

Incorporating Simulations of the Nutrition-Focused Physical Exam into Graduate-Level Dietetics  
Curriculum

BY

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## Abstract

**Introduction:** The nutrition-focused physical exam (NFPE) is an integral component of a nutrition assessment performed by registered dietitians, and is used to identify signs of malnutrition. However, many dietitians are not performing NFPE in clinical practice due barriers such as lack of training, lack of time, and discomfort touching patients. The Accreditation Council for Education in Nutrition and Dietetics (ACEND) has set a new 2017 competency of “Conduct nutrition-focused physical exams” for dietetic internships and coordinated programs in dietetics, indicating the need to incorporate NFPE training into dietetics education programs. Simulations have shown to be useful teaching tools for hands-on clinical skills, and may be a practical and effective method to train dietetics students in NFPE.

**Methods:** Dietetics students (n=16) in a combined internship and Master’s program at the University of Kansas Medical Center participated in a simulation of the NFPE for a graduate-level medical nutrition therapy class. Observers evaluated participants using the NFPE Skills Assessment tool created by the Academy of Nutrition and Dietetics. Components of the NFPE were split into seven categories, each containing criteria used to evaluate participants. NFPE skill baseline was taken by having students perform an NFPE in pairs on each other while an observer checked off NFPE skills performed. Students received an NFPE training packet after baseline. Student learning from the training packet was self-directed. One month later, students performed a timed NFPE simulation on a standardized patient actor, with observers checking off NFPE skills performed. Constructive feedback was given to students on both the pre-test and post-test. The NFPE Skills Assessment tool measured objective measures of performance, and students took a pre-test and post-test survey to assess subjective measures of performance.

**Results:** Significant improvements were seen in muscle assessment, subcutaneous fat assessment, and overall performance. When pre-test and post-test surveys were compared, student’s sense of NFPE importance significantly increased. Their perceived ability to assess subcutaneous fat, muscle, fluid accumulation, and micronutrient deficiencies increased. Student’s comfort touching patients significantly increased. 82% (n=13) of students felt they were adequately guided through the simulation process and

94% (n=15) felt the case study and training materials adequately prepared them for the simulation. 88% (n=14) of students felt the simulation increased their proficiency and confidence in performing an NFPE. From open-ended questions, students reported they enjoyed the realism of the standardized patient (n=11) and the opportunity to practice NFPE in a safe environment (n=6). Students felt the simulation could be improved by increasing simulation realism (n=4), additional materials for the training packet (n=3), and additional practice sessions before the live simulation (n=3).

Conclusion: This study created an NFPE training program using role-play simulations for graduate dietetics students. The program demonstrated effectiveness at improving NFPE skills and perceived proficiency and confidence performing the exam. Students benefitted from constructive feedback and the opportunity to practice the exam in a safe setting. Student learning can further be improved by modifications to the training program. Overall, the study demonstrated an effective approach to incorporating NFPE training into a dietetic internship program, in efforts to meet the new dietetics education competency set by ACEND.

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## Chapter 1 – Introduction

### **1. Background**

Registered dietitian nutritionists (RDNs) follow the nutrition care process and model (NCPM) as a framework for best practice in nutrition care planning (1). The NCPM consists of nutrition assessment, diagnosis, intervention, and monitoring and evaluation. As a fundamental part of the nutrition assessment, the nutrition-focused physical exam (NFPE) is crucial in identification of nutritionally relevant signs and symptoms indicating malnourishment. Prevalence of malnutrition is high, yet malnutrition diagnosis is low. Malnutrition reduces the body's overall resilience and ability to function. As such, it is highly associated with undesirable clinical outcomes. The NFPE considers muscle and fat wasting, fluid accumulation, and functional status. These four factors, in addition to weight loss and adequacy of dietary intake, are used to identify malnutrition (2) As a physical exam is required to assess four of the six recommended diagnostic criteria for malnutrition, it is standard of practice in nutrition care to perform NFPE in a nutrition assessment (3). With recent calls to action to address malnutrition, NFPEs play a crucial role in malnutrition identification, diagnosis, and intervention.

### **2. Summary of relevant literature**

Though NFPE is an integral part of a nutrition assessment, it is not conducted as often as recommended due to barriers such as inadequate training and discomfort touching patients. Though there are training programs available for current registered dietitians, there are no validated methods of teaching nutrition-focused physical exams to dietetics students. Simulations for health care students have shown to be effective in teaching and evaluating hands-on clinical skill such as physical exams and provide a safe environment for students to practice clinical skills. Students benefit from the experience by identifying their weaknesses and obtaining valuable feedback. In addition, scenario standardization allows for uniform assessment of skill competence.

### **3. Need for further investigation**

As nutrition experts, identification and treatment of malnutrition lies primarily in the hands of registered dietitians. Recent literature implies that NFPE training has not yet been adequately incorporated into dietetics curriculum; offering an explanation as to why many dietitians are not using physical exams to identify malnutrition. Furthermore, the Accreditation Council for Education in Nutrition and Dietetics (ACEND) has set a new 2017 competency of “Conduct nutrition-focused physical exams” for dietetics programs, indicating the need to incorporate NFPE training into dietetics education (4). Hands-on simulations are an ideal NFPE training method, as the physical exam is both a visual and tactile experience. However, there are currently no validated NFPE training programs or simulations available to dietetic students. It is expected that training dietetic students in NFPE will increase the number of dietitians who are trained in and feel comfortable performing a physical exam, subsequently increasing malnutrition diagnosis and treatment.

#### **4. Statement of purpose**

The purpose of this project is to create and carry out an NFPE training simulation for dietetics students and evaluate its effectiveness. The primary outcome was to assess change in performance of NFPE skills before and after the simulation. Secondary outcomes were change in student’s perceived ability and confidence in performing NFPE. We expected to see an improvement in number of skills performed after the training and simulation. We also expected to see a reduction in barriers to performing NFPE such as inadequate training and discomfort touching patients, as well as an increase in perceived ability and confidence in performing the exam.

#### **5. Research Question**

Does preparing for and performing a simulated NFPE improve NFPE skills in dietetic students, as measured by the Academy of Nutrition and Dietetics’ NFPE Skills checklist? Does preparing for and performing a simulated NFPE improve perceived competency and confidence at performing an NFPE in dietetics students, as measured by pre- and post-simulation surveys?

## Chapter 2 – Review of Literature

### I. Introduction

Registered dietitians are trained to perform nutrition assessments that lead to the formulation of a nutrition diagnosis and intervention. Nutrition assessment involves the collection of five categories of information: medical tests/labs, diet history, client history, anthropometrics, and the nutrition-focused physical examination (5). A nutrition-focused physical exam (NFPE) is a systematic full body examination that helps dietitians determine nutritional status. NFPE is especially useful in diagnosing malnutrition. The Academy of Nutrition and Dietetics, the American Society of Parenteral and Enteral Nutrition, and other organizations have issued recent calls to action to improve the identification of malnutrition (2). Though a valuable tool, NFPE is underutilized by dietitians due to barriers such as lack of training and discomfort touching patients (6-9). Incorporating validated NFPE training simulations into dietetics curriculum may be an effective way to break these barriers and increase the number of dietitians performing NFPE.

#### *History of NFPE*

Traditionally, dietitians did not perform physical exams on patients. This changed in the 1980s when the Subjective Global Assessment (SGA) was developed, a tool that assesses nutrition status by physical examination of muscle, fat, fluid stores, and functional status (10). By the 1990s the American Dietetic Association (ADA) encouraged “upskilling” of dietitians and actively supported use of physical exams to assess nutritional status (11). In the early 2000s, the ADA released competencies for entry-level dietitians, one of which was to “perform basic physical assessment” (12). Despite endorsement by the ADA, incorporation of physical assessments into dietetics curriculum lags behind recommendations due to barriers such as lack of trained educators and appropriate resources (13).

#### *Simulations in Medical training*

Simulations have long been used in medical training and may be an effective delivery platform for NFPE training. Using simulations, health care students can practice skills in a safe environment without the risk of harming patients. Consequently, simulations improve the student’s ability to deliver

quality patient care in a real setting. Another benefit is that students may obtain valuable feedback from observers for skills improvement after the encounter. Specific to dietetics education, simulations have been effective at teaching counseling and clinical reasoning skills (14-18). Simulations are helpful for these skills as they are application-based and difficult to teach using a standard classroom lecture (14-18).

### *Purpose of this Review*

This review of literature seeks to capture best practices for the creation of a learning simulation for dietetics students to develop proficiency and confidence in performing a nutrition-focused physical exam. NFPE is a skill best learned by case study application and hands-on practice. Incorporation of a validated simulation into dietetics curriculum will increase the number of registered dietitians who are competent and comfortable performing NFPE, which will lead to increased identification of malnutrition and higher quality patient care. The review will first confirm there is a need to increase the number of dietitians who perform NFPE. Next, current NFPE training methods and evaluation tools will be explored. The use of training simulations in medical education, both virtual and role-play, will also be discussed. Finally, the literature in its entirety will be considered with regards to creation of a NFPE simulation for dietetics students.

## II. There is a need for validated NFPE training methods

### *Closing the Gap between Malnutrition Prevalence and Diagnosis*

Registered dietitians are ideally positioned to identify and treat malnutrition. Malnutrition diagnosis is much lower than actual malnutrition prevalence. Malnutrition prevalence is estimated to range from 30 to 50%, yet only about 3% of hospitalized patients receive a malnutrition diagnosis (18,19). Up to one out of every two older adults are at risk for malnutrition (20,21). Poor nutrition status increases hospital length of stay by 4 to 6 days and leads to more complications, falls, readmissions, and higher mortality rates (21-23). The financial burden of malnutrition is significant as well. An estimated annual cost of \$51.3 billion is attributed to disease-associated malnutrition, and hospital costs are 309% higher for malnourished patients (23,24).

The Academy of Nutrition and Dietetics and the American Society for Parenteral & Enteral Nutrition (ASPEN) collaborated to create a consensus statement on malnutrition with specific diagnostic criteria. Malnutrition may be diagnosed with at least 2 of the following criteria: unintentional weight loss, evidence of inadequate intake, loss of muscle mass, loss of subcutaneous fat, fluid accumulation, and diminished functional status (2). Dietitians address all six of these criteria during their nutritional assessment. The last four criteria are specifically addressed during an NFPE, confirming its essentiality when one is assessing for malnutrition. The gap between prevalence and diagnosis of malnutrition can be closed by increasing the number of dietitians performing NFPE.

#### *Barriers Prevent Competent-Level Performance of NFPE*

Dietitians are required to be competent in NFPE upon entry-level practice. It is Standard of Practice in Nutrition Care for dietitians to perform an NFPE as part of the nutrition assessment. The Academy's Commission on Dietetic Registration (CDR) also released Essential Practice Competencies. Under sphere 10.2.1, dietitians must be able to "identify and select valid and reliable tools to conduct a comprehensive nutrition assessment", with mention of performing an NFPE as a practice illustration for this competency (25). Furthermore, the Accreditation Council for Education in Nutrition and Dietetics (ACEND) recently released 2017 competencies for dietetics education programs, including a new addition of "Conduct nutrition-focused physical exams" (4). Another recent paper from the Academy stresses the nutrition-focused physical exam as one of the five categories of a nutrition assessment (5).

Dietitians are recognized as experts in assessing nutritional status, yet many of them are not performing NFPEs. The 2015 dietetics practice audit (n=1,048) states only 47% of practicing entry-level dietitians perform nutrition focused physical exams (6). Similarly, a 2017 survey of 542 practicing dietitians in nutrition support reported only 44% of them consistently perform NFPE (26). Barriers to performing NFPE include lack of education and training, discomfort touching patients, and lack of time (8,9,27). A 2009 survey of 367 dietitians showed that only 34.6% of dietitians received training in NFPE (27). There is clearly a discrepancy in the Academy's expectations, what is taught in dietetic curriculum,

and performance of NFPE in clinical practice.

How do we align the differences between what dietitians are expected to know, what they are taught, and what they practice? To address this problem, foundational knowledge of NFPE beginning in dietetic education is fundamental. The Academy released a Practice Applications paper in 2014, titled “The Time is Now: A Blueprint for Simulation in Dietetics Education” (16). The article describes why simulations are valuable and delineates a framework for designing an effective, validated simulation for dietetics. The Academy’s endorsement of simulations substantiates the assumption that simulations would be a practical approach to integrating NFPE training into dietetics curriculum.

### III. NFPE Training Methods and Skills Assessments

#### *NFPE Training for Current Dietitians*

With a new emphasis on performing NFPE and diagnosing malnutrition, hands-on workshops and online trainings for malnutrition identification have emerged. Many of these trainings are provided as continuing education credits for current dietitians. The Academy developed an interactive, hands-on workshop using simulations with trainers and real practice on patients (6,25). The workshop supplies participants with tools including NFPE guidelines, a medical penlight, a patient/dietitian script, and an NFPE skills assessment checklist (28). The Cleveland Clinic has also created a training program open to dietitians, educators, and interns (29). The workshop involves simulations with trained actors and observers and a focus on learning to diagnose malnutrition based on the new Academy/ASPEN guidelines (29). Similarly, Rutgers University has a physical assessment workshop for dietitians that includes identifying malnutrition, measuring vital signs, assessing fluid status, heart and lung sounds, oral assessment, and dysphagia screening (30).

Online NFPE training has also been made available to reach audiences unable to attend in-person workshops. Nestlé Nutrition Institute has a three-part video series to educate dietitians on nutrition-focused physical assessment (31). The series can be completed individually online, or Nestlé representatives can provide on-site group training for dietitians at medical facilities. Abbott Nutrition

Health Institute created a virtual patient simulation titled “Putting Malnutrition Screening, Assessment, Diagnosis, and Intervention into Practice” (32). The simulation is performed online, complete with a post-training exam and supplemental handouts. Lastly, ASPEN has a recorded program on NFPE from their 2015 Clinical Nutrition Week available for purchase (33).

#### *NFPE Training for Dietetic Students*

Though there are quite a few NFPE training options for dietitians, there has been less focus on educating dietetic students in NFPE. A survey mailed to 193 directors of a dietetic internship (DI) or coordinated program (CP) in 2006 revealed that 17% did not teach physical assessment. Body composition was most frequently taught (86%), followed by skin assessment (70%), vital signs (66%), and dysphagia screening (50%). Skills were mostly taught via classroom lecture (88%) and evaluated with written exams (47%). Only 17% of programs assessed skills by demonstration on an actual patient. Barriers cited were lack of trained faculty (81%) and lack of resources (62%) (13). In a more recent 2012 survey of directors for DI/CP, the most common NFPE skills taught were anthropometrics. 64% of programs taught skin assessment, 38% taught dysphagia screening, and only 7% taught cranial nerve screening (8). The survey listed barriers to teaching NFPE as lack of availability of educators trained in NFPE (56%), multimedia resources (52%), and preceptors experienced in NFPE (51%) (8).

#### *Assessment of NFPE Skills*

Accurate assessment of a student’s clinical skills before clinical placement is valuable to both students and patients. Students can identify their weaknesses and patients are more likely to receive adequate, safe care from a student whose skills have been confirmed. In the past, students have had clinical skills evaluated using written exams, case presentations, simulations, or true patient interactions (13). Students are commonly observed performing interactions with real or simulated patients, however, observer bias may be high due to subjectivity and human error (34). In addition, lack of uniformity in patient scenarios makes creation of an accurate and consistent grading system difficult.

Objective structured clinical examinations (OSCE) are used to perform an objective assessment

of clinical skills in health care students. OSCEs allow for assessment of context competence, professional behavior, and integration of skills. It can include both summative and formative components, as a student is given a summative judgement of performance and formative feedback after the OSCE (35).

An OSCE is typically a series of stations visited by students where they undergo a structured clinical scenario and are graded using objective measures taken by an observer (34-39). OSCE is considered the “gold-standard” to assess health care students’ performance in a clinical setting (38). A pyramidal model described by Miller in 1990 outlines development of clinical skill performance. The bottom two levels of the pyramid (“knows” and “knows how”) can only be assessed with written and oral exams. The third level (“shows how”) allows for assessment of competence and can be assessed with simulations and OSCE. The third level (“does”) allows for assessment of performance and is only assessed by observation in a real setting (40). By this model, OSCE allows for higher level of skill assessment than traditional written and oral tests. OSCEs have demonstrated many benefits such as greater objectivity, a high level of validity and reliability, reduction of observer bias, greater inter-rater reliability, increased consistency of experience between students, and ability to test a broad range of skills. Additionally, OSCEs are positively viewed by students and lecturers and serve as a powerful motivator for student learning (41).

A 2011 review article by Zayyan provides basic steps in organizing a quality OSCE (37). Benefits of OSCE include reproducibility, objectivity, tailoring of scenarios, no patient risk, and post-exam feedback for students (38). Though OSCE has many benefits, they require a large amount of planning, training, and expense. They have also been criticized for not appropriately mimicking real-life scenarios (38). OSCE has primarily been used for medical and nursing students. Few articles on OSCE in dietetics students have been published; those existing have mainly been on undergraduate or preclinical students and are generally well-received (36,37,39). OSCEs in dietetics students have been used to determine clinical placement, evaluate communication skills, and to assess perceived readiness to practice and key dietetic skills (34,36,37,39). Farahat et al. discusses how they used OSCE to significantly

increase dietetics student's perceived clinical skills and how OSCE may be implemented into dietetics education (39).

Though OSCE is a useful way to teach and test clinical skills, it is critical to have an appropriate grading tool to evaluate student's performance and provide direction for feedback. Ideally, the grading tool should be based around learning objectives and validated for precision and accuracy. The Academy of Nutrition and Dietetics created an "NFPE Skills Assessment Tool" for their physical exam workshop (42). Essentially, the tool is a thorough checklist of NFPE components an observer can use to objectively measure a trainee's competency at physical assessment. This tool is valuable in that it may be considered the standard for NFPE skills assessment, as it is developed and used by the Academy of Nutrition and Dietetics.

#### IV. Simulations in Dietetics Education

A simulation is an instructional technique that imitates the real world to provide a guided learning experience. The simulation model is used as a teaching tool for training health care professionals, as it provides a safe space where students can test out their clinical skills and receive feedback. There are many ways a simulation can be implemented. Role-play simulations use peers, trained actors, or mannequins who act as patients for the student to practice on. Virtual simulations may be case studies performed on a computer or tablet, in which students make decisions and the virtual patient responds accordingly. Both virtual and role-play simulations have been used in dietetics education.

##### *Role-Play Simulations*

Role-play simulations may use standardized patients to simulate a live patient. Standardized patients present with a specific story and set of signs and symptoms which are the same for every student. Standardized patients create uniformity in scenarios so each student's performance can be evaluated equally. Role-play with standardized patients has been helpful in dietetics for training counseling and communication skills.

A study by Henry and Duellman had dietetic interns complete two counseling sessions with standardized patients (15). The interns participated in focus groups which showed the simulations increased student's self-confidence using counseling methods (15). Another study using standardized patients tested communication skills in third year undergraduate dietetics students. Communication skills were evaluated twice; two weeks apart using an OSCE. The study demonstrated a significant improvement in communication skills between the first and second encounter (17). A new approach to role-play simulations was performed by Gibbs and George, where high-fidelity mannequins were used in an inter-professional setting to evaluate dietetic interns' clinical judgement and communication skills (43). A skills checklist for completion of expected tasks was used, along with a pre- and post- survey to assess student views of the simulation. The simulation was found to be helpful in identifying knowledge gaps and practicing communication skills with other professions and patients (43).

#### *Virtual Simulations*

Teaching tools and simulations delivered via virtual platform have increased in popularity along with technology advances. One of the earliest computer simulations used with dietetics students was by Raidl et al in 1995. The investigators tested clinical reasoning skills and found students scored high when they were given a tutorial case study with a simulation using computer assisted instruction (14). In 2000, another computer based simulation was given to dietetic interns. Performance in clinical rotations of those who took the simulation and those who did not was compared. Though there was no difference found in clinical performance between individuals who took the simulation and ones who didn't, the simulation was well-received by the students (44).

As technology has advanced, more sophisticated virtual simulation designs have been developed. In 2006, Zary et al. created an innovative patient simulation platform that is capable of being edited and changed in accordance with educational needs (45). More recently, the Academy of Pediatrics collaborated with Kognito, developers of various virtual-role play simulations, to create an online and mobile app called "Change Talk" (46). Change Talk is an interactive simulation with the goal of helping

health care professionals learn motivational interviewing, a counseling skill used to build motivation in patients to make positive changes in health behavior. The app allows the learners to act as a physician confronting childhood obesity in a child with his mother. The learner attempts to use motivational interviewing as a strategy to guide the family in making a positive change (46).

### *NFPE simulations*

There is limited, if any, research appraising the use of simulations to teach nutrition-focused physical exams. There is one 2012 FNCE presentation that mentions two four-hour NFPE training sessions for dietetic interns that use simulations (47). As previously noted, simulations are used in various NFPE workshops for dietitians (28-30,32). However, further research is needed to establish whether an effective simulation of NFPE can be designed for dietetics students. Furthermore, if one can be designed, strategies for implementation into dietetics curriculum must be considered.

### *Designing an effective simulation*

Evaluation of simulation effectiveness proves challenging and is not well-researched (16). It is difficult to measure how well a simulation accurately mimics reality and if knowledge outcomes are met (16). To date, most simulations have focused on student satisfaction and their perception of simulation effectiveness (14,16,34,36,39). The Lasater Clinical Judgement Rubric is a validated tool used to assess clinical judgement in simulations (48). Based off this tool, a Nutrition Care Process Evaluation Instrument was developed at the University of Kansas Medical Center to measure clinical judgement of dietetics students during interprofessional simulations (49). Validation of simulation quality is an important step in the design process that should not be overlooked.

Jeffries describes a five-step framework for designing, implementing, and evaluating simulations for nursing programs (50). Thompson and Gutschall discuss the use of Jeffries' framework with application to dietetics education in a practice paper published by the Academy of Nutrition and Dietetics (16). The five steps of developing a simulation are as follows: first, goals and objectives are defined based

on student needs and ACEND competencies. Second, the simulation must be designed to be as realistic as possible. Third, the simulation sequence and complexity is planned. Fourth, method of presentation such as student cues and delivery mode is planned. Fifth, student debriefing plans are made (16). After simulation development, a method of validation must be considered. Both internal validation (subjective feedback, objective learning outcomes) and external validation (successful performance in a supervised practice setting) are important in deciding whether the simulation measures what it is intended to measure (16). The validation sequence will provide opportunity for continuous improvement of the simulation scenarios (16).

In addition to validating the simulation, providing feedback to students is essential and is arguably the most important part of a simulation (16,38). Training simulations for health care students have an overarching goal of helping the student learn a skill. The ability to evaluate performance and provide formative feedback is valuable to the student and assists learning (34). For this reason, the fifth step described in Jeffries' five-step plan to simulation development should be incorporated into the simulation design.

#### IV. Conclusion

The nutrition-focused physical exam is a crucial component of a complete nutritional assessment. The NFPE identifies malnutrition by assessing muscle, fat, fluid stores, functional status, and signs of micronutrient deficiencies. As nutrition experts, dietitians are suitably positioned to address the recent calls to action for malnutrition care with NFPE (2, 51-53). Unfortunately, dietitians are not performing physical assessments as often the Academy's guidelines suggest (6). Though NFPE training for current dietitians is available, it is critical for incoming dietitians to be trained to meet malnutrition care needs for the upcoming years. Incorporation of NFPE into dietetics curriculum has been slow due to barriers. There is a need for validated methods of NFPE training for dietetics students that surpass these barriers. Simulations have proven to be an effective delivery method in training and testing clinical skills. Various frameworks for quality simulation design have been suggested (16,50). Physical assessment is a hands-on

skill that is best learned through hands-on performance. As such, validated simulations of the NFPE for dietetics students may increase proficiency, confidence, and performance of physical assessments with the end goal of addressing malnutrition and improving patient care.

## Chapter 3 – Methods

Sixteen female dietetic interns in a combined Master's program at the University of Kansas Medical Center participated in the simulation as a learning experience for part of their Spring 2017 Medical Nutrition Therapy class. All students have completed a Baccalaureate degree at an accredited university for dietetics education. Students received a consent form (see Appendix A) and consented to participation before the study. IRB approval was obtained prior to student participation in the research and simulation.

The simulation was based off an OSCE framework in attempts to provide an objective, structured evaluation of clinical skills using a standardized patient. Participants served as their own controls. NFPE skill baseline (Pre-test) was taken by having students perform an NFPE in pairs on each other while an observer checked off NFPE skills performed. Students received an NFPE training packet after the pre-test (See Appendix D). Student learning from the training packet was self-directed. Students were expected to learn the required material and prepare for their post-test simulation as they felt was necessary. One month later, students perform a timed NFPE simulation on a standardized patient actor (Post-test), with 2 observers checking off NFPE skills performed. The trained standardized patient was sourced from the Neis Clinical Skills Lab at the University of Kansas Medical Center. Students took a pre-test and post-test survey to assess subjective measures of performance. Constructive feedback was given to students at two points. Formative feedback was given verbally by observers to student pairs during the pre-test and after the post-test in the form of written comments on their NFPE skills sheet.

Content was introduced to students in the first semester of a year-long medical nutrition therapy class via lecture on malnutrition assessment. Baseline (pre-test) measurements were taken on the first day of the second semester. The post-test simulation, given one month later, supplemented a lecture on cancer, as malnutrition is a common occurrence among cancer patients. The students received a pass/fail grade dependent on active preparation and performance of simulations.

Outcome measurement tools are summarized for each outcome in Table 1 below. An NFPE skills

checklist created by the Academy of Nutrition and Dietetics (consent for use in Appendix B) was used for objective measures. A pre- and post-test survey was used for subjective measures (See Appendix E, F).

Table 1: Measurement of Outcomes

<b>Outcome</b>	<b>Measurement Tool</b>	<b>Assessment Method</b>
Change in performance of NFPE skills	NFPE skills checklist	Checklist of skills performed
Change in student's sense of NFPE importance	Pre- and Post- survey	Likert scale
Change in student's perceived ability to perform NFPE	Pre- and Post- survey	Likert scale
Change in student's confidence in performing NFPE	Pre- and Post- survey	Multiple choice Likert scale
Feedback on simulation experience	Post- survey	Likert scale Multiple choice Open-ended
Opinions regarding virtual simulations for NFPE training	Post- survey	Likert scale

Differences in NFPE skills performed on the pre-test and post-test were analyzed using paired t-tests. This test assumes normality of data; if data is not normal another test may be more appropriate. Agreement between observers was analyzed using Cohen's kappa for inter-rater reliability test. Differences between responses on pre-test and post-test surveys were analyzed using Wilcoxon Signed Ranks test. One-tailed tests were done for both paired t-tests and Wilcoxon Signed Rank as it was anticipated that scores would increase from pre-test to post-test. Statistical significance was set at  $p < 0.05$ . Data was considered "approaching significance" if  $p < 0.1$ . Frequency distributions were made for unpaired survey data. Qualitative analysis of open-ended questions on surveys identified common themes in responses. Statistical tests were performed using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS, v20).

## Chapter 4 – Results

The aim of this research was to create, execute, and assess the effectiveness of an NFPE training program incorporated into graduate-level dietetics curriculum.

### Analysis of NFPE Skills Performed

Improvement in NFPE skills from pre-test to post-test were analyzed by category and overall performance. Components of the nutrition focused-physical exam were split into seven categories, each containing criteria which received a “check” from the observer if the student performed the skill. The categories consist of communication (introduce self and use patient identifiers, explain purpose of visit), personal/patient safety (wash hands, wears personal protective equipment), patient interview (medial history, nutrition/diet history, weight history, GI symptoms, functional status), subcutaneous fat exam (orbital fat pads, buccal fat, triceps, ribs), muscle exam (temples, clavicle, shoulder, scapula, interosseous, quadriceps, calf), micronutrient exam (hair, eyes, mouth, lips, gums, tongue, nails, skin, use of penlight), and fluid accumulation (lower extremities). Inter-rater reliability between the two observers on the post-test demonstrated good agreement with Cohen’s kappa at 0.7813. Mean scores for pre-test and post-test are summarized in Table 2 and 3 below. Significant improvements were seen from both observers in the muscle exam and subcutaneous fat exam. Significantly lower scores were seen in the communication and fluid status categories. One observer reported significant improvements in overall performance. The second observer’s report approached significant improvement ( $p < 0.1$ ) in overall performance.

Table 2: Observer 1: NFPE Skills Performed (Paired t-test)

Category	Max Score	Pre-Test Mean	Post-Test Mean	t-statistic	p-value
Communication	2	1.813	1.4375	1.567	0.069 <sup>+</sup>
Personal / Patient Safety	2	N/A	0.875	N/A	N/A
Patient Interview	5	1.75	1.375	1.065	0.152
Subcutaneous Fat	4	1.5	2.438	-1.861	0.042*
Muscle	7	3.5	5.125	-3.204	0.003*
Micronutrients	9	5.938	5.688	0.000	0.500
Fluid Status	1	0.813	0.5	2.076	0.028*
All	30	15.31	17.44	-1.584	0.067 <sup>+</sup>

\*significant (p<0.05)

+approaching significance (p<0.1)

Table 3: Observer 2: NFPE Skills Performed (Paired t-test )

Category	Max Score	Pre-Test Mean	Post-Test Mean	t-statistic	p-value
Communication	2	1.8125	1.4375	2.087	0.027*
Personal / Patient Safety	2	N/A	0.75	N/A	N/A
Patient Interview	5	1.75	1.75	0.000	0.500
Subcutaneous Fat	4	1.5	2.375	-1.849	0.042*
Muscle	7	3.5	4.875	-2.711	0.008*
Micronutrients	9	5.938	5.813	-0.220	0.415
Fluid Status	1	0.813	0.625	1.379	0.094 <sup>+</sup>
All	30	15.31	18.44	-2.153	0.024*

\*significant (p<0.05)

+approaching significance (p<0.1)

Analysis of Pre-Test and Post-Test Surveys

Pre-test and post-test survey responses are summarized in Table 4 below. Frequency tables of responses are found in Appendix G, Table 5. When pre-test and post-test surveys were compared, student’s sense of NFPE importance significantly increased. Their perceived ability to assess subcutaneous fat, muscle, fluid accumulation, and micronutrient deficiencies increased. There was a significant decrease in students who felt they needed additional training in assessing muscle/fat wasting, as well as more hands-on experience. Student’s comfort touching patients significantly increased.

Table 4: Paired Survey Data (Wilcoxon Signed Rank, One-Tailed Test)

<b>Question</b>	<b>Z-statistic</b>	<b>p-value</b>
1. How important is it to perform nutrition-focused physical exams as part of a nutritional assessment?	-2.048	0.020*
2. How likely are you to perform NFPE regularly in clinical practice?	-0.791	0.215
3. How comfortable do you feel touching patients/clients to perform an NFPE?	-2.511	0.006*
4. How would you rate your ability to assess an individual's subcutaneous fat stores?	-2.919	0.002*
5. How would you rate your ability to assess an individual's muscle stores?	-2.919	0.002*
6. How would you rate your ability to assess an individual for fluid accumulation?	-2.324	0.010*
7. How would you rate your ability to assess an individual's functional status?	-0.952	0.171
8. How would you rate your ability to assess for physical signs of micronutrient deficiencies or excesses?	-2.126	0.017*
9. Are there any specific areas of NFPE you would like more education/training on? (choice=Malnutrition diagnosis/criteria terminology)	-1.414	0.079
10. Are there any specific areas of NFPE you would like more education/training on? (choice=Assessing muscle and/or fat wasting)	-2.53	0.006*
11. Are there any specific areas of NFPE you would like more education/training on? (choice=Assessing micronutrient deficiencies)	-0.447	0.328
12. Are there any specific areas of NFPE you would like more education/training on? (choice=Communication skills with patient)	-0.447	0.328
13. Are there any specific areas of NFPE you would like more education/training on? (choice=Additional hands on-experience)	-2.236	0.013*

\*significant (p<0.05)

Students provided feedback for simulation improvement in the post-test survey. 82% (n=13) of students felt they were adequately guided through the simulation process and 94% (n=15) felt the case study and training materials adequately prepared them for the simulation. 88% (n=14) of students felt the simulation increased their proficiency and confidence in performing an NFPE. From open-ended questions, students reported they enjoyed that the standardized patient was realistic (n=11) and that they had the opportunity to practice NFPE in a safe environment (n=6). Students felt the simulation could be improved by increasing simulation realism (n=4), additional materials for the training packet (n=3), and additional practice sessions before the live simulation (n=3). Frequency tables of unpaired survey data and common identified themes in open-ended questions are found in Appendix G, Tables 6 and 7.

## Chapter 5 – Discussion

The study aimed to see if the NFPE training simulation was effective at teaching dietetics students how to perform an NFPE. Results did show the simulation to be effective on multiple levels. Students significantly increased their scores in the post-test simulation for the muscle assessment and total score. Perceived competency and comfort at performing the exam was also significantly increased.

This study demonstrates an effective approach for training dietetic interns in NFPE skills. All previously reported barriers to performing NFPE in clinical practice were addressed, including lack of training/education, lack of hands-on experience, discomfort touching patients, and lack of time (5,6,24). Students in this study reported barriers similar to what has been found in other studies. Average simulation time was 5.8 minutes, demonstrating that the exam can be completed without taking up excessive time. Meanwhile, other barriers were addressed by providing training and hands-on experience in advance of the simulation, and most reported a reduction in discomfort touching patients from baseline.

Observation of students during the post-test simulation revealed key areas that can be improved. As demonstrated by the feedback from students to open-ended questions on the post-survey, some students were disoriented upon entering the simulation room and could be provided with more direction beforehand, such as telling them where the handwashing station, gloves, and penlight will be located. Students were also observed rushing through the exam and were hesitant to palpate the patient to the degree needed to truly assess the patient. This may have been related to “exam anxiety” and/or inadequacy in training materials. Some students did mention in their survey that they would like to see an instructor perform an NFPE in class as part of their training, which may be helpful in allowing students to visually observe palpation techniques. It is also possible that students did not feel the need to truly assess the patient, as there was no post-simulation write-up on the patient. If students were required to write up a brief note on their findings of the patient, they may spend more time adequately assessing the patient.

Other observations during the simulation included hesitance at moving the patient’s gown to properly assess around the shoulder and lower ribs, two key areas used to identify muscle and fat loss. One of the

aims of the simulations was to improve comfort with patient physical contact, and is something that will improve with time and practice. All students did well with bedside manner and the patient actor reported she felt comfortable with almost all students. However, the patient actor and observers noted that many students failed to inform the patient what they are looking for in the exam and what the findings of their assessment were. Multi-tasking by asking assessment questions during the exam was encouraged, and many students displayed this ability. The most common assessment questions were regarding appetite, chewing, and swallowing. Students assessed functional status primarily by asking questions that varied in scope, such as “Are you getting around at home OK?” and “Have you been needing extra help around the house?” It was apparent some students did not keep the client’s “story” from the case study in mind, as they gave her oral nutrition recommendations when the patient is having a J-tube placed tomorrow.

There were a few limitations of this study. Baseline pre-test scores (control) and post-test scores (intervention) were not taken under the same conditions. Students performed an exam on another student and had one observer for the pre-test. For the post-test, they performed the exam on a standardized patient actor with 2 observers. The control group data was taken in this way for research purposes to obtain a baseline measure of skills. There was also a lack of standardization among what is considered a “check” on the checklist of skills performed. The simulation can be improved by delineating exactly what constitutes a “check” on the skills checklist tool to reduce observer bias and improve inter-rater agreement. Another limitation was the lack of a patient write-up post-simulation. Students would benefit from documenting the degree of fat/muscle wasting and fluid accumulation, as well as documenting signs of micronutrient deficiencies or excess and using preferred terminology for a malnutrition diagnosis. Follow-through and documentation of patient care is a reality in clinical practice, and student experience would be better-rounded with post-visit documentation.

Student learning may be improved with some alterations and additions to the training process and materials. After the simulation, 81% (n=13) of students desired more training in assessing micronutrient

deficiencies and 44% (n=7) would like more training in patient communication skills. The training process can benefit from additional materials in these areas. In addition, practicing the exam on another student during class did not appear to be very helpful, as realism of this method is low and students seem directionless in their performance. Students may find more benefit from a class project such as creation of a video in which they perform an NFPE on a non-student “patient”. Educators can then give feedback for improvement based on the video. This method would save class time and is predicted to be more effective at preparing the students for the live simulation. Another strategy to save class time would be to have the students perform the simulation as part of their final exam in addition to their written exam, using the OSCE framework. The class is graduate level medical nutrition therapy and all students will have been through their clinical rotations for their dietetic internship at the end of the semester. As such, a practical exam in addition to the written exam seems a reasonable suggestion. The practical exam would allow instructors to observe students performing clinical skills in realistic situations and give valuable feedback. Additionally, simulation realism could be improved by allowing students to perform an entire nutritional assessment instead of solely the NFPE. It would be beneficial for students to perform the entire Nutrition Care Process (assessment, diagnosis, intervention, monitoring and evaluation to allow instructors to assess student’s performance through the entire continuum of patient care. The OSCE may be expanded to include additional stations to evaluate clinical skills in multiple areas. This would allow instructors to further evaluate other skills such as interpersonal communication, counseling, and knowledge of dietetics content (34-39). The recommended training timeline for subsequent years is delineated below.

**Recommended timeline:**

1. Introduce content in fall semester with malnutrition assessment lecture. Instructor and/or teaching assistant performs NFPE for class. Allow students to practice with one another. Provide access to training materials; review in class if time allows.
2. Additional practice: In fall semester, students participate in an NFPE simulation on a standardized patient actor and receive constructive feedback during the exam by an observer. If class time does

not allow this, alternatively, students may complete an NFPE project such as recording a video of themselves performing an NFPE on a non-student with post-assessment documentation.

3. Malnutrition in cancer: In the spring semester, students learn about the importance of assessing for malnutrition in the cancer population. Consider having students view SGA training video.
4. At semester end, students display clinical skills by completing a full assessment on a standardized patient as practicum component of their final examination. The simulation may be designed using OSCE as a framework. The OSCE may be expanded to include additional stations to evaluate clinical skills in multiple areas. It is recommended that students write-up the patient with an ADIME note, due within 48 hrs.

As a secondary outcome, students were asked for their opinion regarding use of a virtual simulation for NFPE education, as this was a training method considered in the development of this project. Students did not feel a virtual simulation would be an adequate replacement for a live role-play simulation. However, students noted that a virtual simulation would be useful as part of the training materials used in preparation for the role-play simulation. The virtual simulation could be created similarly to the interactive mobile app “Change Talk” to teach motivational interviewing, as discussed in the literature review. An interactive virtual NFPE simulation would be a useful training tool that could save on student and class time. It may be especially useful in the undergraduate setting, where students may not have access to simulated or real patients for hands-on experience.

To evaluate long-term effectiveness of the NFPE training program, a question assessing frequency of NFPE use in clinical practice may be added to the Master’s program exit survey. In the future, further exploration on use of simulations for NFPE training in dietetics students can be performed on larger samples from different populations. It would be beneficial to assess effectiveness of the program in other geographical locations, other types of dietetics programs, and on students in different stages of their education.

This study resulted in a training method for graduate dietetics students to learn the NFPE using a role-play simulation. The simulation showed effectiveness in improving NFPE skills and perceived competence and confidence performing the exam. Students could self-guide their education with given materials in preparation for the simulation, and benefitted from practicing the exam in a safe setting. Students also benefitted from constructive feedback for improvement. Student learning can further be improved by modifications to the training process as previously described. Overall, the study demonstrated it is feasible to incorporate an effective NFPE training program into graduate level dietetics curriculum.

## Appendix A: Consent Form

January 6, 2017

Dear Potential Subject,

This letter serves to answer some of the questions you may have about participating in the research study, “Simulations of the Nutrition-Focused Physical Exam in Dietetics Education.” Prior to your simulation, a research team member will review this letter with you and answer any further questions you have.

You will fill out surveys regarding the simulations you will be participating in as part of this class. During those surveys, you will be asked if your data can be used for this research study. If you do not want to participate in the research, indicate that you would not like to have your data used when you are filling out the survey. Please read on for further information.

You are being asked to participate in this study because you are a dietetics student who is enrolled in DN 826 in the Spring semester and will be participating a simulation of the nutrition-focused physical exam with a standardized patient actor at the University of Kansas Medical Center. You do not have to participate in this research study. The main purpose of the research is to evaluate the effectiveness of simulations as a training method for the nutrition-focused physical exam in dietetics students. Research studies may or may not benefit the people who participate.

Research is voluntary and you may change your mind at any time. There will be no penalty to you if you choose not to participate or if you start the study and decide to stop early. Participation in the study will not affect your grade.

You can ask questions now or at any time during the study. This study will take place in the Nutrition Literacy Lab (CCHD GO21).

### **Why is this study being done?**

Simulations are commonly used in educating health professionals, especially nursing and medical students. However, simulations are less common in dietetics education and the use of simulations to teach nutrition-focused physical assessments are less researched. We are investigating whether preparing for and participating in a role-play simulation improves nutrition-focused physical exam skills and confidence. We also hope to aid in future development of dietetics curriculum including the nutrition-focused physical exam.

### **What will I do if I participate in this study?**

You will fill out a pre-test survey that will take 10 to 15 minutes as part of the requirements for this class. After your simulation, you will fill out a similar post-test survey. If you choose to participate in this study, you will indicate during the survey that your data can be used. These surveys are online surveys and your data will be kept confidential. Your performance in the simulation will be evaluated using the Academy of Nutrition and Dietetics nutrition-focused physical exam skills checklist, which will be provided to you. We ask you to refrain from discussing the scenario with others at your school until the project is completed.

### **What are the risks of the study?**

There are no known risks associated with filling out the surveys. However, if you are uncomfortable with any of the questions that are contained in the survey, you can choose not to answer those questions. Your

survey data will be de-identified. The files will not be shared with anyone except the study personnel. There may be other risks of the study that are not yet known. You will be told anything new that might affect your decision to participate in the study.

**Are there any benefits to being in the study?**

You may improve your skills and confidence at performing nutrition-focused physical examinations. However, it is possible you may experience no benefits. Researchers hope the information gained from the study will benefit future students in developing curriculum to help them learn more effectively.

**Do I have to be in this study?**

Participation is voluntary. Participation in this study will have no effect on the grade you receive in this simulation or in your classes at KUMC.

**Will it cost anything to be in the study?**

There is no cost associated with participating in the study.

**Will I get paid to be in this study?**

You will not receive any form of payment for participating in the study.

**How will my privacy be protected?**

The researchers will protect your information. All surveys will be anonymous. The researchers may publish the results of the study. If they do, they will only discuss group results. Your name will not be used in any publication or presentation of this study. Print data (evaluation forms) will be stored in a locked file in a locked lab. Electronic data (survey) will be securely stored on the KUMC REDCap server and/or KUMC-supported network drive.

**Can I stop being in this study?**

You may stop being in this study at any time. Your decision to stop participating will not affect your grade in the simulation or in your coursework.

We look forward to speaking with you about this exciting research!

Sincerely,

Heather Gibbs, PhD, RD

Clinical Assistant Professor

School of Health Professions

Department of Dietetics and Nutrition

Caitlin Tyler, RD

Graduate Teaching Assistant

School of Health Professions

Department of Dietetics and Nutrition

Appendix B: NFPE Permission Approval Letter

August 26, 2016

University of Kansas Medical Center  
Heather Gibbs, PhD, RD  
Assistant Professor  
3901 Rainbow Blvd. MS 4013  
Kansas City, KS 66160  
(913)945-9138  
[hgibbs@kumc.edu](mailto:hgibbs@kumc.edu)



120 South Riverside Plaza  
Suite 2000  
Chicago, Illinois 60606-6995  
800.877.1600

Dear Heather Gibbs:

Thank you for your request to reprint the following content:

- NFPE Patient/RDN Script (Script for Performing Nutrition Focused Physical Exam (NFPE) on a Patient)
- NFPE Skills Assessment (Nutrition Focused Physical Exam (NFPE) Hands-On Training Skills Assessment)

The Academy understands that this information will be used for course material for educational use only (at the University of Kansas Medical Center). The materials below will be provided to the requestor, Heather Gibbs, in a secure PDF that cannot be forwarded to students. It will be available for two years from September 1, 2016 to September 1, 2018.

The Academy is pleased to grant the permission to reprint the content in PRINT based on the terms indicated below:

- You must include the credit line below on the first page of the reproduction:
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- Permission is granted for ONE-TIME, NON-EXCLUSIVE world rights in the English language.
- The material to be used has appeared in our publication without credit or acknowledgement to another source.
- A copy of your final product, when available, should be submitted.
- This permission is not valid until payment has been received by the Academy of Nutrition and Dietetics – Nutrition Focused Physical Exam Workshop in the amount of \$50. Please do not make payment until you have received an invoice. We will confirm receipt of payment.

We appreciate your interest in the Academy of Nutrition and Dietetics' Nutrition Focused Physical Exam Workshop Material. If you need further assistance, please let me know.

Kind Regards,

A handwritten signature in black ink that reads "Beth A. Mordarski". The signature is written in a cursive style and is positioned above a horizontal line.

Beth Mordarski, RDN, LD

NFPE Project Manager/Consultant

## Appendix C: Case Study and Actor Script

### Case Study:

#### **Summary**

Charlotte Dawson is a 58 year old female with esophageal cancer, moderately to poorly differentiated adenocarcinoma of the esophagus, stage IIB T1, N1, M0. She is scheduled for transhiatal esophagectomy tomorrow with plans for J-tube placement at time of surgery. She is receiving pre- and post-op external beam radiation therapy.

#### **Nutrition Assessment**

*Anthropometrics* Height: 64” Weight: 109#

#### *Client History*

Mrs. Dawson is married with 2 grown children. She is a ½ pack a day smoker x 35 years and drinks 1-2 alcoholic beverages most nights. 20 year history of GERD with Barrett’s esophagus and use of PPIs, pepcid and Tums. She complains of difficulty and pain with swallowing for 8 months. Pre-op radiation therapy (prior 3 weeks) has worsened swallowing difficulty and given her extreme dry mouth. She explains that food tends to “stick” in her throat. She often experiences burning and pain in her chest with occasional coughing and nausea. She also reports extreme fatigue, reduced appetite, and unintentional weight loss. Denies vomiting, diarrhea, constipation.

#### *Food/Nutrition History*

Recently at home has only been eating small amounts of scrambled egg, oatmeal, apple juice, canned peaches, and soup. She is currently NPO for surgery tomorrow.

#### *Biochemical/Tests/Procedures*

Modified barium swallow revealed functional oropharyngeal swallow, but moderate-severe esophageal dysphagia with delayed movement of liquids in upper esophagus and reflux into pharynx.

Sodium - 138 mEq/L	Alb - 2.9 mg/dL
Potassium - 3.7 mEq/L	Prealbumin - 8 mg/dL
Chloride - 100 mEq/L	Hgb - 11.5 mg/dL
Phos - 3.2 mg/dL	Hct - 37%
CO2 - 25 mEq/L	BUN - 15 mg/dL
Glucose - 89 mg/dL	Cr - 0.8 mg/dL

#### *Medications:*

- Famotidine 20 mg PO BID
- Omeprazole 20 mg qd
- Calcium carbonate liquid 1250mg PRN
- Compazine 25 mg rectal suppository PRN for nausea
- Percocet 5 mg/325 mg q 4 hrs PRN for pain. Max 12 tabs/day
- Marinol 5 mg PO BID, 30 min before meals

#### **Actor Script**

\*Note - the physical exam will reveal signs of nutrient deficiencies not truly present in the actor. Actor will need to supply the student with cues to what they are visually observing. Summary of cues located after the script\*

*[Student enters room and washes hands, puts on gloves]*

Hi Mrs. Dawson, I am (name). I am the dietitian and would like to assess your nutrition status by asking you a few questions and doing a brief physical exam.

- Nice to meet you (name).

*[Student may ask assessment questions before/during exam]*

How is your appetite?

- Not too good. It seems like I get full really fast. The doctor put me on Marinol to help with my appetite but I'm not sure if it's helping. The pain in my throat makes it difficult to eat. I also have a very dry mouth since starting radiation therapy which makes it hard to chew and swallow. I feel like I barely taste anything.

What is your usual weight/any weight loss?

- Well I normally weigh about 130 pounds. I know I've lost probably 20 pounds in the last 6 months or so though.

Do you take any supplements/vitamins etc?

- I've been taking Tums and Pepcid for my reflux for years now, but other than that, no.

Have you tried any nutrition drinks like Ensure or Boost?

- No, I've heard of those. They don't sound like they'd taste very good but I'd be willing to try them if it helps me gain back the weight I've lost.

How often do you have a bowel movement? Do you have problems with diarrhea or constipation?

- Usually I go every day, but lately it's been every 2-3 days. My guess would be because I'm not eating as much.

Have you had any vomiting or reflux?

- No vomiting, but reflux has always been an issue for me. I've been pretty nauseous lately, too.

Have you been experiencing any pain?

- Yes, my throat is always hurting. I also have these annoying painful cracks in the corners of my mouth that started a few months ago. My whole mouth, especially my tongue, seems to hurt.

*[Student begins physical examination]*

Now, I am going to do a nutrition exam to assess your muscle and fat status. This will include me lightly touching you on your head, arms, back, stomach, and legs to help me assess your nutrient stores. This exam should not hurt, so let me know if you have any tender areas.

- That sounds OK to me.

I will begin up here at your hair. Is this normal for you?

*[Actor cues student that hair is sparse, dry, dull, and/or pluckable]*

- My hair has been really dry and just doesn't have the sheen it used to. I also notice when I brush my hair it seems to be falling out. It's really thinned out lately.

Now I am going to look and feel around your eyes.

*[Student touches temporal region assessing for muscle loss. Student lightly presses under eyes, assessing orbital fat pads, and may pull eyelid down to assess for pallor]*

Now I will look into your eyes. Please look right. Now look left. Have you had any vision changes, problems seeing at night, or excessive dryness?

- No, none of that.

I am now going to look around your mouth.

*[Student assesses for fat loss the cheeks. Actor cues for angular stomatitis]*

- I have these burning cracks in the corners of my mouth that started up a few months ago. They've really been bothering me.

Can you please stick out your tongue? Now open your mouth?

*[Student uses penlight to examine oral cavity]*

Do you have any mouth pain, sores, or discomfort? Any bleeding from the gums?

*[Actor cues for glossitis]*

- My gums don't bleed, but I have really sore tongue lately. It also seems red and swollen to me. I also have a really dry mouth since starting radiation therapy.

Any difficulty chewing or swallowing? Coughing when eating or drinking?

- Yes, I've had problems with that. I had a swallow study done and they told me I'll need a feeding tube put in during my surgery tomorrow until it's safe for me to eat again.

Sometimes when patients lose weight, the face is one of the first places we notice. Have you noticed any changes when you look in the mirror? Have family or friends commented on this at all?

- Well I think my family's too nice to mention it, but I've sure noticed my face looks a little thinner. I'd really like to gain back the weight I've lost.

I am going to unbutton your gown to look at your upper body. First I will look at your shoulders. Have you noticed your clothes fitting differently or any areas of your body that looks different than usual?

*[Student unbuttons one or both sides of gown and palpates for muscle loss in the deltoids, clavicular/chest area]*

- My clothes have been feeling looser lately. I definitely feel like I've lost some muscle.

I'm going to feel around your arms now.

*[Student feels biceps for muscle tone and pinches under arm triceps for fat loss]*

Now can you lean forward for me so I can look at your back? Do you have any open sores or wounds?

*[Student assess scapula and rib prominence. Student may ask patient to lean forward or if they can stand and press their hands against the wall]*

- No sores or wounds that I know of.

Thank you, I will button up your gown now. I'd like to look at your hands now. Can you touch your thumb and pointer finger together?

*[Student observes interosseous muscle]*

Can I look at your nails? Have you noticed any changes in your nails?

*[Actor cues for brittle nails with ridges and white spots. Student may press nails to assess capillary refill]*

- Yes, they don't seem to be in too good of shape lately. They always seem to break, and have all these ridges and white spots.

Now I'm going to move down to examine your legs. Do you ever notice fluid accumulation around your ankles or the lower parts of your legs?

*[Student palpates quadriceps/calf, presses ankles for edema]*

- No, I haven't noticed any of that.

Ok, the exam is done. I have a couple more questions. Has there been any change in your ability to move around? Are you able to do the things you enjoy? Have you needed help doing things around the house? Do you feel weak? How is your energy level?

*[Student assess for functional status. Questions may vary]*

- I definitely noticed I feel weaker and more tired lately. Thankfully I have my husband to help around the house because I don't have the energy to clean and cook like I used to. I'm glad you're here to help me because I'd love to feel stronger and get back to my old self.

Thank you for your time and patience. The exam was helpful to get a better picture of your nutrition. You have signs of both muscle and fat wasting, which is not uncommon with the amount of weight you've lost. I also noticed a couple of things such as your brittle nails/hair and sore tongue/mouth, which may mean we need to add some nutrients to your diet. I will talk to your doctor, possibly recommend some bloodwork to see how your nutrient levels are. Do you have any questions for me?

- No thank you.

I'll follow up with you after your surgery and we'll discuss making sure you get the nutrition you need to get back to your old self. Thank you.

*Summary of cues actor must mention to student during exam:*

- Usual weight of 130#, weight loss of 20# in 6 months
- Hair dull, dry, sparse, falling out
- Burning painful cracks in the corners of mouth
- Sore red tongue
- Weak, brittle nails with ridges and white spots

Student to identify:

- Usual weight, weight loss
  - Usual weight = 130# (6 months ago)
- Nutrient deficiencies
  - Angular stomatitis - riboflavin, niacin, B6, folate (B-vitamins), iron, zinc
  - Glossitis - iron, folate, niacin, riboflavin, B6, B12 (B-vitamins)
  - Fatigue - iron, protein, B-vitamins
  - Dull, dry pluckable hair - protein, energy, iron, zinc, EFA
  - Nails - ridges, white spots - iron, zinc, protein

Muscle/fat wasting assessment will depend on body composition of patient actor.

## Appendix D: Training Packet

### *Participant Learning Objectives:*

1. Assess subcutaneous fat stores, muscle stores, fluid accumulation, functional status, and micronutrient deficiencies.
2. Use appropriate communication skills to gather assessment data from patients and help them feel comfortable during the exam.
3. Identify degree of malnutrition using appropriate terminology.
4. Feel confident performing NFPE skills.

### Training Packet included:

- Journal Articles
    - Fischer M, JeVenn A, and Hipskind P. Evaluation of Muscle and Fat Loss as a Diagnostic Criteria for Malnutrition. *Nutrition in Clinical Practice*. 2015;30(2):239-248.
    - Esper DH. Utilization of Nutrition-focused Physical Assessment in Identifying Micronutrient deficiencies. *Nutrition in Clinical Practice*. 2015;30(2):194-202.
    - Russell MK. Functional Assessment of Nutrition Status. *Nutrition in Clinical Practice*. 2015;30(2):211-218
    - Jensen GL, Hsiao PY, Wheeler D. Adult Nutrition Assessment Tutorial. *JPEN*. 2012;36(3):267-74.
  - Videos
    - Abbott Nutrition Health Institute Video- “Patient Simulation: Putting Malnutrition Screening, Assessment, Diagnosis, and Intervention into Practice”
    - YouTube– Students search for “Nutrition-focused Physical Assessment/Exam” and “Subjective Global Assessment”
    - “Listen to Your Body Talk” By Coco Newton – Dietetics in Integrative Medicine Archived Webinar – Permission given to use
  - Patient-RDN script - the Academy of Nutrition and Dietetics
  - Observations sheet - To record observations as you are performing the exam.
  - Three reference charts of clinical signs and symptoms of nutrient deficiencies
- Formative feedback from observer during pre-test NFPE

## Appendix E: Pre-Test Survey

### Pre-Test Survey

1. How important is it to perform nutrition-focused physical exams as part of a nutritional assessment?
  - a. Not important
  - b. Slightly important
  - c. Fairly important
  - d. Important
  - e. Very important
2. How likely are you to perform NFPE regularly in clinical practice?
  - a. Not at all
  - b. Slightly
  - c. Moderately
  - d. Very
  - e. Extremely
3. How comfortable do you feel touching patients/clients to perform an NFPE?
  - a. Very uncomfortable
  - b. Uncomfortable
  - c. Neither uncomfortable nor comfortable
  - d. Comfortable
  - e. Very comfortable
4. How would you rate your ability to assess an individual's subcutaneous fat stores?
  - a. Very poor
  - b. Poor
  - c. Fair
  - d. Good
  - e. Very good
5. How would you rate your ability to assess an individual's muscle stores?
  - a. Very poor
  - b. Poor
  - c. Fair
  - d. Good
  - e. Very good
6. How would you rate your ability to assess an individual for fluid accumulation?
  - a. Very poor
  - b. Poor
  - c. Fair
  - d. Good
  - e. Very good
7. How would you rate your ability to assess an individual's functional status?
  - a. Very poor
  - b. Poor
  - c. Fair

- d. Good
  - e. Very good
8. How would you rate your ability to assess for physical signs of micronutrient deficiencies or excesses?
- a. Very poor
  - b. Poor
  - c. Fair
  - d. Good
  - e. Very good
9. Which, if any, do you feel are barriers for you in performing a nutrition-focused physical exam? Check all that apply.
- a. Lack of training/education
  - b. Lack of hands-on experience
  - c. Discomfort touching patients
  - d. Other \_\_\_\_\_
10. Are there any specific areas of NFPE you would like more education/training on? Check all that apply.
- a. Malnutrition diagnosis/criteria terminology
  - b. Assessing muscle and/or fat wasting
  - c. Assessing micronutrient deficiencies
  - d. Communication skills with patient
  - e. Additional hands on-experience
  - f. Other \_\_\_\_\_
11. I consent to use of my survey data for research purposes.
- a. Yes
  - b. No

## Post-Test Survey

### *Perceived skills*

1. How important is it to perform nutrition-focused physical exams as part of a nutritional assessment?
  - a. Not important
  - b. Slightly important
  - c. Fairly important
  - d. Important
  - e. Very important
2. How likely are you to perform NFPE regularly in clinical practice?
  - a. Not at all
  - b. Slightly
  - c. Moderately
  - d. Very
  - e. Extremely
3. How comfortable do you feel touching patients/clients to perform an NFPE?
  - a. Very uncomfortable
  - b. Uncomfortable
  - c. Neither uncomfortable nor comfortable
  - d. Comfortable
  - e. Very comfortable
4. How would you rate your ability to assess an individual's subcutaneous fat stores?
  - a. Very poor
  - b. Poor
  - c. Fair
  - d. Good
  - e. Very good
5. How would you rate your ability to assess an individual's muscle stores?
  - a. Very poor
  - b. Poor
  - c. Fair
  - d. Good
  - e. Very good
6. How would you rate your ability to assess an individual for fluid accumulation?
  - a. Very poor
  - b. Poor
  - c. Fair
  - d. Good
  - e. Very good
7. How would you rate your ability to assess an individual's functional status?
  - a. Very poor
  - b. Poor

- c. Fair
  - d. Good
  - e. Very good
8. How would you rate your ability to assess for physical signs of micronutrient deficiencies or excesses?
- a. Very poor
  - b. Poor
  - c. Fair
  - d. Good
  - e. Very good

*Simulation Quality*

9. I was guided through the simulation process appropriately and given adequate instruction.
- a. Strongly disagree
  - b. Disagree
  - c. Agree
  - d. Strongly agree
10. The case study and training materials adequately prepared me for the simulation.
- a. Strongly disagree
  - b. Disagree
  - c. Agree
  - d. Strongly Agree
11. The formative feedback session was helpful (the first NFPE practiced with partners).
- a. Strongly disagree
  - b. Disagree
  - c. Agree
  - d. Strongly agree
12. Please rate the realism of the simulation experience.
- a. Very poor
  - b. Poor
  - c. Acceptable
  - d. Good
  - e. Very good
13. The simulation increased my proficiency and confidence in performing an NFPE.
- a. Strongly disagree
  - b. Disagree
  - c. Agree
  - d. Strongly Agree
14. Are there any areas of NFPE you would like more education/training on? Check all that apply.
- a. Malnutrition diagnosis/criteria terminology
  - b. Assessing muscle and/or fat wasting
  - c. Assessing micronutrient deficiencies
  - d. Communication skills with patient

- e. Additional hands on-experience
- f. Other \_\_\_\_\_

*Virtual Simulations*

- 15. A virtual simulation of the NFPE delivered on a mobile platform (e.g. smartphone/tablet app or website) would be a useful teaching tool for the NFPE.
  - a. Strongly disagree
  - b. Disagree
  - c. Agree
  - d. Strongly Agree
- 16. I would prefer a virtual simulation over a live role-play simulation.
  - a. Strongly disagree
  - b. Disagree
  - c. Agree
  - d. Strongly Agree
- 17. A virtual simulation would help students learn NFPE skills just as well as a live role-play simulation.
  - a. Strongly disagree
  - b. Disagree
  - c. Agree
  - d. Strongly Agree
- 18. How would a virtual simulation compare to a live role-play simulation, with regards to effectiveness in teaching NFPE skills to students?
  - a. It would be much worse
  - b. It would be somewhat worse
  - c. It would be the same
  - d. It would be somewhat better
  - e. It would be much better

*Reflection*

- 19. What did you enjoy about the simulation experience?
  - a. Free text
- 20. What did you learn from the simulation?
  - a. Free text
- 21. What feedback do you have for improvement of the NFPE simulation?

Free text

Appendix G: Results

Table 5: Paired Survey Data Frequency Table (n=16)

Question	Survey	Response Category					p-value
		Very important	Important	Fairly Important	Slightly important	Not important	
How important is it to perform nutrition-focused physical exams as part of a nutritional assessment?	Pre-test	6	5	3	2	0	0.02
	Post-test	10	5	1	0	0	
		<b>Response Category</b>					
		Extremely	Very	Moderately	Slightly	Not at all	
How likely are you to perform NFPE regularly in clinical practice?	Pre-test	2	3	9	2	0	0.215
	Post-test	3	6	6	1	0	
		<b>Response Category</b>					
		Very comfortable	Comfortable	Neutral	Uncomfortable	Very Uncomfortable	
How comfortable do you feel touching patients/clients to perform an NFPE?	Pre-test	1	5	2	6	0	0.006
	Post-test	1	10	3	2	0	
		<b>Response Category</b>					
		Very Good	Good	Fair	Poor	Very Poor	
How would you rate your ability to assess an individual's subcutaneous fat stores?	Pre-test	0	5	7	3	1	0.002
	Post-test	2	10	3	1	0	
How would you rate your ability to assess an individual's muscle stores?	Pre-test	0	6	7	2	1	0.002
	Post-test	2	10	3	1	0	
How would you rate your ability to assess an individual for fluid accumulation?	Pre-test	0	6	7	3	0	0.010
	Post-test	2	8	6	0	0	
How would you rate your ability to assess an individual's functional status?	Pre-test	1	5	6	3	1	0.171
	Post-test	0	9	4	3	0	
How would you rate your ability to assess for physical signs of micronutrient deficiencies or excesses?	Pre-test	0	3	8	3	2	0.017
	Post-test	0	5	10	1	0	
		<b>Response Category</b>					
		<b>Checked</b>			<b>Unchecked</b>		
	Pre-test	7			9		

What areas of NFPE you would like more education/training on? Check all that apply. (choice=Malnutrition diagnosis/criteria terminology)	Post-test	3	13	0.079
What areas of NFPE you would like more education/training on? Check all that apply. (choice=Assessing muscle and/or fat wasting)	Pre-test	10	6	
	Post-test	2	14	0.006
What areas of NFPE you would like more education/training on? Check all that apply. (choice=Assessing micronutrient deficiencies)	Pre-test	14	2	
	Post-test	13	3	0.328
What areas of NFPE you would like more education/training on? Check all that apply. (choice=Communication skills with patient)	Pre-test	6	10	
	Post-test	7	9	0.328
What areas of NFPE you would like more education/training on? Check all that apply. (choice=Additional hands on-experience)	Pre-test	9	7	
	Post-test	4	12	0.013

Table 6: Unpaired Survey Data – Frequency Distribution (n=16)

Question	Survey	Response Category	
		Checked (Yes)	Unchecked (No)
Do you feel like lack of training or education is a barrier to performing an NFPE?	Pre-test	11 (68.8%)	5 (31.2%)
Do you feel like lack of hands-on experience is a barrier to performing an NFPE?	Pre-test	14 (87.5%)	2 (12.5%)
Do you feel like discomfort touching patients is a barrier to performing an NFPE?	Pre-test	10 (62.5%)	6 (37.5%)

Do you feel like lack of time is a barrier to performing an NFPE?	Pre-test	12 (75%)		4 (25%)	
		<b>Response Category</b>			
		Strongly agree	Agree	Disagree	Strongly Disagree
I was guided through the simulation process appropriately and given adequate instruction.	Post-test	2 (12.5%)	11 (68.8%)	3 (18.8%)	0
The case study and training materials adequately prepared me for the simulation.	Post-test	3 (18.8%)	12 (75%)	1 (6.3%)	0
The simulation increased my proficiency and confidence in performing an NFPE.	Post-test	6 (37.5%)	8 (50%)	2 (12.5%)	0
A virtual simulation of the NFPE delivered on a mobile platform (e.g. smartphone/tablet app or website) would be a useful teaching tool for the NFPE.	Post-test	2 (12.5%)	11 (68.8%)	3 (18.8%)	0
I would prefer a virtual simulation over a live role-play simulation.	Post-test	0	2 (12.5%)	10 (62.5%)	4 (25%)
A virtual simulation would help students learn NFPE skills just as well as a live	Post-test	0	2 (12.5%)	11 (68.8%)	3 (18.8%)

role-play simulation.						
		<b>Response Categories</b>				
		Very good	Good	Fair	Poor	Very Poor
Please rate the realism of the simulation experience.	Post-test	2 (12.5%)	10 (62.5%)	3 (18.8%)	1 (6.3%)	0
		<b>Response Categories</b>				
		Much Better	Somewhat better	The same	Somewhat worse	Much worse
How would a virtual simulation compare to a live role-play simulation, with regards to effectiveness in teaching NFPE skills to students?	Post-test	0	0	2 (12.5%)	12 (75%)	0

Table 7: Survey Qualitative Data (Common Themes)

Question	Number of Responses Identified with Theme (Percentage)	Theme
What did you enjoy about the simulation experience?	11 (68.8%)	Patient was realistic
	6 (37.5%)	Opportunity to practice in a safe environment
	2 (12.5%)	Increased confidence/comfort performing NFPE in clinical practice
What did you learn from the simulation?	4 (25%)	Memorization of a standardized process for NFPE
	3 (18.8%)	Gained hands-on experience
	3 (18.8%)	Multitasking during exam
	2 (12.5%)	How to be comfortable touching patients
	2 (12.5%)	Performing an NFPE is quicker/easier than anticipated

	2 (12.5%)	Communication with patient during exam
What feedback do you have for improvement of the NFPE simulation?	4 (25%)	Increase simulation realism
	3 (18.8%)	Training packet additions
	3 (18.8%)	Additional practice session
	2 (12.5%)	More direction/orientation
	2 (12.5%)	Feedback for post-test
	2 (12.5%)	Watch instructor perform an exam

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