SIMULATION IN DIETETICS EDUCATION: A SCOPING REVIEW OF THE LITERATURE

By

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2017

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
July, 2019

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SCOPING REVIEW OF THE LITERATURE

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ACKNOWLEDGEMENTS

I would like to start by thanking my thesis advisor, Dr. Gail Gates. Thank you for trusting me to carry out this project with you. My life went through many changes in the past year and a half this thesis was written and despite it all, I was still able to finish on time because of your support. I hope that one day, I can be half the mentor to someone else that you were to me.

I would also like to thank Dr. Lauren Amaya and Dr. Lynne Simpson, my thesis committee members. Their insight throughout this entire project was priceless and I couldn't have asked for better committee members.

My entire graduate school cohort was supportive of each other, but four special ladies in particular deserve acknowledgement: Caroline, Esosa, Florence and Jessica. From listening to my thesis proposal before I gave it to supporting me on the day of my thesis defense, their encouragement to keep going and their interest in my project gave me extra motivation to finish.

In my personal life, I must thank my husband, Matt first and foremost. There aren't enough words to express how grateful I am for his love, patience and support. Graduate school would've been so much more stressful without him to help me through.

I would also like to thank my parents for their love and support as well. I can only hope that as their "one and only", I made them proud and that this thesis can be a testament to their work in raising me.

And finally, to Ophelia, our cat: thank you for constantly reminding me not to take myself too seriously and that there is always time to play.

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Date of Degree: JULY, 2019

Title of Study: SIMULATION IN DIETETICS EDUCATION: A SCOPING REVIEW OF THE LITERATURE

Major Field: NUTRITIONAL SCIENCES

Abstract: There are not enough dietetic internship spots to meet the growing rate of DPD graduates. Dietetics educators are looking into different alternatives to provide clinical experience and one solution is the use of simulation experiences. Simulation use has been common in fields such as medicine and nursing, but the extent of its use in dietetics is currently unknown. The purpose of this scoping review was to assess any literature available on the topic of use of simulation in dietetics education over the last ten years. A systematic literature search was conducted across ten different academic databases. Twelve articles were included in the final analysis. The results show that standardized patients are the most utilized simulation type in dietetics education, with communication and interviewing skills being the most investigated outcome. It was also found that outcomes in included studies improved with simulation use. Future research could focus on developing specific validated tools to assess interested outcomes in dietetics students and also in how simulation use could improve development of nutrition focused physical exam (NFPE) skills in dietetics students.

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CHAPTER I

INTRODUCTION

Preceptorship in allied health is a fundamental part of a novice transitioning from the role of a student in the classroom to a practicing professional. Within dietetics education, preceptorship during dietetic internships has remained a consistent part of the overall experience, despite other changes that have been made.[1] Definitions of what a preceptor does differ between medical disciplines, but for dietetics, it is defined as a professional who guides an intern's learning experiences while providing direction and evaluation.[2] However, there is currently an inadequate number of clinical preceptors and sites available for an increasing amount of dietetics undergraduate students and dietetic interns. The Accreditation Council for Education in Nutrition and Dietetics (ACEND) has stated that since 2003, the number of dietetic internship spots has not increased at a sufficient rate to meet the rate of new graduates.[3]

In terms of supply and demand in the field, The US Bureau of Labor Statistics estimates that the demand for Registered Dietitians (RDs) will grow by 15% in the period of 2016 to 2026, which is high compared to the normal growth standard of 7%.[2] But despite the potential for more RD opportunities, The Dietetic Workforce Demand Study from 2012 projects that by 2020, only 75% of the demand for RDs will be met. Even more sobering, that percentage is dependent on the supply of credentialed dietetics

professionals entering the field increasing to meet the demand and fill the gap that exists.[3] It is with the realization of these problems that alternatives for helping these students complete supervised experiences rotation hours are currently being explored. As educators begin to look for information on potential alternatives, there are many different answers to the question of how best to tackle this problem. One solution may be the use of simulations to partially replace some of the required supervised practice experiences. "Simulation" is defined as "…the artificial representation of a complex real-world process with sufficient fidelity with the aim to facilitate learning through immersion, reflection, feedback and practice minus the risks inherent in a similar real-life experience".[4] Simulation is more than a technology, but rather a methodology that provides guided, participative experiences to students outside real-world settings.[5] Types of simulation and brief descriptions are outlined in Table 1.

Many different medical disciplines have been incorporating methods such as simulation in order to address the gap between traditional didactic teaching and real-life situations in supervised practice.[4] Simulation is not meant to completely replace supervised practice, but to enhance it. The primary focus with simulation experiences is to improve trainee competencies and assess their knowledge while allowing for creation of scenarios that may be too dangerous or expensive to perform on a live patient. It is a cost-effective way to train future professionals in that it can help to reduce accidents and injuries to both trainees and patients and may also be used to identify and eliminate issues before an actual emergency occurs.[6] Within dietetics education, Table 2 provides examples of current simulation use.

This research project was an evidence scoping review, also called a scoping review, of different academic databases and gray literature about the topic of the effectiveness of simulation within dietetics education. The purpose of this project was to assess, examine and describe the characteristics of current literature on the topic of simulation in dietetics education. This study is needed because associations such as ACEND, the Academy of Nutrition and Dietetics (AND) and certain Dietetics Practice Groups (DPG) within the Academy are beginning to research simulation in depth and how it may benefit undergraduate Didactic Programs in Dietetics (DPD) and supervised practice programs. Currently, simulations have been included in ACEND DPD and Dietetic Internship (DI) Accreditation Standards[7,8] as part of "experiential learning". "Experiential learning" is a term used in medical education that refers to including experiences within a curriculum that are designed to bring the learner into contact with others through a particular role and context. Though simulation is included in these standards, the practice simulation implementation is complex with many different factors to consider when creating an experience.

This study aimed to answer the questions "what does literature have to say about simulation in dietetics education, specifically what types of simulations are being utilized if any" and "how are they affecting outcomes of interest in included studies in the last ten years". For this project, an evidence scoping review, also called a scoping review, was deemed more appropriate than a systematic review.

While there is no set definition as to what an evidence scoping review is, the general consensus is that a scoping review is meant to rapidly identify key concepts in an area of research and provide an overview of a broad topic, not specific answers to questions.[9-11]

One can consider them related to systematic reviews in that both types of reviews need to have detailed methods so that they can be replicated by others, but the difference lies in how the research question is structured. The research questions for this project are broad in nature in that they are aimed at looking at literature for simulation in dietetics education in general versus comparing narrowed characteristics of studies typical of a systematic review.

Table 1. Different Types of Simulation

Type of Simulation	Description
Standardized Patient	Persons trained to act as "patients" to act out specific clinical scenarios.
Mannequin	A model is provided for students to practice with. The model can either be whole or a part of the body.
Computer-based	A computer delivers a simulation experience. Students make decisions based on information provided.
Role-play	An example of a scenario is played out for students. Students have very little interaction.
Peer-to-peer	In pairs, students practice skills and scenarios with each other.
Case study	Similar to computer-based, but can be delivered on paper.

(Adapted from Thompson and Gutschall)[1]

Table 2. Examples of Simulations that Exists within Dietetics Education

University/Organization	Program	Use	Notes
Brigham Young University[12]	Nutrition Assessment Lab	DXA scans, indirect calorimetry, anthropometric and biochemical analyses.	---
University of Idaho[13]	SimMan	Nutrition assessment and medical nutrition therapy.	---
Academy of Nutrition and Dietetics (AND)[14]	P.E.D.R.O. (Practice Experience, Diabetes, pediatRic Online)	Pediatric NCP, to learn billing and coding.	Pilot. Can only be used in dietetic internship clinical rotations.
University of Texas Health Sciences Center at Houston[15]	Mr. Sim	Nutrition assessment and medical nutrition therapy.	Located in School of Public Health.

CHAPTER II

REVIEW OF LITERATURE

Simulation has a long and complex history. Fields outside of medicine have long used simulation techniques and made it a core element of their practice. Military forces used chess as a form of simulation in order to learn about the possibilities that could occur in actual warfare.[16] In commercial aviation, pilots are trained extensively with simulation techniques before transitioning to an actual aircraft in order to prevent "loss of control" accidents during flight.[17] Incidents such as Three Mile Island, Fukushima and Chernobyl have influenced the field of nuclear energy to utilize simulation in order to prevent problems before they happen.[18] What these fields have in common is that training systems utilized would either be too costly or too dangerous to attempt in the real world;[19] therefore, simulation is the ideal solution to close that knowledge gap. Medicine presents the same risks as the fields previously mentioned; therefore, one could conclude that if simulation could enhance these fields, it could also enhance medical education and in extension, dietetics education.

Though the art and science of simulation use within medical programs has increased over the last twenty years due to the development of technology[20] and it may seem like a newer concept, the actual history of medical simulation extends over a period of 1500 years. Traditional apprentice-based training medical education was quickly being

overwhelmed by a demand for a different way to teach student practical skills and situations in which to use them. As early as the eighteenth century, certain training programs were utilizing aspects of simulation known as mannequins (also called manikins and phantoms) and it was recognized that these methods were useful in teaching future practitioners. Simulation within nursing education was also recognized quite early and by 1911, life-sized dolls were being used to teach essential skills.[21]

Recent events have led to the increased investigation of simulation within dietetics education, some of which include increased focus on patient safety, a growing need to practice and hone skills in a safe, controlled environment, and a call to move away from an apprenticeship model of medical training.[22] There are advantages to incorporating simulation into an established dietetics program, and depending on the type implemented, it could achieve different outcomes.

Owen[21] says that while it shouldn't be a surprise that simulation has such an exhaustive history, it should be surprising that more professionals in healthcare aren't using it despite proof that says it works. Simulation use is patchy and uncoordinated at best within the medical disciplines using it the most, so one can infer from that conclusion that professionals within dietetics education have a wide gap to close with simulation use.

Types of Simulation

Simulation encompasses a wide range of techniques and methodologies. Choosing which one in particular to use depends on the goals of the program and the objectives that need to be taught to the students experiencing the simulation.[23] Within medical education,

there are six commonly used types of simulation: standardized patient, mannequin, computer-based simulation, role-play, peer-to-peer, and case study.

Standardized Patient

A standardized patient (SP), also called a "simulated patient", is defined as a person who has been trained to portray a specific character or medical problem as described by a provided script. It is one of the most widely used types of simulation in medical education.[24] The terminology of whether this simulation is called "standardized" or "simulated" varies between countries. While the United States and Canada use "standardized", the United Kingdom and Australia use "simulated". For the purposes of this project, "standardized patient" will be used, but this can also apply to "simulated patient".[25]

SPs have three distinct types: community volunteers or paid actors; faculty, academic staff, administrative staff and teaching staff; and student peers.[26] The script given to an SP usually has some room for improvising. One unique advantage with using an SP is that he or she can either be "announced" or known to the students or "unannounced", meaning the student does not know they are talking to an SP or an actual patient. The overall goal of using an SP in either case is to provide students a consistent simulation experience and to assess how consistent students' interpersonal and communication skills remain between encounters with both "announced" and "unannounced" SPs.[27]

In medical disciplines where clinical placement is challenging, using an SP provides an adjunct to traditional clinical placement. In a study where a standardized patient simulation experience was provided in a family nurse practitioner (NP) master's of

science program, standardized patients were considered the most realistic encounters, allowing the opportunity for students to practice communication and clinical skills and allow for small variations in each student's plan of care for the SP. The students used the SPs to practice clinical guidelines in diagnosing diseases such as peptic ulcers, a gastrointestinal bleed and osteoarthritis. SPs also portray different psychological and emotional aspects in ways that other types of simulation could not provide.[28]

Mannequin/High-fidelity Simulation

A mannequin (or "manikin") is defined by the Oxford English Dictionary[29] as "a model of (part of) a human figure". A mannequin simulation can either include a complete replica of a human body or parts of it. Models of human organs were used as early as 1600 BCE to diagnose possible ailments of the liver, but it wasn't until the Middle Ages that mannequin creation and use became more common in response to limited times of the years that human dissection could occur.[21] Over the years, mannequins have been made from many types of materials, such as wood, wax, leather, clay and stone,[21,30] but modern technology has enabled mannequins to become highly sophisticated. The greatest advantage with using this simulation technique is that it is customizable. Advanced mannequins can be programmed by software to have specific physiological responses that are similar to that of a human.

While there are many types of mannequins, Resusci-Anne and SimMan are two of the most well-known and most utilized. Resusci-Anne was developed in the 1960s to teach mouth-to-mouth resuscitation.[31] While not complex in design and limited in what it can do, Resusci-Anne mannequins are still utilized today in CPR classes. The creation of

SimMan during the 1990s marked a new era of computer controlled, highly realistic mannequin simulation (also known as high fidelity simulations). SimMan's advanced settings and features make it possible for the entire chain of rescue to be conducted and teach specific concepts such as patient handover and emergency reporting.[32] Because of the nature of having to manage "unusual but lethal events" in real life, anesthesiology was one of the first medical specialties to utilize mannequins as a core part of training airway management techniques. Research has shown that simulation training with mannequins improved management of core topics in airway management for novice medical residents while in the operating room.[33]

Computer-based Simulation

Computer-based simulation is also a modern technological approach to simulation, utilizing elements such as computers, tablets, and the Internet to teach concepts and skills. The ability for computer simulation to be completed both on and off university campuses, repetition of training modules, allowance for error without repercussions, reduced training time and costs, and reduced risk of harm to real patients are some of the reasons why medical training programs are using this type of simulation more frequently.[34-37] But one advantage that is quite important in assessing student progress is that it provides the ability for educators to follow decisions that students make in a logical sequence.[38]

With medical technology rapidly developing, computer-based simulation is often used to introduce and train clinical staff on how to use and respond to problems with new or unfamiliar technology, such as with ventilators.[39] Another instance where computer-

based simulation was chosen was in teaching cardiac arrest procedures to students during a resuscitation course. Students were to complete a computer learning session to practice response during a cardiac arrest. At the end of their simulation experience, they were given feedback as to how they did.[34] While this type of simulation will take time, effort and practice to perfect for both educators and students, its use within medical education programs is growing.

Role-play

Role-play is a technique that is primarily centered around communication. In its most basic form, role-play is when students take on roles of other people and act out a given scenario. However, this is the only type of simulation where social context is the core element to the overall experience. It differs from SP in that role-play's goal is to provide a framework for students to safely explore feelings, prejudices or biases they may have.[40] It is also different from SP in that those that participate in role-play will usually take on both the role of the medical professional and the role of the patient at some point in order to experience both sides of the scenario.[41] Role-play has been used in medical education programs to help prepare students to communicate with patients or clients from different social backgrounds and emotional states.[42]

In medical education, role-play is well-suited to playing out scenarios that occur in psychiatric medicine. At the University of Melbourne, fifth and sixth year residents were exposed to different modules where role-play was provided by student volunteers playing different roles. Students found that role-play sessions were for the most part helpful in both learning how to respond to the patient and developing empathy while becoming less

judgmental.[43] In some nursing programs, role-play is primarily used to demonstrate mental health behaviors, while SPs are used as a follow up to gauge student reaction.[44]

Peer teaching/"Peer-to-Peer"

Peer teaching or "peer-to-peer" is an arrangement in which a student teaches one or more fellow students. This type of simulation falls under a larger umbrella called PAL (peer assisted learning), which is defined as acquiring knowledge and skill through active helping and support among matched companions.[45] Peer-to-peer is different from all previously discussed simulations in that the student teaching is on or very close to the same educational level as the peers they are teaching. In this type of simulation, the goal is for the student teaching to become less of a student and more of a teacher.[46]

In medical education, peer-to-peer is often used to teach students generic skills, also called "transferable skills" because they can be used across a spectrum of different scenarios. At Alexandria University, the Faculty of Dentistry conducted a study where they assigned 77 undergraduate and postgraduate dental students to act as "peer teachers" to 123 undergraduate students or "trainees". The peer teachers taught a variety of generic skills to trainees in order to prepare them for the role as "delegates" on a mock panel for health care systems. Some generic skills taught by the peer teachers to prepare trainees included communication and presentation skills, problem-solving and decision-making, stress management and technical skills.[47]

Case Study

A case study is a descriptive document based on real-life situations, problems or incidents.[48] It is an extension of problem-based learning, which is defined as learning as a

result of the process of working toward understanding or resolution of a problem.[49] Case studies can be presented in five different ways: on paper, with real patients, with simulated or standardized patients, on a video or DVD or electronically with various levels of interaction. They are different from the other types of simulation discussed thus far because case studies are usually meant to focus on the development of clinical reasoning skills through problem solving and critical thinking. This priority makes it narrower in its goal than SP and computer-based simulation, which bring in outside factors such as environment and risk to the patient. It is also different from role play in that social context does not need to be present in order to benefit from the overall experience.

It is impossible to prepare students for every type of situation they may encounter as practicing professionals. Case studies provide students with a knowledge base to use in order to make the best decision in the context of the situation. As an example, nursing education relies on case studies to introduce students to complex and multi-complex clinical scenarios, such as gout, hyperglycemia and acute pancreatitis. The goal is to develop nursing students into autonomous learners over time in order for them to be well-prepared to practice at the culmination of their education.[50]

Components of Simulation

Designing an effective simulation experience is not a simple task. While there is a large body of research that contributes to knowledge of simulation, there is not as much information on a direct cause-and-effect relationship that may be present.[51] For example, it has been suggested in simulation education research that as simulation is incorporated

more into medical education, there needs to be more research about how patient outcomes are affected along with student outcomes.[52] Without this information, it can be difficult for dietetics educators to decide which simulation technique would have the best outcome with not only the students, but the patients the students will later encounter.

There is a wide variety of ways in which simulation can be carried out and evaluated across different medical disciplines. This variety makes it harder to have a seamline, systematic way to designing a strong simulation program. While there are simulation programs that exist for dietetics students and interns, the question remains as to how the effectiveness of the program can be accurately measured when there is a variety of evaluation methods.

In order to address these points, there are a few principles that simulation education research has identified that create the foundation of a good simulation program. One of these principles is to determine the desired outcomes of using the simulation. Simulation is at its best when it is complimenting an already existing curriculum. Motola et al.[22] described an integration framework for simulation, in which one of the points is planning. Planning includes focusing on aspects such as a curriculum with outcomes and determining which outcomes are best addressed via simulation.

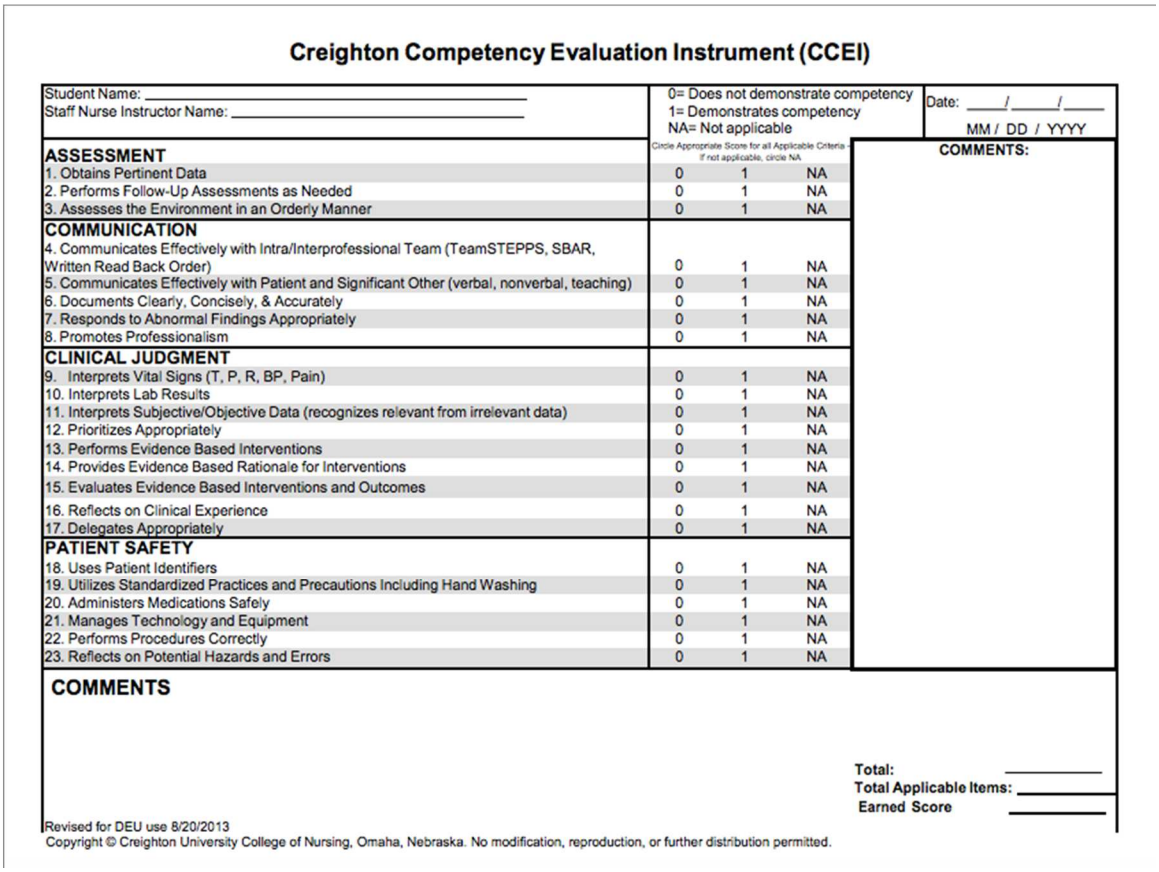
Another principle to consider when creating a simulation experience is understanding the simulation methodology. This includes understanding what simulation techniques are available and which one works the best with the outcomes established in the planning phase. Understanding what resources are available for simulation experiences is also important in this part of creating a simulation. Some examples of resources to consider

are funds available to spend and space available to utilize.[30] With as many techniques that are available, there is no right or wrong use or combination as long as outcomes for the curriculum are met via the simulation experience.

The last principle is incorporating evaluation of the simulation into a program. Nursing education has many different tools used to evaluate simulation use in their programs; however, the evaluation focuses more on evaluating student response and skills rather than evaluation of the simulation itself. For example, the Creighton Competency Evaluation Instrument (CCEI) is a known valid and reliable tool for measuring the effectiveness of clinical learning in a simulation environment with a mannequin. Figure 2 presents the rubric for evaluation. Nursing and dietetics are similar in that both fields are competency-based, so it can be inferred that simulation techniques and rubrics such as the CCEI can potentially be developed for dietetics programs to use in their simulation programs.[53]

Summary

The research presented in this literature review shows that simulation has a rich history and methodology that some medical disciplines are utilizing it more than others. There are many types of simulation that educators can use with varying degrees of complexity. While building a simulation program is not a set process across medical disciplines, there are still common principles that educators could use to design effective simulation experiences to complement their curriculums. With this in mind, there is a potential for gaps in the field of knowledge between simulation methodology and outcomes in dietetics because simulations may not be commonly used.



Creighton Competency Evaluation Instrument (CCEI)

Student Name: _____
Staff Nurse Instructor Name: _____

0= Does not demonstrate competency
1= Demonstrates competency
NA= Not applicable

Date: ____/____/____
MM / DD / YYYY

Circle Appropriate Score for all Applicable Criteria - If not applicable, circle NA

ASSESSMENT				**COMMENTS:**
1. Obtains Pertinent Data	0	1	NA	
2. Performs Follow-Up Assessments as Needed	0	1	NA	
3. Assesses the Environment in an Orderly Manner	0	1	NA	
COMMUNICATION				
4. Communicates Effectively with Intra/Interprofessional Team (TeamSTEPPS, SBAR, Written Read Back Order)	0	1	NA	
5. Communicates Effectively with Patient and Significant Other (verbal, nonverbal, teaching)	0	1	NA	
6. Documents Clearly, Concisely, & Accurately	0	1	NA	
7. Responds to Abnormal Findings Appropriately	0	1	NA	
8. Promotes Professionalism	0	1	NA	
CLINICAL JUDGMENT				
9. Interprets Vital Signs (T, P, R, BP, Pain)	0	1	NA	
10. Interprets Lab Results	0	1	NA	
11. Interprets Subjective/Objective Data (recognizes relevant from irrelevant data)	0	1	NA	
12. Prioritizes Appropriately	0	1	NA	
13. Performs Evidence Based Interventions	0	1	NA	
14. Provides Evidence Based Rationale for Interventions	0	1	NA	
15. Evaluates Evidence Based Interventions and Outcomes	0	1	NA	
16. Reflects on Clinical Experience	0	1	NA	
17. Delegates Appropriately	0	1	NA	
PATIENT SAFETY				
18. Uses Patient Identifiers	0	1	NA	
19. Utilizes Standardized Practices and Precautions Including Hand Washing	0	1	NA	
20. Administers Medications Safely	0	1	NA	
21. Manages Technology and Equipment	0	1	NA	
22. Performs Procedures Correctly	0	1	NA	
23. Reflects on Potential Hazards and Errors	0	1	NA	

COMMENTS

Total: _____
Total Applicable Items: _____
Earned Score _____

Revised for DEU use 8/20/2013

Figure 1. Creighton Competency Evaluation Instrument (CCEI).

CHAPTER III

METHODOLOGY

Study Design

This scoping review was based on methods described by Tricco et al.[54] and reported using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol. To ensure that this study was not a duplicated effort, a search was done in PROSPERO International Prospective Register of Systematic Reviews database for any systematic or scoping reviews either completed or currently ongoing. No studies were ongoing at the time of this project being conducted.

Search Strategy

A comprehensive search strategy was developed with an experienced librarian. Articles were extracted from Academic Search Elite, CINAHL, Compendex, ERIC, MedLine, PubMed, PsycINFO, ScienceDirect and Scopus. Non-published dissertations and theses and newsletters were also searched for via the ProQuest Digital Dissertations database and EatRight.Org website, the website of the Academy of Nutrition and Dietetics. Key words used by the authors were tested with certain databases to ensure that relevant articles could be obtained. Table 2 shows the key words used for all database searches. A

Population, Intervention, Comparison and Outcome (PICO) search strategy was implemented to organize all keywords into concepts that were used in the databases and were manipulated or changed as needed in order to generate relevant results. Figure 2 shows an example search strategy employed in all EBSCO databases

Study Selection

The range of publication for included studies was from January 1st, 2007 to December 31st, 2017. Inclusion criteria included some type of simulation use. Simulations could either be digital or traditional in design. Articles had to be written in English and be accessible as full text.

Participants

Eligible research articles included studies with participants who were undergraduate nutrition or dietetics students, graduate nutrition or dietetics students or dietetic interns within the United States, Canada, Great Britain and Australia. Also included were articles that included students from Coordinated Programs in Dietetics (CPD) and Individualized Supervised Practice Pathways (ISPP) programs if they were available. Articles were excluded if they included populations that did not consist only of dietetics students.

Interventions

Eligible articles were required to include a simulation as the intervention. Simulations eligible for inclusion in final results included standardized patients, mannequins or high-fidelity simulations, computer-based, role play, peer-to-peer and case studies.

Outcomes

Eligible articles made use of some kind of evaluation that came during or after participants engaged in simulation. The feedback could come from the participants themselves or from instructors or preceptors.

Data Management

Endnote version X8 was used for references and EndNote Web was used to keep track of what articles were used for the scoping review.

Selection Process

One independent reviewer conducted electronic database searches and initial screening of titles and abstracts against the selection criteria. Ten percent of the total titles and abstracts screened were checked by a second independent reviewer. Full text articles were obtained for titles and abstracts that met the inclusion criteria. Any discrepancies were resolved via discussion. The reviewers were not blind to study authors, journal titles or institutions where studies were conducted.

IRB Approval

Because of the nature of the study was a comprehensive search across academic databases, this study was excluded from necessitating IRB approval.

Search ID	Search terms
1	Undergraduate student
2	University student
3	College student
4	Graduate student
5	Dietetic intern
6	Simulation
7	Gaming
8	Educational technology
9	Augmented reality
10	Standardized patients
11	Computer-assisted instruction (CAI)
12	Role play
13	Interactive software, games, drills
14	Computer-based simulation
15	Experimental learning
16	Educational simulation
17	Internet-based simulation
18	Simulator
19	Mannequin
20	Case study
21	Simulation methodology
22	Simulation-based tools
23	Simulation experience
24	Experiential learning
25	Peer teaching
26	Peer coaching
27	Manikin
28	Nutrition-focused physical exam

Figure 2. Key Words used by Authors in all Database Searches

ERIC, May 21st, 2018 (113 articles)

1. Undergraduate student or college student or university student or graduate student or dietetic intern
2. Nutrition or dietetics
3. Simulation or gaming or educational technology or augmented reality or standardized patients or computer-assisted instruction or role play or interactive software, games, drills or computer-based simulation or experimental learning or educational simulation or internet-based simulation or simulator or mannequins or manikins or simulation methodology or simulation-based or simulation experience or peer coaching or peer teaching or high-fidelity simulation or experiential learning or case study or nutrition-focused physical exam
4. 1 AND 2 AND 3
5. Limit 4 to English results

Figure 3. Example Search Strategy for ERIC and Number of Articles Retrieved.

CHAPTER IV

RESULTS

Introduction

A total of 1,371 unique articles were found in the initial comprehensive search. Of those 1,371 articles, 80 articles were selected for final full text analysis. Of those 80, 12 met all of the eligibility criteria to be included in the final review (see Figure 1). The most prevalent reasons for article exclusion were that the article did not include the study population and articles did not include a simulation component.

Study Characteristics

Of the 12 articles included for final analysis, seven of them utilized standardized patients, [55-61] one utilized high-fidelity simulation/mannequins,[62] one utilized computer-based simulation,[63] and one utilized peer-to-peer simulation.[64] Two studies used a mix of simulations methods. One of the studies used role-play and standardized patients together[65], while the other study used mannequins and standardized patients in the same study[66].

Ten of the studies took place in the United States[55,58-63,65,66], two took place in Australia [56,57]and one was from the United Kingdom[64]. None were from Canada. Three studies used only undergraduate dietetics students as the target study population,[56,57,65] four used

only graduate students[58,61,62,66], four used mixed academic populations[55,60,63,64] and one study used only dietetic interns.[59] Sample sizes for included studies varied from eleven subjects to 452 total subjects. Two studies used multiple cohorts from different academic years.[56,60]

The most used study design was a one-group pre- and post-test design,[55,61,63,66] followed by a two-group design.[60,64,65] Two studies were observational[56,57], two used repeated measures[62,64], one included a control group[63], one only had a post-test[58], one used an ex post facto design[60] and one utilized focus groups.[59] Nine of the included studies specified a time frame for simulation intervention, ranging from 20 to 155 total minutes.[55-59,61,62,65,66]

Various tools were used by included studies to measure outcomes that included both qualitative methods (surveys, questionnaires, focus groups)[55,57-59,61,64-66] and quantitative methods (statistical analysis, objective checklists),[55-58,60-63,66] but it is important to note that most of the quantitative data collected was on non-standardized scales created by those leading the studies. However, authors noted when they were using a standardized scale to measure an outcome of interest.

Results of Included Studies

Table 4 provides a summary of all included studies, with relevant data that addresses outcomes of interests to the authors presented in the methods. Of the studies included, seven measured counseling or communication skill outcomes,[56,58-60,63,65,66] four measured clinical skills outcomes,[55,57,61,66] one measured outcomes related to self-efficacy[62] and one measured satisfaction overall related to the simulation.[64]

Communication and Counseling Skills

Of the seven studies that investigated outcomes related to counseling and communication skills,[56,58-60,63,65,66] four of the studies had significant improvements in knowledge, competence, awareness,[59] attitudes about being a nutrition counselor and interviewing techniques.[58] Two studies that compared different simulation techniques in regards to counseling and communication skills saw no significant difference in outcomes.[60,65] One study showed no statistically significant improvement in self-rated confidence in interprofessional communication.[66]

Clinical Skills

Of the four studies that investigated outcomes related to clinical skills,[55,57,61,66] significant improvements in overall readiness for clinical work, assessing nutritional statuses in various populations, charting skills,[55] and performing nutrition focused muscle and subcutaneous fat exams were seen.[61] Categories that did not see a significant difference include monitoring and evaluating impact of nutrition intervention and personal self-assessment.[55] Assessing fluid status and communication between groups were two categories that were noted by observers in one study to be significantly lower in the observed group.[61] One study in this group concluded that objective structured clinical examinations (OSCEs) were a significant predictor of clinical placement scores that students would receive during clinical rotations and were also shown to predict which student would struggle during their clinical placements.[57] In another study, for the clinical skills portion of the simulation experience, formative evaluation of ADIME notes showed that 53% of assigned tasks were completed by students during the study. For summative

evaluation post simulation, the students were allowed to correct for missed tasks, raising scores up to 77% of tasks fulfilled.[66]

Self-Efficacy

For the one study that investigated outcomes related to self-efficacy, there was a small, but significant improvement in confidence levels from before to after the simulation experience in the group observed.[62]

Overall Satisfaction

For the one study that investigated outcomes related to overall satisfaction, students in the PAL placement model reported having a good learning experience during their rotations in the last week significantly more than those placed in the traditional 1:1 (one student to one practice educator) model. There were no differences seen in overall learning experience in the groups.[64]

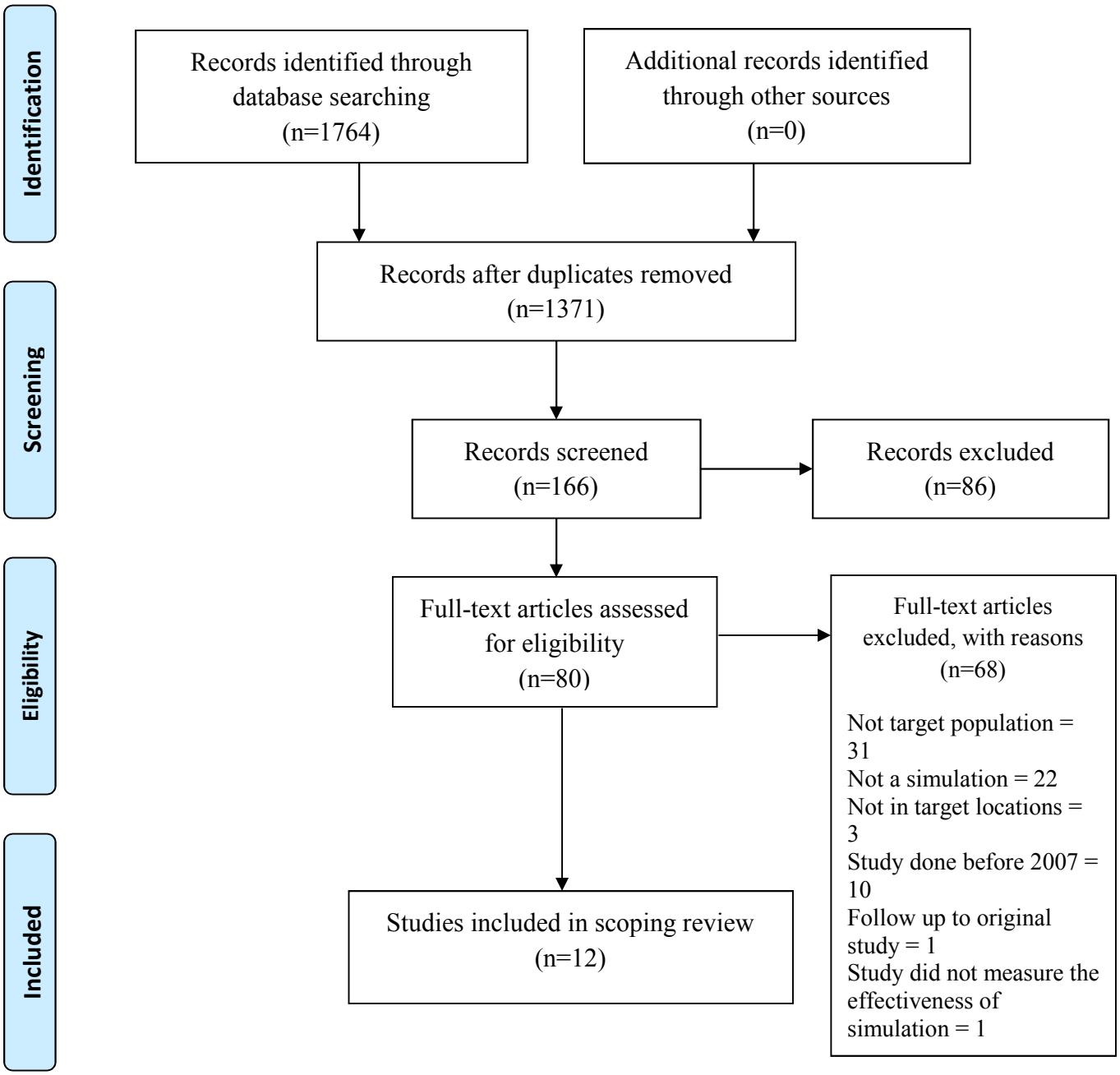


Figure 4. PRISMA Flow Diagram: Simulation in Dietetics Education

Table 3. Outcomes of Included Studies (n=12).

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of Simulation, Time Frame of Simulation	Outcome(s) of Interest, Measurement Tool(s) Used	Results
Standardized patient	Farahat et al.[55] 2015 United States	BS, BS/MS and MS students from one university 37 total students (35 female, 2 male); 15 dietetics students, 22 public health students.	One group pretest, posttest design. OSCE completed three times during class. Students rotated through seven stations that reinforced the topic being discussed in class for that week. Station 1: 15-minute chart review Station 2: 20-minute SP encounter Station 3: 25-minute charting Station 4: 10-minute healthcare professional interaction Station 5: 25-minute article reading and answering related questions Station 6: 20-minute video of RD interacting with patient Station 7: 40-minute debriefing	To improve student confidence and readiness for clinical work. Pretest/posttest done during OSCEs, follow up student interviews after OSCEs, Perceived Readiness for Dietetics Practice (PRDP) questionnaires to assess student readiness. Feedback for students via evaluation forms done by RDs, healthcare professionals and SPs.	Statistically significant improvement from pre-to posttest was seen in overall readiness after three OSCE encounters. Other categories that saw a significant improvement include assessing nutritional status in various settings, creating PES statements, nutrition intervention, charting skills and confidence with taking on a professional role. Categories that did not see a significant difference include monitoring and evaluating impact of nutrition intervention on a nutrition diagnosis and personal self-assessment.

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of simulation, time frame of intervention	Outcomes of Interest, Measurement tool(s) used	Results
Standardized patient	Gibson et al.[56] 2016 Australia	Third year dietetics students from one university 215 students total (three separate cohorts from 2010 to 2013)	One group observational study design, comparison of performance on two SPs. Dietetics students participated in the first SP interview and after a 2-week period, participated in the second interview. After the first interview, students were asked to watch a tape of their interview session with the SP if it was available, read all SP and assessor feedback and complete a self-reflection paper before their second interview. 20 minutes per interview.	To explore how a student-standardized patient encounter influenced communication skills. Assessment tool created by academic staff to assess the dietetics interview skills of students. Face validity used by trained assessors in both formative and summative interviews.	The entire study cohort experienced a modestly significant improvement in communication skills from the first SP interview to the second. However, the most significant improvement came from students who had "borderline" or "fail" scores after their first SP interview, with those classified as "fail" experiencing the greatest improvement.

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of Simulation, Time Frame of Simulation	Outcome(s) of Interest, Measurement Tool(s) Used	Results
Standardized patient	Hawker et al.[57] 2010 Australia	3rd year BS students enrolled at one university during a six-year period. Not stated	One group, observational study design Students rotated through three stations, two of which had a SP. One station was for taking a diet history, the other was for measuring height, weight, waist and hip circumferences. Examiners for each station evaluated specific criteria related to that station for each student. 20 minutes per station, totaling 60 minutes.	To ensure that the teaching of basic clinical skills in the classroom are effective prior to hospital placement for students. Standard marking sheets used by examiners to assess student skills during OSCE. Anonymous questionnaire used by students to provide feedback about the OSCE and discuss whether they think OSCEs are a fair way to measure clinical skills. No information was provided on the measurement of placement scores.	Performance on OSCEs was a significant predictor of clinical placement scores that students received during their clinical rotations. Students also consider OSCEs to be a fair and objective way of measuring their clinical skills. OSCEs have also been shown to predict which students are more likely to struggle during their clinical placement.

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of simulation, time frame of intervention	Outcomes of Interest, Measurement tool(s) used	Results
Standardized patient	Henry[58] 2007 United States	Graduate-level dietetic interns enrolled in one internship 12 total students	One group, two encounters posttest study design Dietetics students were paired with a student from the Marriage and Family Therapy (5 total) program who was trained as an SP. All SPs reenacted a case scenario for a hypothetical patient. One-hour counseling session	To develop students' knowledge of counseling methods, interviewing skills and attitudes about being a nutrition counselor. Evaluation checklists were completed by SPs post simulation. A follow up questionnaire was also used to get feedback about the simulation from both student-counselors and SPs. The students also wrote reflective papers describing their experience with the SPs.	Evaluations and follow ups indicated that student-counselors progressed in all outcomes of interest. All 17 participants (dietetics students and SPs) reported positive experiences with the standardized patient encounters.

Simulation type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of Simulation, Time Frame of Simulation	Outcome(s) of Interest, Measurement Tool(s) Used	Results
Standardized patient	Henry et al.[59] 2009 United States	Dietetic interns enrolled in one internship 11 total students	Qualitative focus groups after completion of SP encounters. Two SP scenarios were created for this simulation: a client with type 1 diabetes reeducation session and a new client diagnosis of hypertension with hyperlipidemia. One intern was paired with one SP to complete a counseling session for each designed scenario. Range of 20-55 minutes for each SP encounter	To explore how using an SP during a medical nutrition therapy (MNT) course increased counseling competence and awareness among dietetic interns. Feedback on counseling using simulation form completed by SP post each simulation with an intern Focus group discussions completed by interns after SP encounters, MNT rotations and three weeks into fall semester.	Interns expressed that feedback from the SPs increased awareness of what was important from the patient perspective. They also expressed that the SP encounters also helped their confidence as counselors and competence in practicing nutrition counseling increase. However, they felt the SP scenarios were different than the types of actual patient encounters they experienced during their rotations.

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study design, description of simulation, time frame of simulation	Outcome(s) of interest, measurement tool(s) used	Results
Standardized patient	Schwartz et al.[60] 2014 United States	Undergraduate senior and second year graduate students from one university 75 total students (three separate cohorts during winter quarters from 2011 to 2013)	Two groups: SP and RP (real patient), ex post facto design. Each cohort of students was required to complete two encounters with the same patient. All encounters took place in the university simulation lab, where they were videotape recorded by an experienced lab technician. After the first taped encounter, students completed self-evaluations. Two trained viewers assessed the videos of both encounters. Not stated	To explore the feasibility of using SPs compared to RPs (real patients) during the experiential component of the nutrition counseling course. Shortened Calvary-Cambridge Observation Guide for assessing individual dietetic students' skills during sessions. Behavior Change Counseling Index for measuring how the dietetic students' counseling skills promoted behavioral change in their patients.	Overall, it was found that the use of SPs in this nutrition counseling course resulted in similar communication and behavior change scores to the RPs. While there was measured improvement of counseling skills within the SP and RP groups, there was no significant improvement in scores between the SP and RP groups.

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of Simulation, Time Frame of Simulation	Outcome(s) of Interest, Measurement Tool(s) Used	Results
Standardized patient	Tyler[61] 2017 United States	MS/DI students from one university 16 total students	One group pretest and posttest study design For the pretest, each student was assigned to perform NFPE on a peer and were evaluated by an observer who checked off which skills were performed. Afterward, students were given a training packet to learn at their own pace. One month later, for the posttest, students performed an NFPE on a standardized patient and were observed by two observers, who checked off skills performed on a given NFPE checklist. Average time of six minutes	Primary: to assess change in performance of NFPE skills before and after a simulation. Secondary: to assess changes in student's perceived abilities and confidence in performing a NFPE NFPE used by observers to objectively assess a student's skills in performing a NFPE Pre and post surveys from students to assess changes in ability and confidence when performing NFPEs. Post surveys to obtain student feedback and opinions.	Significant improvement from pre to posttest in performing muscle and subcutaneous fat exams (two out of seven categories evaluated) was noted from both observers for the group. Ratings of communication and fluid status assessment by one observer were significantly lower. Post surveys showed that students experienced increased confidence in performing subcutaneous fat, muscle, fluid status and micronutrient deficiency exams but not functional status during NFPEs.

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of simulation, time frame of intervention	Outcomes of Interest, Measurement tool(s) used	Results
High-Fidelity Simulation	Todd et al.[62] 2016 United States	Masters, coordinated program (CP) at one university 19 total students	One group with repeated measures at three time points: one before debriefing, one immediately after the first simulation experience, but before the second debriefing and one two weeks after starting rotations. Each dietetics student was paired with two nursing students in a simulation experience using high-fidelity mannequins. The dietetics student's role was to make recommendations about advancing the diet from nothing by mouth (NPO) status. 15-minute simulation experience plus debriefing with faculty	To determine whether exposure to a high-fidelity patient simulation would increase student self-efficacy before undergoing supervised practice. Self-efficacy scale (SES) to assess student self-efficacy, completed before and after exposure to the simulations.	Within the total cohort, there was a small but significant improvement in confidence levels from before to after the simulation experience.

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of simulation, time frame of intervention	Outcomes of Interest, Measurement tool(s) used	Results
Computer-based	Puri et al.[63] 2010 United States	Sophomore, junior, senior and graduate-level DPD students from 11 universities 452 total DPD students	Pretest - posttest control group design Students in the intervention group were given one week to complete a pretest module, two tutorial modules and a posttest module. Control group students completed the pretest module and were given 2 to 6 days to complete the posttest module to match the intervention's one-week deadline. All students completed a survey about the experience.	To assess whether students would choose more appropriate communication and counseling techniques after exposure to the simulation. Pretest and posttest assessed changes in counseling techniques within the two groups.	There was a significant improvement in the module scores between the pretest and posttest scores in the intervention group. Results indicate that for the posttest module, the intervention group was able to pick more appropriate counseling and communication techniques after exposure to the tutorial modules. No significant change was seen in the control group between pretest and posttest module scores.

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of simulation, time frame of intervention	Outcomes of Interest, Measurement tool(s) used	Results
Peer-assisted learning (PAL)/Peer-to-peer	Reidlinger et al.[64] 2016 United Kingdom	BS, Post-graduate diploma and MS at one university 50 total students	Two group, partial randomization repeated measures study design. During supervised practice rotations, students were placed either in a traditional 1:1 model, with one student to one practice educator or a PAL placement model with two students around the same academic level leading tutorials that were supervised weekly by one practice educator. PAL pairs remained the same throughout the study and rotated weekly through different rotation teams. 12-week period.	To compare experiences, work load of student and practice educators and satisfaction between those on the designed PAL placement model and those with the traditional 1:1 model Weekly satisfaction surveys of student learning and practice educator supervisory experiences for both groups. Participant evaluation via focus groups with students at end of the study to evaluate how the PAL model was received.	Students within PAL placement reported having a good learning experience in the last week significantly more than those in the traditional 1:1 model. No differences were seen in feedback about level of supervision and overall learning experience for the groups. In focus groups, students in PAL placement reported that the small-group teaching sessions after seeing patients and student-led tutorials were helpful for further developing presentation skills for case studies. However, the students reported that these sessions became repetitive toward the end of the placements.

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of simulation, time frame of intervention	Outcomes of Interest, Measurement Tool(s) Used	Results
Mixed: Standardized patient and Role-play	Beshgetoor et al.[65] 2007 United States	Senior year dietetics students at one university Not stated	Two groups: control group (fall, role play) and intervention group (spring, SP), two encounters design. Control group (CG) students participated in a role play session with fellow peers. Intervention group (IG) students interviewed actors hired as SPs. 40 minutes total (20-minute patient interview, 20-minute follow up 2 weeks later).	To assess the possibility of using actors for nutritional counseling with dietetic students. Follow up survey after counseling experience to assess students' perception of the experience, self-perceived effectiveness and value of the experience for future dietetic practice for both groups.	No statistically significant differences in students' perceptions, self-perceived effectiveness and value of the experience for future dietetic practice were seen between the CG and IG. Students who worked with SPs reported that actors were an effective way to learn counseling skills, while CG students said portraying the patient was difficult and that actors would've been harder to counsel, but more realistic to utilize than a peer.

Simulation Type	Author, Reference Number, Year, Location	Population Academic Status, Sample Size	Study Design, Description of simulation, time frame of intervention	Outcomes of Interest, Measurement tool(s) used	Results
Mixed: Mannequin and Standardized patient	Gibbs et al.[66] 2015 United States	Graduate-level dietetic interns at one university 16 total dietetics students	One group pretest and posttest design Dietetics students worked with two to three nursing students to provide care for two high-fidelity mannequins and one nursing student assigned to play the role of a patient. 20 minutes per rotation, 60 minutes total	To increase graduate student dietetic student confidence in interprofessional communication and enhance clinical judgement. Presurvey and postsurvey to assess student confidence. Formative checklist to assess intern performance during simulation. Summative checklist to grade Assessment, Diagnosis, Intervention, Monitor and Evaluation notes post simulation.	No statistically significant improvement was seen in self-rated confidence in interprofessional communication Formative evaluation showed that 53% of assigned tasks were completed by students during the simulation. Summative evaluation post simulation allowed for students to correct for missed tasks during simulations, bringing the total completed tasks up to 77%.

CHAPTER V

DISCUSSION

Introduction

In this scoping review, we identified twelve studies that addressed simulation use in dietetic education between the years 2007 and 2017. The findings showed that standardized patients were the most used simulation out of the six types that were discussed previously, indicating that while simulation use was limited in dietetics, the standardized patient was the most popular type seen in recent research. The results of this scoping review also showed that counseling and communication skills are the most measured outcomes in studies, indicating that for the included studies, there was a focus on further developing these skills in dietetics students.

The Standardized Patient: Strengths and Weaknesses

One reason that the SP model was likely used more than the other simulation types is because they can be used for multiple purposes while providing a high-fidelity experience. The SP is to provide a consistent experience for to all students who come into contact with them and they can be used for successfully measuring both technical and interpersonal skills.[67] There are advantages to using SPs to teach counseling and

interview skills to students over other types of simulation. One is that using an SP enables students to practice both communication and interpersonal skills at the same time on a live model. Another is that the SP can be trained to provide individualized feedback and assist with running the simulation as a whole, thus enriching the experience that students will receive.[68] They're also one of the most flexible types of simulation that can be used. Simulations with SPs can be customized or changed to focus on a specific skill or set of skills and they can be used in a classroom or in a clinical setting.[68] It is all dependent on the goals of the experience.

Another reason that SPs were likely used more often is that the role they play can be further extended to pair with other simulations. This model, called a "hybrid model", is defined as a combination of more than one type of simulation for use in a single teaching or exercise. In one study, a hybrid model was used to combine SPs with a mannequin chest and torso to mimic a cardiac auscultation, a pathological event that is difficult to replicate in a normal, healthy SP.[69] A study done by Higham et al.[70] combined an SP with a pelvic simulator to replicate smear tests (pap smears). Because of the sensitive nature of these types of gynecological exams, it is difficult for medical students to get this type of experience. Having this hybrid model available to help address the gap that a student may experience in clinical practice later proves to be an invaluable tool.

The SP was the most popular simulation type, but there are weaknesses to using it. One such weakness is cost. A characteristic of using an SP over another type of model is that the actors are paid for not just time in the simulation, but they are also trained formally for a period of time if they are expected to also formally evaluate students, potentially adding to the overall cost.[68] There are only so many physical findings that a standardized

patient can act out, but it is important to note that the range is still quite wide despite this limitation and that modifications to the SP could address this (such as the hybrid model mentioned previously).[68]

Limitations of Included Studies

One limitation to the results of this project as a whole was that many of the sample sizes for the studies were small, save for two studies that had at least 200 participants and both of these studies were completed either across multiple cohort years or across multiple DPD programs to obtain the larger sample sizes.[56,60] Because of the limited number of students that some programs, such as Masters programs and dietetic internships, accept on a yearly basis, it is understandable that limited sample sizes would be a common characteristic seen in these types of studies. Statistical power was not calculated for any of the included studies, so it is questionable as to how representative the findings are in groups as small as what were seen in these results.

Another limitation for this group of results was the lack of similar methods and study designs. No two study designs were the same and because of this diversity in methods, it can be difficult to conclude if improvement in scores was strictly because of the simulation itself or because of previous practice, previous simulation exposure or previous patient care work experience from the students participating in combination with the simulation experience. Only one study in the included results took previous patient care experience of the participants of the simulation into account.[62]

The lack of objective, validated tools to assess outcomes in dietetics students was another limitation to this group of studies. Some studies created their own checklists or scales to

objectively measure outcomes[56,58,61] and some studies used measuring tools from other fields to assess outcomes.[60,62] It is a possibility that because of the lack of standardized tools that some studies chose to use subjective measurements, such as focus groups and surveys, to measure outcomes instead.

The time frame of simulation exposure was another limitation to consider with all included studies. They were not equal, with some being as short as six minutes[61] and some being as long as an hour.[57,58,66] Although one study had a total combined time of 155 minutes, the actual SP encounter was only 20 minutes.[55] Interestingly, included studies that focused on communication skill outcomes reported longer simulation exposure times than studies that were interested in clinical skill outcomes.

As previously stated, simulation has historically been used for many years, but methodology across the medical disciplines isn't cohesive and terminology can be challenging to learn. Because of these factors, there could be some confusion as to what type of simulation is being used and which one is appropriate for the context of the simulation. For example, if a simulation was designed to expose a group of students to different mental disorders, by definition, a role-play model would be the best one to use because of the focus on the social context and its historical use in medicine and nursing for this scenario. However, a SP may also be trained to portray a mental disorder. Interestingly, when compared side-by-side in one of the included studies, the results showed that there were no significant differences between role-play and SP.[65] The results from that study begs the question: realistically, how different are they from each other and can their uses be further expanded? More research is needed to answer this question.

Limitations of Specific Studies

For Farahat et al.,[55] video recordings of students undergoing the OSCE simulation were not included in any outcome measurement. The videos, a more objective measurement of behavior during the simulation, could have been used alongside the perceptions from students to interpret final results. Not all students took advantage of the video tape viewing afterward, which may explain the lack of an improvement in personal self-assessment for this group. There was also no control group for this study to provide a comparison.

For Gibson et al.,[56] the authors stated that students who participated in the SP interviews had extensive classroom-based training in areas such as taking patient histories and building rapport prior to the simulation experience. Because these skills were introduced and refined before the simulation experience took place, the results could potentially look different if more challenging and less practiced skills were introduced instead or if a control group with not as much training was introduced. There was also no pre-test in this study.

For Hawker et al.,[57] costs associated with initial implementing of OSCEs were seen as the greatest limitation to using them. It takes time to develop the OSCEs, train staff and actors, debrief students and collect and analyze feedback provided. It also costs money for the actors' time and to provide benefits such as catering for the actors and staff on the day of examination. There was also no control group or pre-test in this study.

For Henry studies[58,59] one noted that 14 out of the 17 total participants in the study thought that items from the evaluation checklist provided in the study were clear. The

misunderstanding of items on the checklist could have influenced results in that some items may not have been measured as accurately as others that were perceived as clearer. For both of the studies by Henry, there was only one sample from one DI class at one institution and generalizability with results could be a limitation of concern. Both studies did not include a control group or pre-tests.

For Schwartz,[60] there were only two male participants in the sample size, indicating that outcomes of communication for this study are largely representative of female skills and likely not as representative of male communication skills. However, it is important to keep in mind that women make up the majority of the field of dietetics when compared to males. There was also a majority of Caucasian students, limiting the applicability of these results to those from other cultures. There was no control group or pre-test for this study.

For Todd et al,[62] there was no control group included. The authors created the self-efficacy scale (SES) used in the study and based on Bandura's guide to developing self-efficacy questionnaires. Though this study was a repeated measures design, the time in between the second and third simulation exposure was not equal between the students. According to the authors, there was a period of anywhere from four to 18 weeks from the second to the third simulation exposure, introducing a potential for recall bias.

For Tyler,[61] pre- and post-test NFPE scores were not taken under the same conditions. The pre-test was conducted to only obtain baseline measures of skills with included students. There was also no patient post write-up simulation component for the students to complete. Charting results from a nutrition focused physical exam on a patient is a

necessary clinical skill and it would be a welcome addition for students to complete. There was also no control group present in this study.

For Puri et al,[63] the modules provided to the students were not diverse in ethnicity or culture. The authors questioned whether students would have learned more about counseling skills if more populations outside of Caucasian were introduced in the modules.

For Reidlinger et al,[64] in the focus group evaluation, students reported that while the small-group teaching sessions and student-led tutorials were helpful for developing presentation skills, these sessions became repetitive toward the end of placements. Students may have learned more in this study if a variety of methods were introduced into these sessions. No pre-test was present for this study.

For Beshgetoor,[65] students noted that roles assigned to an SP needed to be closer matched to the actual ethnicity of the SP themselves to provide a more realistic encounter. This distraction could prove to be one that would be hard for students to ignore, possibly affecting their performance during SP encounters. There was no pre-test present for this study.

For Gibbs et al,[66] the authors noted that the lack of difference in self-rated confidence in interprofessional communication was likely because of high presurvey scores, leaving little room for improvement in this area at the end of the study. They also noted that the expectations for the clinical judgement and technical writing skills for the assessment, diagnosis, intervention, monitoring and evaluation (ADIME) notes was based on ADIME

notes written by registered dietitians, meaning that the standard for accuracy was probably set too high (80%). No control group was present for this study.

Limitations of Scoping Review

This scoping review project had some limitations. A time frame of ten years was established to account for changes in language in regards to technology and simulation. Compared to other scoping reviews, the number of studies included in the results for this project was limited. Finally, although there were studies published with no significant changes in outcomes, it is very unlikely that studies with negative results related to the outcomes of the studied simulation will be published, introducing a potential publication bias.

Conclusion

With simulation in dietetics education on the rise, it is important to understand what has been done and the direction in which simulation use in the field is moving. This scoping review aimed to answer the question of what kind of simulation is being done in dietetics education and how the different types affected outcomes. We found that SPs were the most common simulation type and that students in the studies that used simulation improved in outcomes.

This scoping review could provide guidance to educators as to what kind of research has been published in the last ten years on the use of simulation in dietetics education. Although SPs are the main simulation type used, there are others that are still being used alongside them. Further research could be done on developing simulation methodology specific to dietetics and also in creating validated tools that measure outcomes in research

for dietetics students. While outcomes in simulation experiences seem to be focusing on communication and interviewing skills, there is also emerging research in using simulation to develop nutrition focused physical exam (NFPE) skills in students. NFPEs are a newer concept that is still being implemented in dietetic programs and internships and simulation could prove to be very useful in helping to develop these skills in students. Lastly, this scoping review could be expanded later into a systematic review, the focus likely being on standardized patients and how they influence communication and counseling skills in dietetics students.

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