Pediatric Triage Education for the General Emergency Nurse: A Randomized Crossover Trial Comparing Simulation With Paper-Case Studies

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CE Earn Up to 7.5 Hours. See page 472.

Contribution to Emergency Nursing Practice

- The current state of scientific knowledge on pediatric triage education in the emergency department does not indicate conclusively which method of education is most effective for general emergency nurses.
- The main finding of this research study is that simulation and paper-based cases were both effective at improving pediatric triage accuracy with the Emergency Severity Index when measured using a set of previously validated pediatric triage cases.
- Key implications for emergency nursing practice from this research are: a combined approach of pediatric-specific simulation and paper-based cases appears effective at improving pediatric triage accuracy using the Emergency Severity Index, general emergency nurses trended toward undertriage, and no demographic variable appeared to have a relationship with the accuracy of pediatric triage.

Abstract

Introduction: The majority of pediatric emergency patients are seen in mixed-age emergency departments and triaged by general emergency nurses. Educational methods for teaching pediatric triage education to general emergency nurses have not been well studied, and previous studies of the use of the Emergency Severity Index in children have been performed primarily in centers that are high volume for pediatrics.

Methods: A repeated-measures, randomized crossover study comparing 2 different methods of pediatric triage education was conducted. Participants were general emergency nurses recruited from a general emergency department that is classified as low volume for pediatrics. Each participant was exposed in a random order to both educational methods: paper-based cases and high-fidelity simulation.

Results: All participants had substantial improvement in pediatric triage accuracy as measured by a standardized set of pediatric triage cases. The previously reported trend toward undertriage of the pediatric patient was observed despite a mean triage agreement rate of 73% at the end of the study period. No differences were observed between groups; the order of the educational intervention did not result in statistically significant differences in triage accuracy.

Conclusion: A combined approach of paper-based cases and high-fidelity simulation was effective at improving

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pediatric triage accuracy among a group of general ED nurses with limited exposure to pediatric patients. The results from this study suggest that combining both methods of education may be a viable means of providing general emergency nurses with additional knowledge in pediatric triage; however, persistent trends in undertriage should be studied further.

Key words: Emergency; Pediatric; Nursing; Triage; Emergency Severity Index; Education

Introduction

In February 2005, the report from the American College of Emergency Physicians (ACEP) and the Emergency Nurses Association (ENA) 5-Level Triage Task Force published the recommendation that all US emergency departments adopt the use of valid and reliable 5-level triage tools such as the Emergency Severity Index (ESI) or the Canadian Acuity and Triage Scale (CTAS).[1] At that time, they recommended that additional study be performed on the pediatric aspects of these tools.[1] The next month, Baumann and Strout[2] published the first formal paper demonstrating that the ESI version 3 was valid and reliable for use in pediatric patients. In 2009, Travers et al[3] and Durani et al[4] demonstrated the validity and reliability of the current fourth version among pediatric patients. Travers et al[3] found that general emergency nurses were more likely to undertriage pediatric patients compared with pediatric emergency nurses, a trend that has also been seen in other publications describing triage accuracy among emergency nurses.[5,6] Mistry et al[7] found that nurses from 3 different emergency departments applied the ESI less accurately to pediatric scenarios compared with adult scenarios. The current ESI training manual specifically recommends the development of more pediatric triage case scenarios.[8]

Significance

Although the ESI has been shown to be valid and reliable for use in children, most studies of its pediatric-specific characteristics were conducted in centers that saw large numbers of pediatric patients,[2-4] which may not be representative of many emergency departments. The 2015 report on national pediatric readiness reported that 69.4% of US emergency departments see 14 or fewer pediatric patients per day, meaning that the majority of emergency departments are classified as low or medium volume for pediatrics.[9] Formally, low volume is defined as departments who see fewer than 1,800 pediatric patients per year, whereas medium-volume departments see 1,800 to 4,999 pediatric patients annually.[9] This report also found that high-volume centers score statistically significantly better on a standardized measure of pediatric readiness.[9] In addition, when describing how more than 80% of centers report barriers to implementing the full pediatric readiness guidelines, Gausche-Hill et al[9] state that "[t]he most frequent barriers reported were the cost of training (54.4%) and the lack of educational resources (49.0%)."[9]

Relevant Literature

Before developing additional educational resources, an exhaustive review of the current pediatric triage literature was performed.[10] This literature review by Recznik and Simko[10] identified a wide variety of pediatric triage educational methods in the published literature, all of which improved pediatric triage accuracy. The 0 to 2 quality ranking system described by Sosa and Sethares[11] was used, with a score of 2 representing high-quality studies. In this review of the literature, the overall quality of the studies was relatively poor, with an average of 1.37,[10] and very few studies compared multiple methods of education, making generalization difficult.[10] In addition, differences in study design and the triage tool used make it difficult to compare educational interventions across studies. Finally, many authors report inter-rater reliability using values that are weighted or corrected and give credit for errors occurring within 1 triage level. Durani et al[4] point out that a single-level difference can still be clinically significant and recommend that more careful consideration be given to the use of exact triage agreement.

The current study sought to address 3 issues raised by the review of the literature. First, this study was designed as a comparison between 2 methods of pediatric triage education: paper-based cases (PBCs) and high-fidelity simulation (HFS). Second, the review of the literature found significant variability among studies describing the relationship between demographic factors and pediatric triage accuracy;[10] therefore, during this study, a standard set of demographic variables was collected. Finally, this study was deliberately conducted at a center that is classified as low volume for pediatrics.

Purpose

The purpose of this study was to compare and contrast 2 methods of pediatric triage education, specifically using a group of general emergency nurses from a center that is

low volume for pediatrics. The 2 methods studied were PBC and HFS. To improve power, a repeated measures crossover design was used so that each emergency nurse participant received both types of education in a random order.

Research Questions

The primary research question for this study was "What is the effect of paper-case studies compared with high-fidelity simulation on improving triage agreement rate using the ESI for standardized pediatric patients?" These paper-case studies are pediatric-specific triage cases developed by previous researchers specifically for the purpose of teaching and applying the ESI to children.[3] These cases were used in conjunction with formal explanation and discussion as recommended by the ESI handbook.[8] Secondary research questions investigated the relationship among triage agreement rate and emergency nursing, previous pediatric training, and other demographic variables. Finally, the study sought to investigate the participants' level of comfort with pediatric triage before and after the educational intervention.

Methods

STUDY DESIGN

A repeated-measures crossover design was used. Participants were recruited for an individual 2-hour block of education, and each participant received both education types during this single block of time. After informed consent was obtained, participants were randomized to the education order by rolling a standard dice with an allocation ratio of 1:1. Participants who rolled a 1, 2, or 3 did PBC first, and participants who rolled a 4, 5, or 6 completed the HFS education first. After randomization, participants were given copies of the ESI algorithm and instructed to refer to it as needed at any time throughout the study. Participants then completed the demographics page and pretest using a secure link to a survey hosted on REDCap (Research Electronic Data Capture, Nashville, TN), "a secure web application for building and managing online surveys and databases."[12] The demographics page included a single question about comfort level with triaging pediatric patients. This identical comfort level question was again asked of participants following the post-test and stated, "On a scale of 1 (not comfortable at all) to 7 (very comfortable), please rate how comfortable you are with triaging pediatric patients."

SAMPLE

All RNs who were not in education or management positions from a single general emergency department (GED) were recruited to participate, with a total of 51 eligible RNs. Twenty-seven RNs agreed to participate (53%), and 25 of the participants completed the entire study and were eligible for inclusion in the data analysis. Participants ranged in age from 21 to 54 years (mean, 32.1), with an average of 3 years of emergency nursing experience (range, 0.2 to 7.0). Of note, undergraduate pediatric clinical experience ranged from no specifically pediatric clinical to 400 hours (mean, 84.9; median, 60). One participant described completing her final prelicensure preceptor-based course in a pediatric setting, which may have led to the large discrepancy in pediatric clinical hours. Three of the participants reported that they were certified: 1 as a Certified Emergency Nurse, 1 as a Family Nurse Practitioner, and 1 as "Other." Although certification rates were relatively low in this cohort, this sample was representative of the departmental mix at the time, although additional nurses have become certified since the completion of the study.

All participants were eligible to perform triage duties at the bedside, as an immediate bedding strategy and bedside triage are routinely used at the study site. Training to perform bedside triage primarily consists of conducting triage during unit orientation. After an RN has been working as an emergency nurse for a year, he or she is eligible to be assigned to triage as a role. At that time, the RN completes additional triage preceptor time with an experienced triage nurse. Formal triage training is included in the system-wide Emergency Nurse Course, which is offered to as many new emergency nurses as possible, although data regarding completion of this course were not collected for this study.

SETTING

The study was conducted in a private room at a single hospital in the continental United States. The hospital is a 249-bed, urban, acute-care teaching hospital that is designated as a Magnet facility and is classified as low volume for pediatric patients. In fiscal year 2017, the 24-bed emergency department had approximately 38,000 annual visits; 3.7% (1,395) of those patients were below the age of 18, and 2.0% (765) of pediatric patients were below the age of 14 years. As recommended by the National Pediatric Readiness Project (NPRP), this GED has a nurse assigned specifically to conduct pediatric education and equipment updates but does not have a physician pediatric coordinator.

HUMAN SUBJECTS PROTECTION

This study received Institutional Review Board (IRB) approval from the first author's educational institution (Duquesne University), and IRB oversight was officially ceded by the hospital site's IRB, which is consistent with the current guidelines in the Revised Common Rule.[13]

EDUCATIONAL INTERVENTION

The data collection and both educational interventions took place in a single 2-hour individual session. After completing the consent process and rolling the dice for method randomization, each participant completed the demographics page and the ESI pretest. Following the first type of education, the participant indicated which type of education he or she had just completed and then took the midpoint test. After the participant had finished with the second type of education, the type of education was recorded, and the participant took the ESI post-test. After the post-test, participants answered a final question relating to comfort level with pediatric triage. All education was delivered by a single researcher, the first author.

Paper-Based Education

Pediatric-specific PBCs developed by a previous group of authors[3] were obtained for use as education and for testing. This set of cases was originally designed as a result of a Health Resources and Services Administration (HRSA) grant and focused specifically on the application of the ESI to pediatric patients. The original cases contain both teaching and testing scenarios; for this study, the PBC educational component consisted of 10 of the original teaching cases, with 2 of each triage level. Previous research has estimated that triage of each paper case takes approximately 2 minutes or less.[4] This led the current researchers to select 10 cases, allowing for time for questions and discussion of the correct responses. Each case consisted of a 2- to 3-sentence description of a pediatric presentation including the age and gender of the child. Next to this was displayed the pertinent vital signs, and in the printed version, a third column also contained the list of ESI 1, ESI 2, and so forth, for ease of scoring.

As this was not the participants' first exposure to the ESI, outside of the study directions, there was not a formal education session preceding the use of these cases. For the educational intervention, participants were given copies of the cases and asked to triage each case using the ESI. As noted above, they were instructed to refer to the provided copy of the ESI algorithm as needed. After the participants had selected a triage level for each case, they were given copies of the answer key, which included detailed rationales for the correct triage level. Participants were instructed to ask about any cases or rationales that they did not understand, and the educator then provided additional information and explanation, focusing on the cases that the participant had triaged incorrectly.

Simulation

Simulation cases were developed by the researcher and were reviewed by additional experts in simulation and triage. The 2 cases focused on fever and respiratory distress in a 6-month-old and 5-month-old, respectively. The design of these cases was based on the report by Travers et al, which noted that infants in general and pediatric patients with medical complaints, such as fever or respiratory conditions, were more likely to be mistriaged.[3] Each case followed a script that clearly outlined vital sign programming, physical assessment findings (eg, lung sounds), responses by the parent, and background information. The Laerdal Nursing Baby with the SimPad PLUS operating system (Laerdal, Stavanger, Norway) was used.[14] Prior to beginning the simulation, a checklist was used to orient each participant to the simulation equipment and the role of the researcher during the simulation experience. Before the simulation scenarios, prebriefing took place; each participant was given the opportunity to obtain a normal set of vital signs, to use the provided equipment, and to listen to the manikin's lungs and heart. After the participant expressed comfort with using the simulation equipment, including the patient monitor and the programmable thermometer,[15] the researcher would describe how the researcher would function as the parent during the scenarios. Participants were encouraged to not only ask medical questions but also to feel free to ask the researcher/parent about the child's level of consciousness, skin color, and any visible signs of distress. Finally, participants were instructed that, during each scenario, they should function as if they were working out in triage on a busy day, with all the patient-care rooms being full. After the orientation checklist was complete, the researcher would reset the manikin's vital signs and introduce the case by stating the patient's name, age, and chief complaint. The participant then asked questions of the parent/researcher and evaluated the simulation manikin. After each participant had indicated that he or she had reached a triage decision, the researcher would pause the patient monitor and move to a different chair, turning away from the designated triage area without requiring the participant to move. This facilitated a clear transition from the simulation experience to the formal debriefing.

The researcher then conducted a formal debriefing, first inquiring what triage level the participant had assigned and then asking questions related to that decision. As the discussion progressed, the debriefing included a review of specific sections of the ESI algorithm as well as a review of related cases using varying ages and acuity levels. For example, the first case was a 6-month-old child with a temperature of 39.4°C (103°F), incomplete immunizations, and no obvious source of infection. This patient was supposed to be triaged as ESI level 3. A related case was that of a 22-day-old female patient with a temperature of 38.3°C (101°F), but otherwise stable vital signs, who would be triaged as ESI level 2. The debriefing of the first case focused primarily on the pediatric fever criteria as well as normal versus abnormal vital signs, whereas the debriefing of the second case reviewed pediatric respiratory conditions, high-risk situations, and life-threatening conditions. The debriefing included content from the ESI Handbook,[8] the article by Gilboy et al[16] reviewing the pediatric fever criteria, departmental policy on pediatric vital signs, and current evidence-based practice for select pediatric diseases. The debriefing process actively engaged each participant in discussion and often prompted related questions about general pediatric emergency care. At the end of each debriefing, the researcher read a standardized statement summarizing the learning objectives and instructed the participant to ask any additional questions. At the conclusion of the first case, participants were also asked if they had any questions about the simulation equipment or the information that they obtained from the parent.

MEASURES

Demographics

A standard set of demographic questions was compiled including age, years in nursing, years in the emergency department, certifications, and degrees. Participants were also asked to estimate the number of pediatric clinical hours they completed during their initial prelicensure nursing training and to rate their level of comfort with triaging pediatric patients. The same comfort-level question was repeated at the end of the entire educational and testing process.

ESI Testing

The formal, pediatric-specific testing cases developed by Travers et al[3] were used as the pretest, midpoint test, and post-test. These cases were originally developed using a panel of experts and were designed specifically for pediatric ESI competency.[3] Of the original 25 testing cases obtained, 1 case—which described a pediatric patient with suicidality—was excluded, as the policy of the study site at the time of study design required that all patients with a complaint of suicidality be triaged as an ESI level 1. This is inconsistent with the ESI guidelines, which recommend making these patients an ESI level 2 unless a physiologically life-threatening condition exists.[8] Since the time of study design, the facility policy has been updated. After removing this case, the primary author divided the original cases into 3 groups of 8, rearranging them so that the groups were roughly even in the distribution of the ESI triage level. The new sequence of cases was reviewed by the ESI expert for consistency and balance.

REDCap

Study data were collected and managed using the REDCap electronic data capture tools.[17] REDCap is a secure, web-based application designed to support data capture for research studies, providing (1) an intuitive interface for validated data entry, (2) audit trails for tracking data manipulation and export procedures, (3) automated export procedures for seamless data downloads to common statistical packages, and (4) procedures for importing data from external sources.[17]

DATA ANALYSIS PROCEDURES

Before analysis, the study data were cleaned. Two potential participants had misunderstood the directions and completed the pretest, midpoint test, and post-test in the initial testing phase, so their data were removed before analysis. In addition, 1 participant had incorrectly selected the first type of education completed and, during the educational period, had been permitted to redo the beginning components of the survey and answer the question correctly before progressing to the midpoint test. For this participant, a new record containing the original pretest selections and subsequent midpoint and post-test selections was created. Twenty-five of the participants completed the entire study and were eligible for inclusion in the data analysis. After data cleaning, new variables identifying each response as correct/incorrect were created, and a raw agreement rate (in percentage) was calculated for each participant, for each test, and by group (eg, PBC-then-HFS = group 1).

Power Analysis

Using G-Power 3.1.9.2, with a medium effect size of 0.30, $\alpha = 0.05$, and power of 0.80, with 1:1 group allocation, 2 groups, and 3 measurements, a minimum sample size of 20 participants was desired, with the target sample size

TABLE 1
Exact triage agreement by group

Group	Pretest	Midpoint test	Post-test
Both (n = 25)	41.0 (16.0)	54.5 (16.0)	73.0 (7.0)
Paper then simulation (n = 11)	44.3 (5.4)	55.7 (5.7)	75.0 (2.3)
Simulation then paper (n = 14)	38.3 (4.0)	53.6 (3.8)	71.4 (1.6)

Each value is in percentage of agreement, and reported as mean (standard deviation).

set at 25. Power analysis after data collection found that given the unequal distribution of the 2 groups (11:14), 3 measurements, and an $\alpha = 0.207$, there was an actual effect size of 0.51 and power of 0.50. This actual sample size addressed the first research question but was not sufficiently powered to answer the second, third, and fourth research questions adequately. Thus, in the context of this study, the data from the second, third, and fourth research questions provided insight for future research.

Results

GROUP EQUALITY

Dice randomization was used consistently with each participant rolling a standard die. A roll of 1, 2, or 3 meant that the participant first received PBC education, and a roll of 4, 5, or 6 meant that the participant received HFS education first. The groups were not divided evenly, with 11 participants in the PBC-then-HFS group and 14 in the HFS-then-PBC group; however, using demographic variables, preintervention comfort level, and pretest score, no statistically significant difference was found between the 2 groups at baseline.

PRIMARY RESEARCH QUESTION

Although there was statistically significant improvement from the pretest to the post-test for all participants, there was no statistically significant difference between groups at any point. All analyses were conducted with participants in the groups as recorded in the REDCap system. Agreement rate was calculated using the standard preset responses for each case as the correct response. Percent of agreement indicated that the participant gave the exactly correct response; no credit was given for disagreement of any degree. Mean agreement on the pretest was 41%, whereas mean agreement on the post-test was 73%. Using a paired-samples Student's *t*-test, a statistically significant difference between the pretriage agreement rate and post-triage agreement rate was observed: $t = 9.036$, $P < 0.000$. The mean agreement on the midpoint test was 54.5%, and using a paired-samples Student's *t*-test, a statistically significant difference was seen between the pretriage agreement rate and the midpoint agreement rate: $t = 3.420$, $P = 0.002$; a statistically significant difference was also observed between the midpoint test and the post-test: $t = 5.115$, $P < 0.000$. Data used for these calculations can be seen in Table 1.

Evaluation of the differences between groups using the change in score from pretest to midpoint test found that although Levene's test of equality of variances was violated, there was no statistically significant difference between groups: $t = 0.516$ (df = 18.17), $P = 0.612$. Comparison of the groups using the change in score from the pretest to the post-test also found that there was no statistically significant difference between groups: $t = 0.324$ (df = 24), $P = 0.749$.

SECONDARY RESEARCH QUESTIONS

Using simple correlation, no target demographic variable was found to have any relationship with the final triage agreement rate, as seen in Table 2. Of note, 1 participant reported previous experience working in a strictly pediatric setting. This participant did score well on the post-test, which resulted in a statistically significant correlation: $r = 0.436$, $P = 0.029$. Although intriguing, it is not possible to extrapolate anything from this single datum point; the only realistic statement is that this individual participant was more accurate.

COMFORT LEVEL

There was a statistically significant difference between groups for the improvement in comfort level. Comfort level with triaging pediatric patients was measured on a 7-point drag and drop scale that was converted by the REDCap

TABLE 2
Demographic variables and their relationship to final triage agreement rate

Variable	Mean (SD)	Pearson's r	P value
Age in years	32.1 (8.6)	–0.092	0.661
Years of nursing experience	4.7 (3.5)	0.114	0.587
Years of emergency nursing experience	3.0 (2.1)	0.004	0.985
Hours of pediatric clinical	84.9 (91.7)	–0.201	0.336
Pre-comfort level	47.7 (14.8)	0.045	0.831
Post-comfort level	69.7 (14.4)	0.214	0.305

There are no statistically significant relationships in this table.
SD, standard deviation.

software into a 100-point scale. Comfort level with triaging pediatric patients improved from 47.7 (14.8) to 69.7 (14.4), $t = 16.097$, $P < 0.000$. Although the preintervention comfort level was not different between groups, participants in the PBC-then-HFS group had statistically significantly improved postintervention comfort with triaging pediatric patients. The mean comfort level in the PBC-then-HFS group was 77.2, compared with the HFS-then-PBC group, in which the mean comfort level was 63.9. This change was statistically significant, as seen with an independent Student's *t*-test, $t = 2.54$ (df = 23), $P = 0.018$.

MISTRIAGE RATES

Initial rate of exact agreement was 41%; a review of mistriage found that undertriage rates on the pretest were 30%, with overtriage rates at 29%. Of note, on the midpoint test, undertriage was actually worse, with 39% of cases being undertriaged despite exact accuracy improving to 54.5%. Although the 3 tests were only roughly equal, the midpoint test actually had the lowest number of extreme cases, with only 1 each of ESI level 1 and 5. Further study of the order and distribution of the cases and case types is needed to examine this phenomenon further. On the post-test, undertriage rates improved to 22% but remained higher than overtriage at 5%. Table 3 outlines the mistriage rates by test and group.

TEST CHARACTERISTICS

The test cases used as the pretest, midpoint test, and post-test have not been divided in this way previously, and although formally tested as a group,[3] may not all equally measure pediatric triage accuracy. Each of the 3 sets of 8 cases had an ESI level 2 case that scored uniformly poorly, with only 1 or 2 participants answering correctly. Two of

TABLE 3
Mean triage accuracy and mistriage categorizations by group

Test	Exactly correct	Undertriage	Overtriage
Pretest overall	41	30	29
Paper then simulation	44.3	27.3	28.4
Simulation then paper	38.4	32.1	29.5
Midpoint test overall	54.5	39	6.5
Paper then simulation	55.7	40.9	3.4
Simulation then paper	53.6	37.5	8.9
Post-test overall	73	22	5
Paper then simulation	75	19.3	5.7
Simulation then paper	71.4	24.1	4.5

Group distribution is uneven, and therefore exact overall agreement uses weighted means.

these cases involved psychiatric complaints, and the third described a vague history provided by parents unable to communicate in English. Participants both over- and undertriaged these cases, with no discernable differences between education groups. The pretest also included an ESI level 5 case that was overtriaged by all participants except 1. In addition, although efforts were made to distribute the cases evenly, there were more cases describing older children on the pretest compared with the midpoint and the final test; infants, of particular interest, given the focus of the simulation component, were only included in 3 cases, with 1 on each test. Further study of all of the cases is needed, and additional information gained by further investigation of the impact of the age of the child, the target triage level, and the type of complaint.

Limitations

This research was conducted using a surrogate measure for pediatric triage accuracy. Although previous studies have demonstrated good agreement between providers using these same cases, these results may not reflect real-life triage decisions. Given the historical reliability of these cases,[3] it seems likely that there is a substantial correlation, yet the historical differences between surrogate and live data cannot be ignored.[3] However, given that this study was conducted in a center that sees approximately 4 children per day, a surrogate measure was necessary to ensure that the data represented the educational intervention and not merely the gaining of general nursing experience. In a setting with more children, or in which triage is assigned to a smaller number of dedicated providers, it would be helpful to measure live triage data. This research was conducted at a single site, so these results may not be generalizable. It is most likely, however, that this department is more representative of other departments that are low volume for pediatrics compared with previous studies in which participants were often recruited from pediatric-only departments or departments that had higher pediatric volumes.[2-4]

A single researcher conducted all of the educational sessions. Although this ensured consistency in applying the educational intervention, it is quite possible that a different educator, even with the same prompts and directions, would not get the same results. In addition, at the time of the study, the first author had a master's degree in nursing education, was enrolled in a PhD program, held certifications in emergency nursing and pediatric emergency nursing, and was working as a full-time nursing faculty member in pediatrics and simulation education. The researcher may not be representative of educators in many emergency departments.

Implications for Emergency Nurses

Pretest agreement rates were low (41%) and may or may not be representative of actual triage decisions in centers that are low volume for pediatrics. This brief individual intervention made a substantial impact on accuracy, with a mean improvement of 32%. In this group of participants, completion of the PBC educational component alone had a substantial impact on triage agreement, with a mean midpoint score of 55.7% for those participants who completed PBC first. This component of the study could be adapted for administration to larger groups of nurses at once and incorporated into weekly newsletters, daily huddles, or 1-on-1 review.

Although the PBC intervention alone improved mean agreement rate, the simulation intervention also contributed significantly to the final agreement rate. Although simulation equipment can be expensive, this study was conducted with minimal cost because of the generous agreement of a local university to lend the equipment during a school break. Most, if not all, hospitals in the US serve as clinical sites for nursing and medical schools, which may have access to substantial training resources. As simulation has become common in health care education,[18] partnerships between local universities and their clinical sites should be considered as potential avenues for access to high-quality training and equipment.

Triage is the first point of contact with a health care provider in the emergency department and has been described a "high-risk skill" by the ENA.[19] Previous studies of pediatric triage indicate that GED nurses are more likely to undertriage,[3] and a persistent rate of undertriage was observed in this study. Efforts should be made to focus on the improvement and standardization of pediatric triage, specifically considering differences in GEDs, as recognized previously by Barata et al.[20]

Discussion

This study compared 2 different methods of pediatric triage education and applied both methods to each participant. All participants had dramatic improvement in their triage accuracy, regardless of group allocation. The groups were not statistically significantly different from one another, and, in this sample, there does not appear to be a statistically significant educational advantage to either method. A combined approach of PBC and HFS strategies appeared useful in this small single-center study, and this finding should guide future research.

Conclusions

National data demonstrate that the majority of pediatric patients present first to a GED[20] and that most emergency departments are low-to-medium volume for pediatrics.[9] This study found that a 2-hour educational intervention improved pediatric triage accuracy among a group of emergency nurses employed at a GED that is low volume for pediatrics. Further study of mistriage is needed, as undertriage can lead to individual adverse outcomes, and overtriage can lead to delays in patient care and inappropriate use of resources. This study highlights a possible educational strategy that was conducted inexpensively through collaboration with a local university. Further study of pediatric triage accuracy in GEDs is needed to evaluate the impact of providing ongoing training to RNs who perform this vital task.

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