Impact of Two Educational Modules on Practitioner Knowledge of Pediatric Delirium

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OBJECTIVES The purpose of this study was to evaluate the efficacy of education modules in preparing staff before the implementation of a pediatric delirium screening protocol.

METHODS After consenting participants began phase 1 of the study, which covered general information on pediatric delirium. It comprised a 21-question assessment administered as a pretest followed by an education module and then the same 21-question assessment administered as a posttest. After completing phase 1, participants proceeded to phase 2, which focused on use of the Cornell Assessment of Pediatric Delirium (CAPD) tool. It comprised an education module and a 14-question postassessment. Participants completed these phases at their convenience via provided instruction documents. Assessments were delivered through the online service SurveyMonkey. Education modules were available online as invisible YouTube videos.

RESULTS A total of 50 nurses and pharmacists gave consent, and 37 of these participants initiated phase 1. All 37 participants completed the phase 1 preassessment, averaging a score of 46% (range, 29%–71%). A total of 27 participants completed the phase 1 postassessment, with an average score of approximately 76% (range, 48%–95%). A total of 20 participants, with no prior training on the CAPD, completed the phase 2 postassessment, averaging a score of 88% (range, 43%–100%).

CONCLUSIONS Both the pediatric delirium general education module and the CAPD use education module resulted in participant learning, as evidenced by the assessment score averages.

ABBREVIATIONS CAPD, Cornell Assessment of Pediatric Delirium; pCAM-ICU, Pediatric Confusion Assessment Method for the Intensive Care Unit; PICU, pediatric intensive care unit

KEYWORDS delirium, education, educational measurement, pediatrics

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Introduction

Pediatric delirium impacts up to 30% of patients in the pediatric intensive care unit (PICU) and results in several adverse outcomes.¹ These outcomes include greater hospital length of stay, higher health care costs, persistent patient morbidities, and increased mortality.^{2–4} Adverse outcomes associated with delirium can be avoided by employing suitable preventative measures and can be mitigated by implementing appropriate therapies.^{5,6} Diagnosis of delirium must occur before treatment begins, however, and pediatric health care teams on their own are ineffective at recognizing all forms of delirium.⁷ More effective patient evaluation was made possible with the development and validation of several pediatric delirium assessment tools: the Pediatric Anesthesia Emergence Delirium, the Pediatric Confusion Assessment Method for the Intensive Care Unit, the Pre-School Confusion Assessment Method for the Intensive Care Unit, and the Cornell Assessment of Pediatric Delirium (CAPD).^{8–13}

Even though these tools are available, 71% of facilities

housing a PICU fail to administer regular screenings, and only 2% of facilities screen patients per the assessment tool recommendations.¹⁴ Additionally, a study by Flaigle et al¹⁵ demonstrated a need for pediatric delirium education within PICUs. A deficiency of awareness compounded by want of effective education may be at fault for this lack of action. Accordingly, our study was designed to evaluate the efficacy of pediatric delirium education modules in preparing staff for the implementation of pediatric delirium screening protocols. Based on this information, we suspect that knowledge on proper screening, appropriate preventative measures, and treatment options could lead to improved patient outcomes as well as decreased health care costs.

Materials and Methods

This study took place at a not-for-profit private hospital in Oklahoma City, Oklahoma. This 511-bed facility houses a 10-bed PICU, a 26-bed general pediatrics unit, and a 40-bed level 3 neonatal intensive care unit. The Institutional Review Board approved the study in

December 2016.

The study opened for participation January 2017 and closed April 2017. Participants included PICU and general pediatrics nurses, PICU physicians, pharmacists, and medical residents. Verbal, paper, and/or electronic means were used to notify those who qualified about the study's existence. The means used depended on each profession's preferred method(s) of receiving information. Participation was voluntary, and those interested were required to sign a written informed consent form.

After returning the consent form, participants could progress to phase 1 of the study, which focused on general pediatric delirium information. It consisted of 3 components: a preassessment, followed by an education module and a postassessment. Information for creation of the assessments and education module was obtained via a comprehensive literature search.¹⁻³⁰ All study assessments and education modules were reviewed by the facility's pediatric clinical pharmacist and the pediatric clinical nursing coordinator prior to dissemination. Instructions for completion of each component were provided in steps via an instructions document. This allowed participants to progress through each step at their own pace. QR codes and Web site links embedded in the document enhanced study accessibility.

The phase 1 preassessment included 21 content-related questions in addition to questions gathering demographic information and data to account for potential confounding variables. The phase 1 postassessment comprised the same 21 content-related questions as the preassessment, gathered data on additional potential confounding variables, and included comments sections for participants to provide input and ask questions. Assessments were made available via an online service familiar to most of the participants, SurveyMonkey (Survey Monkey, San Mateo, CA).

Participants were required to complete phase 1 assessments alone and without the use of any outside resources. The content-related questions were issued one at a time, and participants could not return to a question once an answer had been submitted. There was no time limit for completing the assessments, but completion in one sitting was required. Participants were instructed not to discuss assessments or education modules with anyone who had yet to complete them.

After finishing the phase 1 preassessment, participants progressed to the phase 1 education module. It was formatted as a PowerPoint presentation with integrated audio and published as an unlisted YouTube (Google, San Bruno, CA) video so that only those with the direct link could access it. Module content included pediatric delirium epidemiology, outcomes, pathophysiology, symptoms, risk factors, prevention, and treatment. The video lasted approximately 25 minutes,

and participants could review it as many times as they wished prior to starting the phase 1 postassessment. Participants were also provided the option of printing a hard copy of the pediatric delirium background handout.

Within 1 week of a participant's completing the phase 1 postassessment, he or she was sent an instructions document for phase 2. Phase 2 focused on the CAPD, the assessment tool the facility's pediatric clinical nursing coordinator decided best suited their needs. This phase contained an education module and a postassessment for which information was obtained via a comprehensive literature search.^{12,13,30} The phase 2 education module covered proper use of the CAPD, addressed the integration of a delirium assessment with other commonly used screening tools, and incorporated multiple practice patient cases. It was formatted similarly to the phase 1 education module. As in phase 1, participants had the option of printing the CAPD use handout.

Completing the phase 2 education module meant participants could progress to the phase 2 postassessment. This assessment contained 14 content-related questions; 3 questions covered general information, and 11 questions were case based. Of the patient case questions, 6 questions focused on the use and interpretation of the CAPD, whereas the remaining 5 questions centered on integrating the CAPD with other patient assessment tools.

As with the phase 1 assessments, phase 2 had to be completed alone and in one sitting. Unlike phase 1, however, phase 2 provided 2 resources participants could use during the postassessment. These resources were a copy of the CAPD assessment scale and a copy of the CAPD anchor points chart. Within 1 week of a participant's completing the phase 2 postassessment, he or she was sent notification that he or she had completed the study in its entirety. Results were analyzed using descriptive statistics via Microsoft Excel (Microsoft, Redmond, WA) and stratified based on demographic characteristics and potential confounding variable data. This was accomplished by evaluating the scores of all participants falling in to each category analyzed.

Results

A total of 117 individuals qualified to participate in the study, 50 of whom signed consent forms. Of the 117 qualifying individuals, 27 (23.1%) completed the phase 1 postassessment, and 20 (17.1%) completed the phase 2 postassessment (Figure 1). Only individuals within the nursing and pharmacy professions participated in the study. Of those participants initiating phase 1, 70% had no prior exposure to information on pediatric delirium. Additional background characteristics of participants can be found in Table 1.

The percentage of participants answering each question correctly was higher on the phase 1 postas-

Figure 1. CONSORT diagram flow of participants from study initiation to close.

assessment than the preassessment for every question except one. Additionally, the percentage of participants with correct responses was 74% or higher for all post-assessment questions except three. The phase 1 pre-assessment score average approximated 46% (range, 29%–71%), or 10 correct answers (range, 6–15) out of 21 questions. The phase 1 postassessment score average saw a 30% increase to approximately 76% (range, 48%–95%), or 16 correct answers (range, 10–20) out of 21 questions (Figure 2).

Phase 1 data were stratified by participant demographics and by potential confounding variables. Stratifying assessment scores by participant years of pediatric experience showed less than a 10% score variation for each category for both the preassessment and postassessment. Preassessment scores stratified by profession varied by less than 3%, whereas there was greater variation between postassessment score averages (Figure 3). Phase 1 assessment scores were also stratified by years of practice in current profession. The 0 to 10 years group had preassessment scores that were more than 12% higher than the 11 to 20 years group. The remaining groups had less than 6% variation in preassessment scores. All postassessment scores in this category also varied by less than 6%.

Because of an unequal distribution of participants in the potential confounding variable analyses, most data stratifications did not offer usable information.

Confounding variable data can be found in Table 2. Despite unequal participant distribution between groups, the stratification of assessment averages by prior exposure to pediatric delirium information yielded results worth mentioning. The preassessment scores between those with prior exposure to pediatric delirium information differed by less than 3% from the scores of those with no prior exposure. Additionally, the post-assessment scores between these 2 groups varied by less than 4% (Figure 4).

No participants participating in phase 2 had prior exposure to training on use and interpretation of the CAPD. The phase 2 postassessment scores averaged 88% (range, 43%–100%; Figure 5). All questions, with the exception of two, were answered correctly at least 85% of the time.

Comments from the assessment comments sections on the tests and education modules were positive overall, although there were also suggestions for improvement. One recommendation was to shorten the length of the 43-minute-long phase 2 education module. Other participants would have preferred a version of the phase 1 education module that was more nursing-centric.

Discussion

This study examined the efficacy of education on pediatric delirium and use of the CAPD. It was open

Table 1. Population Characteristics

Profession	Phase 1 Preassessment (n = 37)		Phase 1 Postassessment (n = 27)		Phase 2 Postassessment (n = 20)	
	Nurse (n = 13)	Pharmacist (n = 24)	Nurse (n = 5)	Pharmacist (n = 22)	Nurse (n = 2)	Pharmacist (n = 18)
Experience in current profession, % of profession						
0–10 yr	30.7	33.3	40	31.8	50	38.9
11–20 yr	23.1	29.2	0	31.8	0	27.8
21–30 yr	38.5	29.2	60	27.3	50	27.8
31–40 yr	8.3	8.3	0	9.1	0	5.6
Experience in pediatrics, % of profession*						
0 yr	0	25.0	0	27.3	0	16.7
0–10 yr	30.8	45.8	40	45.5	50	55.6
11–20 yr	38.5	20.8	40	22.7	0	22.2
21–30 yr	23.1	8.3	20	4.6	50	5.6
31–40 yr	7.7	0	0	0	0	0
No prior information exposure, % of profession	69.2	70.8	20	72.7	100	100

* One participant listed experience in pediatrics as N/A. That participant was counted as having zero years of experience in pediatrics.

to nursing, pharmacy, PICU physicians, and medical residents, but participants were primarily pharmacists. This could be attributed to changes occurring within our facility at the time of the study, especially the change

to a new electronic medical record software provider. Participation could be improved if the study were implemented at a different time or if education modules were made mandatory, because they would be

Figure 2. Phase 1 score comparison. The average phase 1 preassessment score for any participant completing it was 46.6%. The average phase 1 preassessment score of those participants who also completed the phase 1 postassessment was 45.5%. These 2 values average out to the stated value of 46% (range, 29%–71%). The average phase 1 postassessment score was 76% (range, 48%–95%).

Figure 3. Phase 1 assessment scores by profession. Nurses scored an average of 45.05% on the phase 1 preassessment, whereas pharmacists scored an average of 47.42%. On the postassessment nurses scored an average of 66.67% and pharmacists scored an average of 78.57%.

done prior to the initiation of other novel protocols at our facility. Another consideration that may have improved participation is the creation of profession-specific education modules (i.e., one for nursing, one for physicians, and one for pharmacists). This could be beneficial because it would allow for the tailoring of each education module to the factors most pertinent to each profession. Such tailoring would likely improve participant interest in the material as well as buy-in into its importance.

More participants answered 1 question incorrectly on the phase 1 postassessment than on the preassessment. It, along with the 3 questions with overall postassessment scores less than 74%, was likely missed

for one or more reasons. These reasons include poor question and/or answer wording, or inadequate coverage of the information in the education module.

Phase 1 demographic data stratification showed pharmacists performed better on the postassessment than nurses did. This may be due to any number of reasons, including, but not limited to, type of material covered in the education module and/or assessment. Additionally, the scores reported from our study may not be representative of the profession as a whole because of limited nursing participation. Stratification also showed participants who had been working in their given profession for 10 years or fewer performed better on the phase 1 preassessment. This could be due to the

Table 2. Potential Confounding Variables

Profession	Phase 1 (n = 37)		Phase 2 (n = 20)	
	Nurse (n = 5)	Pharmacist (n = 22)	Nurse (n = 2)	Pharmacist (n = 18)
No. of times module completed, % of profession				
1	60	100	100	100
2	40	0	0	0
Time elapsed between module completion and assessment initiation, % of profession				
<1 day	60	90.9	100	94.4
1–3 days	20	4.55	0	0
11–14 days	0	4.55	0	5.6
>14 days	20	0	0	0

Figure 4. Phase 1 assessment scores by prior exposure to information. The average preassessment and postassessment scores for those with prior exposure to pediatric delirium information were 45.02% and 74.29%, respectively. The average preassessment and postassessment scores for those with no prior exposure to pediatric delirium information were 47.25% and 77.59%, respectively.

increase in information garnered on pediatric delirium during the past 15 years, making it unlikely to have been taught in schools before that period. As such, individuals who had attended school more recently could be expected to perform better on the preassessment.

Although exposure to the information while in school is one viable possibility, this theory comes into question when considering the confounding variable analysis. It showed that those with no prior exposure to the information performed just as well on the pre-assessment as those with prior exposure. Taking this into account, it is more likely the higher scorers in the 10 years of practice or fewer group scored better for another reason. One such reason may be that having been in school more recently, those participants were better prepared for learning from lecture-and-notes style online video presentations. Another piece of information gleaned from the phase 1 confounding variable analysis is that participants learned from the education module regardless of their prior exposure to the information.

No participants participating in phase 2 had prior exposure to training on the CAPD. This was expected by the authors and was part of the reason no preassessment had been included for this phase. It may have been beneficial to include a preassessment as done in phase 1, but we did not want to increase the number of participants dropping out of the study by assessing them on use of a tool they had never been exposed to previously. We were also trying to be cognizant of the participant's time. The assessment contained multiple question types, including written patient cases that asked participants to determine the patient's CAPD then interpret the score. To avoid penalizing participants twice for a wrong answer, the accuracy of a CAPD score interpretation was based solely on the CAPD score the participants obtained.

We are not concerned about the poorer scores on two of the CAPD score determination questions because the CAPD is not validated for evaluating written patient cases. It is validated for evaluating real, living patients, making it understandable that some participants struggled. Furthermore, the high scores on the CAPD score interpretation questions speak to the ability of the participants to appropriately use the CAPD scores they obtain.

The information presented in the education modules derived from a comprehensive literature review. Creation of the education modules and assessments employed were a culmination of collaboration between the study team and the pediatric nursing education coordinator at our facility. The education modules were originally intended to be live presentations allowing for direct interaction with study participants and allowing participants to receive immediate answers to questions on material covered. This design eventually gave way to the electronic version actually employed because attendance at live programs would be difficult for some based on shift worked and/or working on an "as-needed" basis. The electronic version was therefore deemed preferable because it would improve participant access to study materials. The phase 1 module can be found at <https://www.youtube.com/watch?v=ek2hc8pRr9c>, and the module handout can be found in Supplement 1. The phase 2 module can be found at <https://youtu.be/ois9bFGO2B4>, and the module handout can be found in Supplement 2.

The content-related questions covered material the authors deemed to either be pertinent to recognizing, understanding, preventing, and treating pediatric delirium, or be common misconceptions about the condition. They were designed to be applicable in some way to all 3 professions invited to participate. The facility's

Figure 5. Phase 2 scores. The average score for the phase 2 postassessment was 88% (range, 43%–100%).

pediatric clinical pharmacist and the pediatric clinical nursing coordinator reviewed the questions prior to study initiation.

It is important for us to note that, although assessment scores indicated the education modules resulted in learning, these education modules and assessments were not formally validated. The education modules and assessment questions could be submitted to experts for review and validation, but we believe such a practice is not standard in most health care facilities. As such, the education modules and assessments employed in this study provide a more accurate “real world” view of the impact they can have on health care team knowledge.

Conclusion

This study showed that education modules on pediatric delirium and CAPD use are effective at teaching, although the data pertain primarily to those in the profession of pharmacy. Before employing these modules and assessments again, we would revise the assessment questions that yielded poor performance and ensure the education material covered those questions thoroughly and clearly. We may additionally consider revising the modules to optimize content, focus on clinical applicability, and create individual modules for each separate profession involved. When these revised assessments and modules are employed, they will be made mandatory for those working with the facility's pediatric population to allow for proper training prior to initiation of a pediatric delirium screening protocol. After training of all medical personnel responsible for the care of our pediatric patients is completed, we hope to see several changes. These changes include improvement in the ability to identify pediatric delirium

and increased awareness of the potential adverse outcomes associated with leaving the condition untreated.

ARTICLE INFORMATION

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