Dysphagia (2011) 26:352–360
DOI 10.1007/s00455-010-9316-y

ORIGINAL ARTICLE

The Use of Simulation in Training Graduate Students to Perform Transnasal Endoscopy

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Received: 17 December 2009 / Accepted: 12 November 2010 / Published online: 3 December 2010

Abstract A challenge facing the field of speech-language pathology is how to equip students at the university level with the transnasal endoscopy skills needed to perform fiberoptic endoscopic evaluation of swallowing (FEES). The use of simulation has the potential to allow students to gain transnasal endoscopy experience with repetitive practice without compromising patients. The present study examined the effects of two different forms of simulation training on multiple transnasal endoscopic passes on healthy volunteers by graduate student clinicians as measured by procedure duration and confidence ratings. Eighteen speech-language pathology graduate student clinicians were randomly assigned to groups that utilized either a human patient simulator (HPS) or a non-lifelike simulator for transnasal endoscopy training. Using a flexible nasal endoscope, each clinician performed seven training passes on a simulator and one pass on two different volunteers. Each volunteer was endoscoped two times, once by a clinician trained using a HPS and once by a clinician trained using a non-lifelike simulator. There was no difference in pass times on volunteers between clinicians trained using the HPS and clinicians trained on the non-lifelike simulator. Both training groups were faster and more confident on the second endoscopy on a volunteer than on the first.

Keywords FEES · Flexible nasal endoscope · University programs · Dysphagia · Instrumental evaluation · Swallowing disorders · Deglutition · Deglutition disorders · Fiberoptic endoscopic evaluation of swallowing · Transnasal endoscopy

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Fiberoptic endoscopic evaluation of swallowing (FEES) is an imaging procedure utilized by speech-language pathologists to evaluate swallowing function [1]. The FEES procedure allows for dynamic examination of the anatomy and physiology of pharyngeal and laryngeal structures at the level of the soft palate and below [2]. Guidelines from the American Speech-Language-Hearing Association (ASHA) suggest that graduate-level swallowing courses include hands-on training in the FEES procedure [3], raising the issue of how to equip speech-language pathology students with basic transnasal endoscopy skills needed to perform FEES. The current training and competency guidelines recommended by ASHA stipulate a three-step process for the acquisition of the technical endoscopy skills involved in the FEES procedure: (1) observation, (2) practice under direct supervision, and (3) independent practice with indirect supervision [4]. ASHA guidelines do not recommend who or what should serve as a patient for practice under direct supervision (step 2) [3].

Simulation has the potential to give speech-language pathology students experience through repetitive practice, bridging observation (step 1) and practice under direct supervision (step 2) without compromising patients [4]. Simulation is being incorporated into multiple healthcare disciplines to train procedural skills prior to practicing on standard patients. Simulators include lifelike mannequins, referred to as human patient simulators (HPS), or non-lifelike simulators such as practice cards for suturing [5, 6]. The use of simulation facilitates the acquisition of clinical skills through repetitive practice, resulting in increased proficiency, knowledge, and self-confidence [5–7]. In 2008, 91% of emergency medicine residency programs in the United States used some form of simulation for practicing medical procedures during residency

training, with 85% of the programs using HPS [8]. Other healthcare fields, including pharmacy and nursing, also incorporate skill training using HPS into their education curricula [9].

While simulation training can be valuable in providing initial experience and familiarization with equipment, multiple repetitions on human patients are also required to become competent in performing medical procedures, with the number of repetitions dependent upon the complexity of the procedure and complexity of the patient [10]. For example, medical residents and fellows need to perform more than 100 procedures to become competent at performing esophagogastroduodenoscopies. ASHA guidelines do not state a specific number of repetitive procedures or criterion at each step to assume clinician competence in performing transnasal endoscopy for FEES; instead they recommend that individual institutions develop a written list of competencies for performing transnasal endoscopy and FEES since presently credentialing or privileging to perform FEES is institution- or state-specific [11].

The present study examines (1) the effects, if any, of two different forms of training, HPS and a non-lifelike simulator, on the acquisition of transnasal endoscopy skills; (2) the effects of repetitive practice during the first two transnasal endoscopy passes on healthy volunteers by speech-language pathology graduate students; and (3) the self-assessment of confidence and competency by speech-language pathology graduate students following transnasal endoscopy procedures on healthy volunteers.

Method

Experimental Design

This was a randomized controlled study of the effects of HPS and non-lifelike simulation training on multiple transnasal endoscopic passes on normal, healthy, female adult volunteers by speech-language pathology graduate students. The primary outcome measure was time (in seconds) required for each clinician to pass the transnasal endoscope on two volunteers following simulation training. The study was approved by the Institutional Review Board of Washington State University.

Participants

Eighteen graduate students in speech-language pathology, who had completed a graduate-level course in dysphagia within the preceding year served as clinicians, and 18 healthy adult female volunteers, who self-reported no history of nasal trauma or surgery, served as volunteers.

Instrumentation

Human Patient Simulator This study utilized a HPS and a non-lifelike simulator. The human patient simulator was a laboratory-modified adult head and neck mannequin (G.H. Stoelting Company Scientific Apparatus; Fig. 1), mounted on a wooden frame and seated in a standard office chair. The external nares were 1.333 m above the floor. Inferior, middle, and superior nasal turbinates and vocal folds, respectively, were made of 2 mm and 4 mm red- and flesh-colored Fibrecraft foam sheets and Loctite Liquid Super Glue and inserted in the mannequin, simulating human adult structures when viewed through a flexible nasal endoscope.

Non-lifelike Simulator The non-lifelike simulator was an unopened standard medical glove box, 234 mm × 133 mm × 82 mm, encased in factory-applied protective plastic wrap and positioned on a cart 1.333 m above the floor (Fig. 2). Two straight parallel lines, separated by 8 mm, were drawn with black marker across the width of the box, simulating a human adult nasal floor when viewed through a flexible nasal endoscope. A target, simulating vocal folds, was on the cart positioned immediately posterior and inferior to the box.

Equipment The KayPentax Digital Swallow Station model 7200 ver. 2.0 was used for simulation and transnasal endoscopy procedures. The procedures were recorded using the integrated Panasonic GP-KS162 camera. A Welch Allyn RL-150 fiberoptic nasolaryngoscope was used during the simulation training. An FNL-7RP3 fiberoptic nasolaryngoscope with an ultraslim 2.4-mm insertion

Fig. 1 Human simulation mannequin

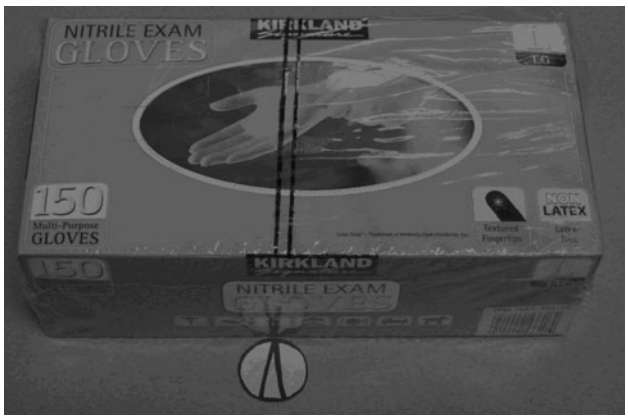

Fig. 2 Nonhuman simulator

tube and a tapered distal tip were used to perform the transnasal endoscopy procedure on the volunteers.

ASHA training guidelines state that adequate manual motor skills are a prerequisite for performing endoscopy [12]. The Purdue Pegboard was used to assess clinician manual dexterity [13]. The Purdue Pegboard includes four subtests: right hand only, left hand only, both hands together, and assembly. Scores are determined by the number of pins inserted into a pegboard or the number of pins, collars, and washers assembled within a specified time interval.

Clinician and Volunteer Surveys

Following each transnasal endoscopy procedure on a volunteer, a nine-question Likert scale survey was used to evaluate clinicians' self-assessment of confidence and competence (Appendix A). A seven-question Likert scale survey was used to evaluate volunteers' perceptions of confidence and competence (Appendix B). The surveys were developed by the authors and reviewed by four members of the Washington State University Spokane's Simulation Professionals Network, an organization of healthcare professionals from nursing, pharmacy, dental hygiene, and physician assistant programs who use human patient simulation for education and training, and by two faculty members from the Department of Speech and Hearing Sciences.

Procedures

Day 1: Training The study was conducted over two consecutive days. On day 1, all clinicians attended a 90-min training session, which included two viewings of a laboratory-designed video of transnasal endoscopy showing (1) the use of the equipment, (2) hand positioning on the scope, (3) hand positioning on the patient, (4) an external view during the transnasal endoscopy procedure, and (5) an internal view (through the endoscope) during the transnasal endoscopy procedure. Also on day 1, live instruction included (1) an overview of FEES, (2) a review of anatomy and physiology of the pharyngeal and nasal structures, (3) observation of a transnasal endoscopy procedure, and (4) a 10-min hands-on session practicing hand positioning and the endoscopic insertion technique using flexible drinking straws. The training and transnasal endoscopy demonstration were performed by the first author, a speech-language pathology graduate student and the second author, a professor and speech-language pathologist with more than 20 years of experience assessing and treating patients with dysphagia. Both authors had attended multiday transnasal endoscopy and FEES workshops and were certified in transnasal endoscopy at Washington State University.

Nine clinicians were randomly assigned to the HPS training group and nine clinicians were assigned to the non-lifelike simulator training (control) group. The clinicians assigned to the HPS training group participated in seven passes of the flexible nasal endoscope on the mannequin. The clinicians assigned to the non-lifelike simulation training group participated in seven passes of the flexible nasal endoscope on the non-lifelike simulator. Seven is the standard number of trials for the acquisition of a foundational skill using a mannequin in the field of nursing (S. Kardong-Edgren, personal communication, April 2009).

Day 2: Transnasal Endoscopy On day 2, each clinician completed the Purdue Pegboard test and then performed transnasal endoscopy on two volunteers. Each volunteer was endoscoped by one randomly assigned clinician from the HPS training group and one randomly assigned clinician from the non-lifelike simulator training group. The order of transnasal endoscopy, HPS-trained clinician first or second, for each volunteer was also randomized. To maintain random assignment, accommodate clinicians' and volunteers' schedules, and minimize endoscope cleaning and disinfecting time, volunteers were not always scoped by one clinician performing his or her first endoscopy procedure and one clinician performing his or her second procedure.

Clinicians were allowed a maximum of 3 min from the time the scope entered the nares to the time the scope reached home position, defined as the scope tip resting on the base of the tongue above the epiglottis with the vocal folds in view and centered in the monitor. Three minutes, excluding the time the endoscope was out of the nose if it was withdrawn and reinserted, was the maximal length of pass time, as agreed on by the investigators, without causing undue discomfort for the volunteers. Volunteers were reminded that they could ask to have the endoscope withdrawn at anytime without "hard feelings." No topical

anesthetic was used during the transnasal endoscopy procedures.

All procedures on volunteers were video recorded on the KayPentax Swallow Station. The elapsed pass time was measured and recorded for each clinician's first and second transnasal endoscopy procedure after data collection, using "in" and "out" markers on the timeline in the video editing software program (Final Cut Pro 6, Apple Inc., Cupertino, CA, 2007). Elapsed pass time was calculated using two different measures, Total Procedural Time and Total Time in the Nose. Total Procedural Time was calculated from the time when the endoscope first entered the nares to when the endoscope reached home position, regardless of whether the endoscope was withdrawn from the nose and reinserted due to a clinician's difficulty in visualizing the nasal passage. Total Time in the Nose was calculated from the time the endoscope entered the nares during single or multiple starts, but excluded all time the endoscope was withdrawn from the nose.

Following the first endoscopy procedure (Scope 1) and second endoscopy procedure (Scope 2) on a volunteer, clinicians and volunteers completed their respective confidence and competence surveys.

Data Analysis

Group comparisons (HPS and non-lifelike) were analyzed with unpaired *t* tests for Total Procedural Time, Total Time in the Nose, and the Purdue Pegboard manual dexterity subtest scores. The clinicians' Total Procedural Time and Total Time in the Nose for Scope 1 and Scope 2 were compared with paired *t* tests. Responses on the clinicians' and volunteers' surveys were analyzed with two-way analysis of variance (ANOVA). The relationships among simulation groups, Total Procedural Time, Total Time in the Nose for Scope 1 and Scope 2, and Purdue Pegboard manual dexterity subtest scores were analyzed with a Pearson Product Moment Correlation. An α level of 0.05 was set.

Results

Seventeen of the 18 clinicians were able to perform the transnasal endoscopy procedure, entering the nares and reaching home position, within the 3-min time limit. One clinician (non-lifelike simulation trained) was eliminated from the study due to inability to find home position after 3 min of Time in the Nose.

Due to difficulty in visualizing nasal passages, one clinician from the HPS training group and five clinicians from the non-lifelike simulator training group on Scope 1 and three clinicians from the HPS training group and two clinicians from the non-lifelike simulator training group on Scope 2 withdrew and reinserted the flexible nasal endoscope.

There were no significant differences between clinicians trained using HPS and clinicians trained using non-lifelike simulation with respect to Total Procedural Time ($t = 0.50$, $p = 0.62$) and Total Time in the Nose ($t = 0.28$, $p = 0.78$). There was a significant difference between Scope 1 and Scope 2 when the simulation training groups were combined for Total Procedural Time ($t = 2.15$, $p < 0.05$) and for Total Time in the Nose ($t = 2.69$, $p < 0.05$; Fig. 3). The differences between Scope 1 and Scope 2 approached but did not reach levels of significance when the training groups were examined individually, likely due small sample size. Means, SD, range, and confidence intervals by group and by Scope 1 and 2 are given in Table 1. All clinicians performed within normal limits on all subtests of the Purdue Pegboard test, with no differences across human simulation and non-lifelike simulation groups for the Purdue Pegboard subtests of right hand only, left hand only, or both hands together. The HPS group was faster than the non-lifelike simulation group for the Purdue Pegboard assembly subtest ($t = 2.16$, $p < 0.05$). There was no significant relationship between any of the Purdue Pegboard manual dexterity subtests and Total Procedural Time or Total Time in the Nose for Scope 1 or Scope 2.

On the clinician survey, 15 of the 17 clinicians reported greater confidence after performing Scope 2 than after performing Scope 1. Clinician confidence ratings increased for (1) instructions to the patient, (2) approaching the patient, (3) bracing on the patient, (4) inserting the flexible nasal endoscope, (5) passing the scope past the nasal turbinates, (6) viewing the pharynx, (7) perceived patient comfort, (8) overall procedure, and (9) procedural competence from Scope 1 to Scope 2 (Table 2). On Scope 2, clinicians who answered "agree" or "strongly agree" to clinicians' survey question 3: "I was confident in approaching the patient," and question 8: "I was confident in my ability to pass the scope on the patient," had faster Total Procedural Time ($F_{1,16} = 22.84$, $p < 0.001$ for question 3; $F_{1,16} = 14.09$,

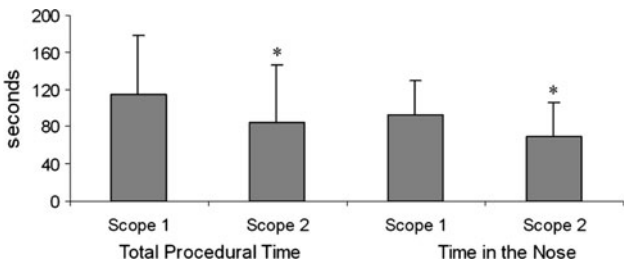

Fig. 3 Mean and standard deviation values for duration of Scope 1 and Scope 2

Table 1 Means, standard deviation, minimum, and maximum for total procedural time (TPT) and time in the nose (TIN) during transnasal endoscopy procedure (in seconds) on healthy volunteers by group, Human Patient Simulator (HPS), and non-lifelike simulator, and number of participants

Simulator group	Scope	Measure	*N*	Mean	SD	Min	Max	Confidence interval
HPS	1	TPT	9	122.10	82.79	41.32	310.16	−68.81–313.01
HPS	2	TPT	9	92.08	82.73	31.22	282.54	−98.70–282.86
Non-lifelike	1	TPT	8	105.39	46.56	29.12	182.12	−4.71–215.49
Non-lifelike	2	TPT	8	74.95	43.72	32.20	167.52	−28.43–178.33
HPS	1	TIN	9	94.56	42.99	41.32	167.50	−4.57–193.69
HPS	2	TIN	9	68.29	45.21	31.22	148.02	−35.96–172.54
Non-lifelike	1	TIN	8	89.20	33.33	29.12	133.24	10.39–168.01
Non-lifelike	2	TIN	8	68.67	30.27	32.20	120.28	−2.91–140.25

$p < 0.01$ for question 8) and Total Time in the Nose ($F_{1,16} = 6.29$, $p < 0.05$ for question 3; $F_{1,16} = 8.07$, $p < 0.05$ for question 8) than clinicians who answered "strongly disagree," "disagree," or "neither agree or disagree." There were no significant group differences on volunteers' surveys, including preference for clinicians trained using the HPS or the non-lifelike simulator.

Discussion

The ASHA graduate curriculum on swallowing and swallowing disorders recommends that students receive hands-on training in the FEES procedure [3]. During a discussion of incorporating hands-on transnasal endoscopy required for FEES into the speech-language pathology graduate program at our university, the faculty expressed three concerns: (1) patient safety, (2) equipment cost, and (3) supervision. The use of simulation has been widely advocated as a means of developing skills of healthcare students resulting in improved patient safety [9]. The present study examined the use of simulation using a HPS and a non-lifelike simulator as a means of providing graduate students with transnasal endoscopy experience through repetitive trials prior to practicing on humans to minimize patient risk. The results showed that there was no difference between the group trained on the HPS and the group trained on the non-lifelike glove box in the time (Total Procedural Time or Total Time in the Nose) required to perform transnasal endoscopy on a human volunteer. This may indicate that repetitive endoscopy practice on a glove box is as effective in training students as the more costly HPS or it may indicate that the HPS used in the present study was not adequately human-like to simulate a realistic transnasal endoscopic procedure.

One of the commonly cited barriers to implementing HPS is that simulation is too unrealistic to effectively transfer to real patients [9]. The glove box was definitely unrealistic. The HPS used in the present study, although visually similar to a human patient, lacked the realism of the sophisticated mannequins used in training physicians, nurses, and pharmacists. The HPS used in the present study had a hard cold feel to the skin, inflexible external nares, and lacked the capacity to simulate physiological reactions. Highly sophisticated HPS mannequins used in training of healthcare students and professionals provide immediate feedback through audio voice and sounds, eyes that open and close, pupils that dilate, and patient monitors that enable tracking of physiological parameters over time. Increasing realism in simulation training raises a second concern. Training students in endoscopy is costly. In addition to the purchase and maintenance costs of the endoscopy equipment, sophisticated HPS mannequins range from $40,000 for a basic HPS to well over $95,000 for a sophisticated mannequin [9].

During graduate school it may not be feasible for students to become competent and independent in performing transnasal endoscopy, but through simulation practice under supervision it may be possible to master a basic skill set in preparation for eventual competence in transnasal endoscopy following graduation. Simulation allows for flexibility in who provides direct supervision during transnasal endoscopy training because patient safety is not a concern. In the present study, a graduate student, who had participated in a weekend endoscopy and FEES training seminar and met Washington State University's institutional competencies for performing transnasal endoscopy, provided the clinician instruction and simulation supervision. An ASHA-certified speech-language pathologist, who was endoscopy-certified at Washington State University, and a registered nurse trained in endoscopy were present only for the transnasal endoscopy on volunteers. Incorporating simulation into a graduate program reduces the need for direct faculty supervision by allowing trained graduate

Table 2 Number of clinicians responding to each option by question, group, and scope

Survey question No.	Survey question topic	Human patient simulator					Human patient simulator				
		Scope 1					Scope 2				
		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1	Instructions	0	0	1	6	2	0	0	0	7	2
2	Approach	0	2	3	4	1	0	0	1	6	2
3	Bracing	0	0	2	6	1	0	0	0	7	2
4	Insertion	1	0	2	6	0	0	2	1	4	2
5	Nasal turbinate	1	0	1	6	0	0	2	1	4	2
6	Pharynx	0	1	1	6	1	0	0	0	5	4
7	Patient comfort	0	4	3	2	0	1	0	3	4	1
8	Confidence	1	1	3	4	0	0	0	3	2	4
9	Competence	1	0	2	5	1	0	1	2	2	4
		Non-lifelike simulator					Non-lifelike simulator				
		Scope 1					Scope 2				
Survey question No.	Survey question topic	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1	Instructions	0	0	0	5	3	0	0	1	3	4
2	Approach	0	1	3	4	0	0	0	0	8	0
3	Bracing	0	2	4	2	0	0	0	2	2	4
4	Insertion	0	2	4	2	0	0	0	4	4	0
5	Nasal turbinate	0	2	2	4	0	0	0	4	4	0
6	Pharynx	0	0	2	4	2	0	1	0	5	2
7	Patient comfort	0	2	4	2	0	0	0	3	5	0
8	Confidence	0	2	3	3	0	0	0	1	7	0
9	Competence	0	1	2	5	0	0	0	1	7	0

students to supervise student clinicians during the initial transnasal endoscopy training on a HPS or a non-lifelike simulator.

Multiple repetitions increase performance competence for medical procedures [14]. In the present study, the first seven transnasal endoscopy procedures were performed on a HPS or a non-lifelike simulator. The eighth and ninth transnasal endoscopy procedures were performed on volunteers. The importance of repetitive practice for transnasal endoscopy was evidenced by the faster pass times and increased confidence ratings between the first and second passes on volunteers. As the student clinicians gained confidence (measured by self-assessment on the clinician survey) in approaching their patient and in their ability to pass the endoscope, they became faster in performing transnasal endoscopy. Following the second endoscopy procedure on a volunteer, the clinicians who "agreed" or "strongly agreed" that they were confident in their ability to pass the endoscope had the fastest Total Procedural Time and the least Total Time in the Nose. One advantage of integrating simulation into clinical education is that the educational focus shifts from knowledge of the procedure to competence in performing the procedure and increases students' self-confidence ratings [15]. After Scope 1, 41% of clinicians "agreed" or "strongly agreed" that they were "confident in passing the endoscope on this patient" (question 8 on the clinician survey) and 65% "agreed" or "strongly agreed" that they were competent in passing the endoscope on this patient" (question 9 on the clinician survey). After Scope 2, 76% of clinicians "agreed" or "strongly agreed" that they were confident and competent in passing the endoscope. Medical residents and fellows require 100 or more procedures to become competent at performing esophagogastroduodenoscopies [10]. Transnasal endoscopy likely requires fewer than 100 procedures to reach competency as this procedure does not involve transversing the number of structures involved in esophagogastroduodenoscopies; however, it is unlikely that graduate student clinicians would be considered competent in passing an endoscope transnasally after seven passes on a simulator and two passes on a human volunteer. ASHA guidelines recommend that individual institutions develop a written list of competencies for performing transnasal endoscopy and FEES [11]. Credentialing standards are important as competency is most likely to be overestimated by individuals with the least experience [16]. In multiple studies of medical personnel, the least skilled are typically the most likely to overestimate their skill level [16, 17].

The 3-min time limit was determined by the second author's previous years of experience training graduate students to perform transnasal endoscopy. Three minutes is a long time, but healthy volunteers typically tolerate a 2–3-min procedure without adverse effects. In the present study, after simulation practice, 30% of the student clinicians required more than 2 min from entering the nares to reaching home position on Scope 1 and 15% required more than 2 min on Scope 2. Individual institutions should consider including a maximum allowed time when developing training and competency guidelines.

According to the ASHA training guidelines for the FEES procedure, speech-language pathologists must have the motor skills and aptitude needed to perform safe, effective endoscopy [12]. The Purdue Pegboard test [13] was included in the present study to examine the effect of manual motor dexterity on the ability to operate a flexible nasal endoscope. The clinicians' scores on the subtests varied, but all were within normal limits. The results of the present study show that when clinicians have adequate manual motor skills, manual dexterity speed is not a predictor of faster transnasal endoscopy times.

There are limitations to the present study; the most important is the lack of a second control group without simulation training. This option was considered but rejected due to the risk of patient compromise secondary to the limited clinical experience of graduate students. Another limitation of the present study is that the effect of repetitive training using a simulator could not be measured as there were no pretraining endoscopy trials on human volunteers. This option was considered but rejected due to the risk of patient compromise with inexperienced clinicians. Ideally, a future simulation study should include pre- and postendoscopic procedural times on humans; however, after observing graduate students' initial attempts at operating the endoscope, it would be difficult to recommend using humans as the first patients. A future study examining procedure duration across multiple repetitions using simulation could determine how many trials are needed to efficiently operate an endoscope. A third limitation of the present study is the small sample size which leads to inadequate statistical power for analyses such as examining change over time from Scope 1 to Scope 2 between HPS and non-lifelike simulation groups.

The use of simulation when training students at the graduate level allows students to gain repetitive transnasal endoscopy experience without compromising patients and may reduce demands on faculty time by using experienced graduate students for supervision. The findings from this study show that repetitive practice on human subjects decreases the time required to perform transnasal endoscopy and increases clinician confidence following training and practice on human patient simulation mannequins or non-lifelike simulators.

Appendix A: Clinician Survey of Fiberoptic Nasal Endoscope Experience

For each question circle only one response

1. I was clear in my instructions to the volunteer.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

2. I was confident in approaching the volunteer.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

3. I was competent in bracing my hands on the volunteer.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

4. I was confident inserting the endoscope into the volunteer's nose.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

5. I was competent in passing the endoscope past the nasal turbinates.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

6. I was competent in viewing the pharynx.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

7. The volunteer was comfortable during the procedure.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

8. I was confident in my ability to pass the endoscope on the volunteer.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

9. I was competent in passing the endoscope on this volunteer.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

Answer the following after you have completed the second endoscopy procedure

10. I felt more confident passing the endoscope on:

_____ The first volunteer or _____ The second volunteer

Appendix B: Volunteer Survey of Fiberoptic Nasal Endoscope Experience

For each question circle only one response

1. The clinician was clear in giving instructions.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

2. The clinician was confident in approaching me.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

3. The clinician was confident inserting the endoscope into my nose.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

4. The procedure was comfortable.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

5. The clinician was confident throughout the endoscopy procedure.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

6. The clinician was competent throughout the endoscopy procedure.

(1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly Agree

Answer the following after the second endoscopy procedure

7. If you were to be endoscoped again, which clinician would you prefer?

_____ The first clinician or _____ The second clinician

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