills. However, aside from print case studies, rarely used computer-based simulators, and standardized patients, dietetic students are rarely given the opportunity to transfer their knowledge to settings outside of the classroom (Henry, Duellman, & Smith, 2009; Turner, Evers, Wood, Lehman, & Peck, 2000; Schwartz, Rothpletz-Puglia, Denmark, & Byham-Gray, 2015). Due to the limited experience before clinical supervised practice rotations, dietetic students often encounter difficulties in applying their classroom knowledge to their patients (Chau et al., 2001). Furthermore, researchers have found that students' self-confidence towards completing tasks related to medical nutrition therapy (MNT) and working within a clinical setting is low (Henry et al., 2009; Thompson & Gutschall, 2014).

Simulation, an educational tool that facilitates learning by replicating clinical environments (Cant & Cooper, 2010), has filled the need identified by Chau et al. (2001) through training transfer (Sturm et al., 2008; Park et al., 2007). Simulation techniques reproduce real-world settings to allow students to practice and apply their classroom knowledge in a safe, guided experience (Gaba, 2004). Simulation training increases students' skill levels in critical thinking and problem solving (Nehring & Lasheley, 2009), communicating with patients (Kameg, Howard, Clochesy, Mitchell, & Suresky, 2010), counseling patients (Henry & Smith, 2010), performing health teaching (Goldenberg, Andrusyszyn, & Iwasiw, 2005), and implementing behavior change strategies (Schwartz et a., 2015). However, simulation in dietetics education has not been widely studied (Safaii-Fabiano

& Ramsay, 2011; Thompson & Gutschall, 2014). Simulation research has largely focused on its use in medical and nursing education. (Aronson, Rosa, Anfinson, & Light, 1997; Cant & Cooper, 2010; Reising, Carr, Shea, & King, 2011). A preliminary study by Todd et al. (2016) found that high fidelity simulation increases dietetic students' self-efficacy, but further research is still needed.

Self-efficacy, defined by Bandura (1997), is the belief in one's own ability to perform a certain task in a given situation. An increase in self-efficacy results in an increase in self-confidence (Bandura, 1977). In practice, individuals with high self-efficacy are more likely to attempt a task because they view the task as challenge rather than a threat (Bandura, 1997).

Therefore, the purpose of this study was twofold: (1) to determine the effect of simulation training on dietetic students' perceived ability to overcome a hypothetical, clinical situation, and (2) to investigate the impact of simulation training on dietetic students' self-efficacy in performing MNT-specific tasks.

Materials and Methods

This study was approved by the University of Idaho (UI) Institutional Review Board (IRB).

Participants

A non-random, convenience sample was taken from the University of Idaho's Coordinated Program in Dietetics (CPD) classes of 2015 (n = 20) and 2016 (n = 22) during the fall semester of their senior year. Students were required to complete the simulation course as part of their supervised practice hours, but completion of the pre- and post-survey was voluntary. Students were informed of the mock dietetic registration examination at the start of the fall semester; they were informed that it would be pass/fail and part of their final

grade. The simulation course allowed students to practice their MNT skills in a simulated environment before starting their clinical supervised practicum. From the 42 students, 34 completed both the pre- and post-surveys. The participants were between the ages of 20 and 45 years of age, 90% were female, and all had a GPA of 3.0 or higher.

Instrument

A self-efficacy scale, tailored to dietetic students, was written in accordance with Bandura's (2006) guide to constructing self-efficacy scales. All survey questions were developed, reviewed, and piloted by simulation content experts. The survey questions were assessed by how easily they were understood by students and their relevance to the CRD. Previous research conducted by Safaii-Fabiano & Ramsay (2011) piloted the survey questions.

The first 14 questions inquired about students' perspectives towards overcoming a hypothetical, clinical situation. Participants were asked to select one response from a Likert scale where 0 = not true at all, 1 = barely true, 2 = moderately true, and 3 = exactly true. This self-efficacy appraisal detailed the level of difficulty the students believed they could overcome.

The succeeding 37 questions incorporated accreditation standards, established by ACEND (2013). These 37 questions asked students how confident they felt in completing an MNT-specific task on a five-point scale where 0% = no chance at all, 25% = a slight chance, 50% = 50-50 chance, 75% = a good chance, and 100% = completely certain. MNT-specific tasks included obtaining a patient's food and nutrition related history, understanding anthropometric measurements, reviewing patients' medications, understanding nutrition-focused physical findings, and providing nutrition education.

Data Collection

The study utilized a pretest-posttest design. Before starting the simulation course, participants completed the pre-survey (Appendix 1). After finishing the simulation course, participants completed the post-survey (Appendix 1), which was identical to the pre-survey. Pre-survey and post-survey data were matched using a numerical process; student names were unknown to the research team. Data was stored on a researcher's password protected computer.

Simulation Coursework and Materials

At the start of the academic semester, students were informed that they were required to take a mock dietetic registration examination after completing the simulation course. This high-stakes assessment was pass-fail and was part of the students' final grade. The simulation course took three weeks, which accounted for 120 hours (10%) of the students' supervised practice hours. The mock registration examination was administered in a classroom setting after the 120 hours of simulation had been completed.

Students were given a patient's chart at the start of each day. The charts included the following information: (a) patient history, (b) laboratory results, (c) home medications, (d) intakes and outputs, (e) physician orders, (f) diet orders, (g) physician progress notes, (h) nursing progress notes, and (i) weight logs. Students were instructed to work independently as they reviewed the patient's chart, gathered relevant information, and composed questions for the simulated patient interview. Students were also instructed to not disclose information about the patient interview to the other students who had not completed the day's simulation. The simulation scenarios took place in a simulation lab near the campus. During the simulation course, students were encouraged to utilize the Nutrition Care Manual (Academy

of Nutrition and Dietetics, 2017a) and Evidence Analysis Library (Academy of Nutrition and Dietetics, 2017c).

SimMan, used in previous research by Safaii-Fabiano & Ramsay (2011), was used for this study. SimMan, a medium-fidelity, stationary manikin, was wired with speakers, a microphone, a camera, and was positioned in a hospital bed in a closed room. Evaluation of each student began once they entered the room. A panel, composed of three Registered Dietitians (one faculty member and two clinical dietitians who served as preceptors), evaluated the students using the CPD Evaluation Instrument (Appendix 2). The panel observed, listened, and responded to students from an adjoining room where the closed video and audio feed was stationed; only one panel member would respond to students using SimMan. For one of the simulated scenarios, a member of the panel also acted as a standardized patient. The simulated scenario took approximately 15 minutes. After completing the simulated scenario, the panel debriefed the student by asking (a) a series of standardized debriefing questions, (b) what went well, and (c) what could have gone better. The panel also reviewed the CPD Evaluation Instrument with the students. Following the debriefing, students submitted a chart note for the panel to review; in order to adhere to the framework established by the Nutrition Care Process, chart notes were required to be written in the ADIME format (Academy of Nutrition and Dietetics, 2017d)

The simulation course utilized the following 10 disease states for the scenarios: (a) Acute Pancreatitis, (b) Celiac Disease, (c) Congestive Heart Failure, (d) Chronic Obstructive Pulmonary Disease, (e) Liver Disease, (f) Lung Cancer, (g) Renal Failure, (h) Type 1 Diabetes, (i) Type 2 Diabetes, and (j) Wound Care. Each of the 10 scenarios had been previously evaluated for face validity by content experts. Each scenario contained the goal of

the simulated scenario, the learning objectives of the simulated scenario, patient chart information, key words, expected scenario events and actions, patient behavior overview, debriefing points, ACEND competencies, and the CPD Evaluation Instrument (Appendix 2).

Data Analysis

Demographic information was not used as part of the analysis. To determine the overall confidence level for each student, median, interquartile range (IQR), and the mean ± standard deviation (SD) was calculated before and after simulation by summing the scores of all survey questions and dividing them by the total number of questions. The self-efficacy survey was written on an ordinal scale. The Wilcoxon signed-rank test was used to determine the difference in students' mean and median confidence level before and after the simulation course. Confidence intervals were set at 95% with one-sided lower bounds (Ho: $\mu \leq 0$, Ha: $\mu > 0$). Descriptive statistics were also calculated for each of the questions. Data from students that left either a pre- or post-survey question blank were not included in the analysis for that survey question; four questions had an n = 33 and two questions had an n = 32.

Results

Overall, calculations based on all survey questions returned a statistically significant ($p<0.0001$) increase in the median self-efficacy level before the simulation course (3.92; interquartile range [IQR] = 3.61-4.22) and after the simulation course (4.30; IQR 4.11-4.49). Furthermore, the mean percentage score ± SD of the post-test examination was significantly higher than the pre-test score (4.29±0.28 vs. 3.94±0.34, $p<0.0001$).

To evaluate students' perceived ability to overcome hypothetical, clinical situations for questions 1-14, pre- and post- mean scores were compared using Wilcoxon signed-rank tests. Results for questions 1-14 have been summarized in Table 1. From questions 1-14, the

following two questions returned significant results: “I can always manage to solve difficult problems if I try hard enough” and “thanks to my resourcefulness, I can handle unforeseen situations.” These findings favor the null hypothesis over the alternative hypothesis in 12 out of the 14 hypothetical, clinical situations.

Table 1. Summary of Wilcoxon signed-rank test results for survey questions related to students’ perceived ability to overcome hypothetical, clinical situations.

Survey Question	N		Mean Rank	Rank Sum	T-Statistic	P-Value
1. I can always manage to solve difficult problems if I try hard enough.	Positive	9	6.00	54.0	54.00	0.0337
	Negative	2	6.00	12.0		
	Zero	23				
	Total	34				
2. If someone opposes me, I can find the ways and means to get what I want.	Positive	9	7.00	63.0	63.00	0.1219
	Negative	4	7.00	28.0		
	Zero	21				
	Total	34				
3. I am certain that I can accomplish my goals.	Positive	4	4.50	18.0	18.00	0.5273
	Negative	4	4.50	18.0		
	Zero	26				
	Total	34				
4. I am confident that I could deal efficiently with unexpected events.	Positive	8	4.50	36.0	36.00	0.0039
	Negative	0		0.0		
	Zero	25				
	Total	33				
5. Thanks to my resourcefulness, I can handle unforeseen situations.	Positive	6	4.00	24.0	24.00	0.0547
	Negative	1	4.00	4.0		
	Zero	27				
	Total	34				
6. I can solve most problems if I invest the necessary effort.	Positive	3	5.00	15.0	15.00	0.8203
	Negative	6	5.00	30.0		
	Zero	25				
	Total	34				
7. I can remain calm when facing difficulties because I can rely on my coping abilities.	Positive	8	6.19	49.5	49.50	0.0874
	Negative	3	5.50	16.5		
	Zero	23				
	Total	34				
8. When I am confronted with a problem, I can find several solutions.	Positive	1	6.00	6.0	6.00	0.9976
	Negative	11	6.55	72.0		
	Zero	22				
	Total	34				

9. If I am in trouble, I can think of a good solution.	Positive	0		0.0	0.00	1.000
	Negative	9	5.00	45.0		
	Zero	25				
	Total	34				
10. I can handle whatever comes my way.	Positive	2	4.00	8.0	8.00	0.8516
	Negative	5	4.00	20.0		
	Zero	27				
	Total	34				
11. I feel comfortable providing Medical Nutrition Therapy for most diseases/conditions.	Positive	2	7.5	15.0	15.00	0.9996
	Negative	16	9.75	156.0		
	Zero	14				
	Total	32				
12. I feel confident in using oral and written communication in presenting an education or diet counseling session.	Positive	2	10.00	20.0	20.00	0.9994
	Negative	17	10.00	170.0		
	Zero	15				
	Total	34				
13. I am able to define diets for various health conditions.	Positive	0		0.0	0.00	1.000
	Negative	16	8.50	136.0		
	Zero	18				
	Total	34				
14. I can remain calm and confident when facing challenges of communicating Medical Nutrition Therapy goals to other members of the health care team.	Positive	3	8.50	25.5	25.50	0.9945
	Negative	14	9.11	127.5		
	Zero	17				
	Total	34				

Wilcoxon Signed-Rank tests were performed on questions 15-51 to evaluate students' perceived self-efficacy in performing MNT-specific tasks. The MNT-specific tasks on the survey can be categorized under CRD 3.1 as identified in the ACEND 2013 CRD; CRD 3.1 requires students to perform the Nutrition Care Process by assessing, diagnosing, intervening, monitoring, and evaluating patients (ACEND, 2013). The results for questions 15-51 have been summarized in Table 2, Table 3, Table 4, Table 5, and Table 6 based on their statistical significance and category in the Nutrition Care Process. From these 37 survey questions, 26 were categorized under assessment, six were categorized under diagnosis, and five were

categorized under intervention. In these three categories, the following results were calculated: (a) 54% of questions in the assessment category had significant results, (b) 83% of questions in the diagnosis category had significant results, and (c) 100% of questions in the intervention category had significant results.

Table 2. Summary of Significant Wilcoxon signed-rank test results for MNT-specific tasks in Assessment

Survey Question	N		Mean Rank	Rank Sum	T-Statistic	P-Value
16. Understanding client food/nutrition related history.	Positive	15	9.20	138.0	138.00	0.0010
	Negative	2	7.50	15.0		
	Zero	17				
	Total	34				
17. Obtaining client biochemical data, medical tests & procedures.	Positive	15	10.40	156.0	156.00	0.0062
	Negative	4	8.50	34.0		
	Zero	15				
	Total	34				
21. Obtaining client nutrition-focused physical findings.	Positive	24	14.44	346.5	346.50	<0.0001
	Negative	3	10.50	31.5		
	Zero	7				
	Total	34				
22. Understanding client nutrition-focused physical findings.	Positive	18	11.75	211.5	211.50	0.0002
	Negative	3	6.50	19.5		
	Zero	13				
	Total	34				
23. Review client's social background.	Positive	11	7.27	80.0	80.00	0.0067
	Negative	2	5.50	11.0		
	Zero	21				
	Total	34				
24. Understand client's social background.	Positive	8	6.94	55.5	55.50	0.0269
	Negative	3	3.50	10.5		
	Zero	23				
	Total	34				
26. Understand client’s past medical status/socio-economic status.	Positive	9	6.22	56.0	56.00	0.0210
	Negative	2	5.00	10.0		
	Zero	23				
	Total	34				

27. Review client's family history.	Positive	7	4.50	31.5	31.50	0.0391
	Negative	1	4.50	4.5		
	Zero	26				
	Total	34				
31. Understand client's medications--reason for use.	Positive	17	11.47	195.0	195.00	0.0021
	Negative	14	9.00	36.0		
	Zero	13				
	Total	34				
33. Review client's laboratory values.	Positive	10	8.10	81.0	81.00	0.0392
	Negative	4	6.00	24.0		
	Zero	19				
	Total	33				
46. Introducing myself and starting a conversation with a patient.	Positive	7	4.57	32.0	32.00	0.0273
	Negative	1	4.00	4.0		
	Zero	26				
	Total	34				
48. Conduct my interview in an organized sequence.	Positive	14	8.50	119.0	119.00	0.0031
	Negative	2	8.50	17.0		
	Zero	18				
	Total	34				
49. Maintain an appropriate conversational style and conduct the interview without notes.	Positive	18	10.06	181.0	181.00	0.0016
	Negative	2	14.50	29.0		
	Zero	14				
	Total	34				

Table 3. Summary of Non-significant Wilcoxon signed-rank test results for MNT-specific tasks in Assessment

Survey Question	N		Mean Rank	Rank Sum	T-Statistic	P-Value
15. Obtaining client food/nutrition related history.	Positive	3	10.83	32.5	32.50	0.9847
	Negative	14	8.61	120.5		
	Zero	17				
	Total	34				
18. Understanding client biochemical data, medical tests and procedures.	Positive	2	8.50	17.0	17.00	0.9994
	Negative	16	9.63	154.0		
	Zero	16				
	Total	34				
19. Obtaining client	Positive	6	6.50	39.0	39.00	0.9351

anthropometric measurements.	Negative	10	9.70	97.0		
	Zero	18				
	Total	34				
25. Review client's past medical status/socio-economic status	Positive	6	4.00	24.0	24.00	0.0547
	Negative	1	4.00	4.0		
	Zero	27				
	Total	34				
28. Understand client's family history.	Positive	1	5.00	5.0	5.00	0.9863
	Negative	8	5.00	40.0		
	Zero	25				
	Total	34				
30. Review client's medications.	Positive	11	8.73	96.0	96.00	0.0795
	Negative	5	8.00	40.0		
	Zero	17				
	Total	33				
34. Understand client's laboratory values.	Positive	1	5.50	5.5	5.50	0.9996
	Negative	13	7.65	99.5		
	Zero	18				
	Total	32				
35. Understand client's skewed values.	Positive	2	10.00	20.0	20.00	0.9999
	Negative	20	11.65	233.0		
	Zero	12				
	Total	34				
36. Complete a dietary recall.	Positive	6	4.00	24.0	24.00	0.2305
	Negative	2	6.00	12.0		
	Zero	26				
	Total	34				
37. Assess the adequacy of the diet recall.	Positive	9	5.61	50.5	50.50	0.0737
	Negative	2	7.75	5.5		
	Zero	23				
	Total	34				
47. Maintain eye contact appropriately.	Positive	2	2.50	5.0	5.00	0.5625
	Negative	2	2.50	5.0		
	Zero	29				
	Total	33				
50. Appear professional to the patient.	Positive	4	5.13	20.5	20.50	0.6328
	Negative	5	4.90	24.5		
	Zero	25				

	Total	34				

Table 4. Summary of Significant Wilcoxon signed-rank test results for MNT-specific tasks in Diagnosis

Survey Question	N		Mean Rank	Rank Sum	T-Statistic	P-Value
32. Understand client's drug/nutrient interactions.	Positive	18	9.50	171.0	171.00	<0.0001
	Negative	0	x	0.0		
	Zero	15				
	Total	33				
38. Diagnosis intake deficiencies/excesses of energy, protein, nutrients.	Positive	23	13.09	301.0	301.00	<0.0001
	Negative	2	12.00	24.0		
	Zero	9				
	Total	34				
39. Determine the correct nutrition diagnosis or diagnoses.	Positive	16	9.13	146.0	146.00	0.0001
	Negative	1	7.00	7.0		
	Zero	17				
	Total	34				
40. Write a nutrition prescription.	Positive	19	10.58	201.0	201.00	<0.0001
	Negative	1	9.00	9.0		
	Zero	14				
	Total	34				
42. Write a PES statement or a medical record note.	Positive	12	7.63	91.5	91.50	0.0416
	Negative	3	9.50	28.5		
	Zero	19				
	Total	34				

Table 5. Summary of Non-significant Wilcoxon signed-rank test results for MNT-specific tasks in Diagnosis

Survey Question	N		Mean Rank	Rank Sum	T-Statistic	P-Value
29. Interpret present medical status.	Positive	4	7.50	30.0	30.00	0.9940
	Negative	14	10.07	141.0		
	Zero	16				
	Total	34				

Table 6. Summary of Significant Wilcoxon signed-rank test results for MNT-specific tasks in Intervention

Survey Question	N	Mean	Rank Sum	T-	P-Value

			Rank		Statistic	
41. Design the appropriate intervention.	Positive	16	9.63	154.0	154.00	0.0008
	Negative	2	8.50	17.0		
	Zero	16				
	Total	34				
43. Provide nutrition education.	Positive	12	7.13	85.5	85.50	0.0209
	Negative	2	9.75	19.5		
	Zero	20				
	Total	34				
44. Provide nutrition counseling.	Positive	13	8.23	107.0	107.00	0.0222
	Negative	3	9.67	29.0		
	Zero	18				
	Total	34				
45. Provide coordination of care.	Positive	14	8.07	113.0	113.00	0.0091
	Negative	2	11.50	23.0		
	Zero	18				
	Total	34				
51. Answer questions that the patient may have.	Positive	20	11.65	233.0	233.00	<0.0001
	Negative	2	10.00	20.0		
	Zero	12				
	Total	34				

Discussion

This research measured the effect of simulation training on CPD students' self-efficacy. The results have shown that simulation training increases students' self-efficacy in performing certain MNT-specific tasks before clinical supervised practice. Nevertheless, the majority of non-significant results were under the assessment category. These results indicate that students were either already proficient in the task, the simulation course did not adequately address the task, or that the students require real-life clinical practice. For example, students likely had a high degree of self-efficacy in their ability to "maintain eye contact appropriately" (p=0.5625) and to "appear professional to the patient" (p=0.6328). These questions could likely be excluded from future simulation research. Conversely,

students reported an increase in self-efficacy for “review client's laboratory values” ($p=0.0392$), but a lack of self-efficacy in their ability to “understand client's laboratory values” ($p=0.9996$). Likewise, students’ self-efficacy towards their ability to “complete a dietary recall” ($p=0.2305$) and to “assess the adequacy of the diet recall” ($p=0.0737$) indicates that the simulation course’s curriculum did not adequately address dietary recalls. In both instances, understanding laboratory values and conducting a dietary recall, students would likely benefit from additional practice in either simulation or in a real-life clinical setting. This research has confirmed that, after simulation, additional education and training is required by students to meet the competencies outlined in the ACEND 2013 CRD.

Additionally, some of the students in this study reported a high degree of self-efficacy on the pre-survey, but a low degree of self-efficacy on the post survey for MNT-specific tasks. This decrease in self-efficacy is likely due to initial overconfidence and the subsequent realization of what a practicing Registered Dietitian is required to do. For example, “interpret present medical status” and “understand client's skewed values” had considerably more negative values following the simulation course. The reverse is also true; students reported a high degree of self-efficacy on the pre-survey and a high degree of self-efficacy on the post survey. In these instances, students likely perceived that they were already prepared to conduct a particular MNT task and then the simulation course either reinforced or did not benefit their perceptions.

The results of this study were similar to three other studies that investigated simulation’s effect on dietetic students’ self-efficacy. Henry et al. (2009) used two simulated patient encounters and subsequent focus groups to evaluate dietetic interns’ perceptions of counseling skills; the dietetic interns reported an increased self-confidence towards

counseling after simulation. Safaii-Fabiano and Ramsay (2011) found that dietetics students were more confident in delivering MNT after completing 50 hours of simulation training. Todd et al. (2016) measured masters CPD students' self-efficacy before simulation, after simulation, and during their clinical supervised practice; the researchers calculated a significant increase in students' confidence after the simulation and during their clinical supervised practice. Findings by Todd et al. (2016) have reinforced the need for additional training following simulation.

Simulation, as an educational tool, has been incorporated into various healthcare disciplines (Reising, Carr, Shea, & King, 2011; Cant & Cooper, 2010; Aronson, Rosa, Anfinson, & Light, 1997). Despite its widespread use in other disciplines, simulation is rarely used or researched in dietetics (Thompson & Gutschall, 2014; Safaii-Fabiano & Ramsay, 2011). Moreover, the shortage in supervised practice facilities and preceptors has increased the relevance of simulation; simulation has the ability to alleviate this shortage by supplementing supervised practice hours. Nevertheless, Hayden, et al. (2014) established that educational outcomes are equivalent when simulation replaces up to 50% of traditional clinical experience; properly trained facilitators, sufficient space and equipment, theory-based debriefing methods, and set simulation objectives were the caveats for supplementing simulation for supervised practice.

Strengths and Limitations

This study had several strengths and limitations. First, unlike previous research, this study provided a standardized simulation experience for students; all students had identical patient charts, exposure to 10 disease conditions, and debriefing session with standardized debriefing questions. Moreover, this research is unique in that it evaluated individual MNT

tasks. Previous studies measured students' overall self-efficacy in delivering MNT without specifying tasks or the Nutrition Care Process' steps. The sample size was small because the simulation course was only available to senior University of Idaho CPD students. However, the survey response rate was 81%. The lack of a control group was another limitation; establishing a control group was not a feasible option because completing the simulation course was a requirement for the CPD students. Nevertheless, dietetics is a competency-based profession; therefore, the results are generalizable beyond this immediate data set. Furthermore, tools to evaluate self-efficacy are available, but no known validated self-efficacy tool exists for the dietetics profession; the survey used in this study was written in accordance with Bandura's (2006) guide to constructing self-efficacy scales and all survey questions were developed, reviewed, and piloted by simulation content experts. Finally, this study did not investigate students' self-efficacy during their clinical supervised practices.

Conclusions

This study examined the impact of simulation training on students' self-efficacy. Simulation training can improve students' self-efficacy and supplement supervised practice. Replicating real-world clinical experiences facilitated training transfer in the sense that students were utilizing classroom knowledge in a simulated environment. Future research, conducted on simulation in dietetics, should investigate training transfer in real clinical settings. Additional research, using control groups and larger sample populations, is also necessary to more effectively evaluate simulation's impact on self-efficacy in delivering MNT-specific tasks. In order to integrate simulation into dietetics curriculum, research is needed to develop and validate a self-efficacy scale that is tailored to dietetics.

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Appendix A. CPD Self-Efficacy Survey

1. CPD Supervised Practice Survey

Please answer the following questions with the one answer that best describes you.

1. I can always manage to solve difficult problems if I try hard enough.

not true at all | barely true | moderately true | exactly true

2. If someone opposes me, I can find the ways and means to get what I want.

not at all true | barely true | moderately true | exactly true

3. I am certain that I can accomplish my goals.

not at all true | barely true | moderately true | exactly true

4. I am confident that I could deal efficiently with unexpected events.

not at all true | barely true | moderately true | exactly true

5. Thanks to my resourcefulness, I can handle unforeseen situations.

not at all true | barely true | moderately true | exactly true

6. I can solve most problems if I invest the necessary effort.

not at all true | barely true | moderately true | exactly true

7. I can remain calm when facing difficulties because I can rely on my coping abilities.

not at all true | barely true | moderately true | exactly true

8. When I am confronted with a problem, I can find several solutions.

not at all true | barely true | moderately true | exactly true

9. If I am in trouble, I can think of a good solution.

not at all true | barely true | moderately true | exactly true

10. I can handle whatever comes my way.

not at all true | barely true | moderately true | exactly true

11. I feel comfortable providing Medical Nutrition Therapy for most diseases/conditions.

not true at all | barely true | moderately true | exactly true

12. I feel confident in using oral and written communication in presenting an education or diet counseling session.

not true at all | barely true | moderately true | exactly true

13. I am able to define diets for various health conditions.

1. not true at all
2. barely true
3. moderately true
4. exactly true

14. I can remain calm and confident when facing challenges of communicating Medical Nutrition Therapy goals to other members of the health care team.

1. not at all true
2. barely true
3. moderately true
4. exactly true

2.

1. For each of the following tasks, indicate which best describes how confident you are of successfully completing the activity.

	0% – no chance at all	25% – a slight chance	50% – 50-50 chance	75% – a good chance	100% – completely certain
Obtaining client food/nutrition related history					
Understanding client food/nutrition related history					
Obtaining client biochemical data, medical tests & procedures					
Understanding client biochemical data, medical tests and procedures					
Obtaining client anthropometric measurements					
Understanding client anthropometric measurements					
Obtaining client nutrition-focused physical findings					
Understanding client nutrition-focused physical findings					
Review client's social background					
Understand client's social background					
Review client's past medical status/socio-economic status					
Understand client's past medical status/socio-economic status					
Review client's family history					
Understand client's family history					
Interpret present medical status					
Review client's medications					
Understand client's Medications-reason for use					
Understand client's drug/nutrient interactions					

Review client's laboratory values					
Understand client's laboratory values					
Understand client's skewed values					
Complete a dietary recall					
Assess the adequacy of the diet recall					

2. For each of the following tasks, indicate which best describes how confident you are of successfully completing the activity.

	0% – no chance at all	25%– a slight chance	50% – a 50-50 chance	75% – a good chance	100% – completely certain
Diagnosis intake deficiencies/excesses of energy, protein, nutrients					
Determine the correct nutrition diagnosis or diagnoses					
Write a nutrition prescription					
Design the appropriate intervention					
Write a PES statement or a medical record note					
Provide nutrition education					
Provide nutrition counseling					
Provide coordination of care					

3. For each of the following tasks, indicate which best describes how confident you are of successfully completing the activity with a patient.

	0% – no chance at all	25% – a slight chance	50% – a 50-50 chance	75% – a good chance	100% – completely certain
Introducing myself and starting a conversation with a patient					
Maintain eye contact appropriately					
Conduct my interview in an organized sequence					
Maintain an appropriate conversational style and conduct the interview without notes					
Appear professional to the patient					
Answer questions that the patient may have					

Appendix B. CPD Simulation Evaluation Instrument

CPD Simulation Evaluation Instrument

Scenario:	0 = Does not demonstrate competency 1 = Demonstrates competency (Circle Appropriate Score for all Applicable Criteria)		Date: M M D D Y Y Y Y
Obtains Food/Nutrition Related Hx	0	1	**GROUP COMMENTS***
Obtains Biochemical Data, medical Tests & Procedures	0	1	
Obtains Anthropometric Measurements	0	1	
Obtains Nutrition-Focused Physical Findings	0	1	
Obtains Client Hx	0	1	
DIAGNOSIS **(KR 1.1, CP 2.2, 3.1b)			
Domain: Intake/Clinical/Behavior-Environmental	0	1	
PES Statement Written	0	1	
INTERVENTION **(CP 1.2, 1.3, 1.4, 2.4 2.5, 2.8, 2.11, 3.1c; KR 2.1,2.2, 2.3)			
Food and/or Nutrient Delivery	0	1	
Nutrition Education/Counseling	0	1	
Coordination of Care	0	1	
NUTRITION MONITORING & EVALUATION *(CP 2.5, 2.11, 3.1d)			
Food/Nutrition-Related Hx	0	1	
Biochemical Data, Medical Tests & Procedures	0	1	
Anthropometric Measurements	0	1	
Nutrition-Focused Physical Findings	0	1	
PROFESSIONAL DEMEANOR	0	1	
Student/Staff Participants Faculty Evaluator:	**Total Score** → **Passing Score** →	If not applicable no score is given. Passing score + 0.75 X number of items used.	*Individual comments on clinical evaluation form **ACEND Competencies addressed ***If NA score as 1 point