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Utilization of Just-in-time Training for Nursing Education using the LA Phonspirometry
Asthma Tool

Kathryn H Pade, MD ¹, Sophia T Seik-Ismail ¹, Todd P Chang, MD, MACM¹, Vincent J
Wang, MD ¹

¹Department of Emergency Medicine and Transport, Children's Hospital Los Angeles, Los
Angeles

Corresponding Author: Kathryn, H, Pade, MD 4650 Sunset Blvd MS #113, Los Angeles CA
90027 1 (323) 361--2109 E-mail address: kathrynpade@gmail.com

Pade KH, Seik-Ismail S, Chang TP, Wang VJ

Abstract

Objective: Just-in-time training (JITT) has been used to teach and re-teach known medical techniques, but has not been used to teach novel techniques. We aimed to assess the performance retention of JITT on a novel asthma exacerbation severity assessment technique known as Los Angeles (LA) Phonspirometry.

Methods: This was a prospective cohort study using a convenience sample of pediatric emergency department registered nurses (RNs) who were asked to watch a brief instructional digital video on LA Phonspirometry, and then asked to practice the technique on a research assistant (RA). A

checklist was used to evaluate proficiency with the primary outcome being the number correct on the checklist. The secondary outcome included whether or not they could identify a common error demonstrated by the RA. RNs were re-tested after 4--6 months to assess skill retention.

Results: Forty RNs were enrolled in the study and 6 were lost to follow-up. The mean time from the first to second testing was 5.4 months $\pm$ 0.5 months. The mean score of the first part of the checklist on the initial testing was 4.6 $\pm$ 0.7 and on second testing was 3.8 $\pm$ 1.5 ($p = 0.008$). This represented a drop in scores and thus minimal knowledge decay of 18% (from 91% to 73%). The mean for number of errors picked up for the first test and second test were 1.3 and 1.5, respectively ($p = 0.2$).

Conclusions: JITT demonstrated feasibility as a rapid instructional tool for RNs, with a limited decay in cognitive knowledge surrounding the LA Phonspirometry technique.

Key Words

Just-In-Time Training, nurses, Los Angeles technique, phonspirometry, learning retention, emergency department

Introduction

As technology advances, continuing medical education has begun to involve digital media, instructional digital videos and online modules to teach clinical techniques and tools. For example, Pediatric Advanced Life Support and Advanced Cardiac Life Support courses utilize video modules prior to hands-on sessions, as they have been shown to be effective teaching techniques [1, 2].

The concept of Just-In-Time Training (JITT) for medical education is to use a teaching technique to provide brief, relevant medical education at the time of patient care. It has been shown to increase learning retention and participation [3-5]. The concept of JITT stems from the manufacturing industry, in supply-chain management, in which supplies are made available at the time of need, rather than stocked in anticipation of need. It has been used to teach dental procedures, improve splinting skills in pediatric residents, teach venipuncture and improve the success of thoracostomy tube placement skills [6-10].

Learning retention rates for medical procedures or techniques range depending on the timing and method of teaching (simulation, video modules, hands-on teaching). Recent studies on skill retention involving cardiopulmonary resuscitation (CPR) have shown that clinical skills deteriorate quickly and thus more frequent practice is required in order to improve retention [11-13]. A study by Mpotos et al showed that there was a 51% decrease in skill retention with

short, individualized CPR self-learning sessions upon retesting 5 months later [14]. Similarly, Braun et al found a 44% decrease in retained skills at 6 months after being taught pediatric resuscitation via a simulation-based learning session [15]. Of note, both of these studies assessed decay of knowledge of common procedures that are previously known. As learning retention can deteriorate significantly over several months, techniques to improve retention or easily retrain or refresh memory are needed. There are no studies that evaluate the use of learning procedures to teach medical professionals medical techniques for the assessment of asthma exacerbation severity.

Pediatric asthma accounts for roughly 9.3 visits per 1000 children to emergency departments (EDs) [16]. Registered nurses (RNs) play a critical role in the evaluation of asthma exacerbation severity in the ED as they conduct patient triage and repeated assessments, and thus help to determine the urgency for which the patient is treated and re-assessed by a physician. There are many tools used by RNs to assess asthma exacerbation severity, including peak flow measurements, the Pediatric Respiratory Assessment Measurement (PRAM) and the Pediatric Asthma Severity Score (PASS) [17,18]. The Los Angeles (LA) phonospirometry technique is a validated technique comparable to peak expiratory flow measurements that helps to determine the degree of dyspnea, and therefore may also be used to assess asthma exacerbation severity [19]. The LA phonospirometry technique simply measures the length of time a child is able to chant “LA LA LA” continuously in a single breath, with shorter measurements correlating with more dyspnea

[19]. Dyspnea or breathlessness correlate with a need for intervention and the technique has been shown to correlate well with peak expiratory flow (PEF) measurements in children age 3 years and above with both symptomatic and asymptomatic asthma [19, 20].

To date, there have been few studies evaluating the potential for JITT to teach novel techniques to medical professionals. Thus, the primary objective of this study was to demonstrate the potential for JITT to effectively teach pediatric emergency department RNs the novel technique LA Phonospirometry to assess asthma exacerbation severity. The secondary outcome was to assess the RNs' knowledge retention of the LA Phonospirometry technique several months after the initial JITT training.

Methods

This study was conducted in a busy urban, tertiary care children's hospital ED with approximately 5,000 visits per year for asthma related diagnoses. There are over 70 registered nurses (RNs) that work exclusively in the ED. The institutional review board at the study site approved this study.

A convenience sample of pediatric ED RNs was enrolled while working in the ED at any available time during their shift. All subjects were naïve to the Los Angeles Phonospirometry technique. The LA phonospirometry technique measures the length of time a child is able to chant "LA LA LA" continuously in a single breath [19].

For this study, subjects were asked to watch a 90-second instructional digital video on a tablet that demonstrates the LA Phonspirometry technique on a child and reviewed the most common errors demonstrated by patients in prior studies [19, 20]. Research assistants who enrolled pediatric patients in prior LA phonspirometry studies were polled regarding the most common errors that patients exhibited. The three common errors were selected based on this information [19,20]. (The digital video can be viewed in Appendix 1). The RNs were permitted to watch the digital video as many times as needed prior to testing.

The assessment tool was developed as a 7-item checklist covering the most important elements of the technique (Table 1). The checklist was separated into two parts: the first part, which included five yes/no items, assessed the subject's completion of five core elements of the phonspirometry technique, while the second part included two yes/no items assessing whether or not the subject picked up on two commonplace errors exhibited by the RA performing the LA phonspirometry technique. The five core elements of the LA Phonspirometry technique assessed in part one included: 1) Demonstrating the appropriate pace of chanting; 2) Asking the RA to take a big breath; 3) Asking the RA to chant "LA LA LA;" 4) Timing it correctly using a stopwatch; and 5) Using the provided cards with the LA Phonspirometry normograms to determine the RA's asthma severity. The three common errors selected at random during each testing included making a poor effort, taking a breath or coughing in between the chanting and then continuing to chant "LA LA LA," and not taking a big breath prior to chanting. If they did not

pick up the first error demonstrated, a second attempt was allowed. A RN was considered proficient in the technique if 4 of 5 core elements were done correctly on the initial demonstration as well as correctly picking up an error that was demonstrated by the RA.

Each RN was asked to verbally teach the RA how to perform the LA phonospirometry technique, as if the RA were an actual pediatric patient. Due to feasibility, the testing was conducted by one RA (author SSI). The RA then performed the LA phonospirometry technique correctly with a normal respiratory effort, regardless of the verbal explanation given by the RN. Then, the RA provided a second LA phonospirometry demonstration, this time with one of the 3 errors selected at random. The RN subjects were instructed to appraise whether the technique was done correctly or incorrectly, and if incorrectly, why. This was repeated if the RN did not notice the error, with up to 2 attempts each.

Enrolled RNs were then approached 4--6 months after the initial testing to be re-tested. At this time, they were not allowed to watch the JITT video and were asked to practice the technique on the RA as described above, and the assessment was scored similarly. Of note, the technique was not introduced into clinical use by nursing staff and thus the RNs had no exposure to this technique in between testing.

Data were analyzed using a paired t-test and descriptive statistics. Histograms were used to summarize performance data. The change in mean of number correct from baseline to the second

testing was examined by a 2-sided paired t-test, with statistical significance set at the 5% level. All analyses were done using Statistical Package for the Social Sciences (SPSS version 19, Armonk, NY).

Results

Forty RNs were enrolled between July 2015 and August 2015, and 6 RNs were lost to follow-up, leaving 34 subjects who completed the study. Their nursing experience ranged from 1 year to over 21 years, with an average of 6 years of experience. All 34 participants were determined to be proficient overall using the LA Phonspirometry technique based on the checklist. One RN viewed the video more than once prior to testing.

The mean time from the initial testing to re-testing was 5.4 months $\pm$ 0.5 months. The mean number correct on the first part of the checklist on the initial testing was 4.6 $\pm$ 0.7 and the mean number correct upon re-testing later was 3.82 $\pm$ 1.5. There was a statistically significant change in total correct between the initial testing and re-testing for the first part of the checklist ($p = 0.008$). However, the mean for number of errors picked up for the initial test and re-test was 1.3 and 1.5, respectively, and this difference was not statistically significant ($p = 0.2$). An analysis of the checklist as a whole, combining the two sets of data above, showed that participants initially correctly performed 91.1% $\pm$ 11.6% of the checklist. Upon retesting 5 months later, they

correctly performed 73.2% +/- 30.7% of the checklist. Using the paired t-test, participants had a drop in scores and thus decay of 18% (95% confidence interval 0.0815 to 0.2770).

The most decay in performance occurred for two items: 1) Reminding the RA to take a big breath ($p < 0.001$); and 2) using the normative card values to analyze the severity of asthma demonstrated ($p = 0.039$). The other three test questions (chanting at an appropriate pace, asking the RA to say LA LA LA and correctly timing the RA) did not show a statistically significant decay ($p > 0.2$). Participants did not have a statistically significant decay in catching the error demonstrated by the RA ($p = 0.774$).

Discussion

Online modules, podcasts and other mobile learning approaches have continued to grow in popularity with significant potential to augment medical education [20, 21]. Brief educational videos applying the principles of JITT represent one such approach that has the potential for wide application in medical education. JITT has been shown to be an effective educational technique for medical students, resident physicians, attending physicians, registered nurses and paramedics [6-10, 22, 23]. It provides efficient and focused clinical education and is easily accessible for self-learning or quick refreshers. For example, Steedman et al used a multimedia learning tool to teach undergraduate students common ophthalmologic conditions and found that, the multimedia

tool was equally effective as standard print in imparting knowledge to the undergraduate student [24].

Our study suggests that JITT is a feasible tool for teaching RNs a novel asthma assessment technique. This study may be the first to use JITT to teach a technique that was not previously used or known and while there was some learning decay from initial testing to re-testing, all of the RNs who participated were still considered proficient based on the checklist criteria at the second test point. Based on these findings, educators and investigators in the ED setting and elsewhere may consider using JITT as a straightforward technique to teach unfamiliar techniques or procedures such as LA Phonspirometry.

This was a new application of JITT for medical education as it assessed the effectiveness of a brief instructional digital video for teaching an asthma severity assessment tool unfamiliar to any of the RNs. RNs are often the first providers to evaluate patients presenting to an ED in triage as well as once the patient is placed in a room. Being able to learn and then implement a simple and efficient asthma severity assessment tool can be essential in a busy ED for the provision of timely and appropriate patient care. The learning decay found in our study (18%) is better than other medical procedure studies which show 44--51% decay after 5--6 months of testing. This may indicate that the JITT tool may be a more effective tool due to its simplicity compared to hands-on, simulation training or digital video modules [14,15].

Our study population consisted of registered nurses and did not include respiratory therapists. As respiratory therapists frequently care for respiratory patients in other hospitals, it is important to acknowledge that our results are not necessarily generalizable to respiratory therapists, or other subsets of health professionals. In addition, the RNs were approached during their scheduled nursing shifts and thus may have been compelled to complete the study as quickly as possible. This may be the reason that only one RN watched the video more than once, and thus is a potential explanation for some of the errors made. Additionally, some nurses were on the 11th hour of their 12-hour shift and thus some errors may have been due to RN fatigue, as we did not standardize the time during their shift in which they participated in the study. However, RNs would be expected to use this technique throughout their shift and so these may not necessarily be limitations, but closer to actual nursing practice. A single RA performed the testing due to feasibility. This could lead to incorrect results, however it does provide consistency. We did not compare the JITT digital video to a workshop or in-person training session and thus it may be an equal, better or worse teaching tool compared to an in-person demonstration and practice session. Other limitations include that the study was not performed on children, the checklist assessment was not validated and there were several nurses lost to follow-up from the first to second testing. Of note, although not having a control group may be considered a limitation, LA Phonospirometry is a novel technique that the nurses were not exposed to previously and thus it is unlikely that the nurses would have scored very high.

In the future, LA Phonspirometry could be taught in real time to registered nurses to further examine JITT's potential to teach asthma assessment techniques. LA Phonspirometry could be implemented as an asthma exacerbation severity tool in a pediatric emergency department using JITT. However, given that there was some knowledge decay, we recommend frequent viewing of the JITT video.

Conclusion

JITT can be a rapid instructional tool for RNs, with minimal decay in cognitive knowledge surrounding the LA Phonspirometry technique.

Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Table 1: Checklist Used in Initial testing and Re-testing

<u>INITIAL DEMONSTRATION:</u>	YES (Y)	NO (N)
Did they demonstrate LA Phonspirometry by chanting at an appropriate pace?		
Did they ask the RA to take a big breath?		
Did they ask the RA to say LA LA LA?		
Did they time it correctly?		
Could they use the provided nomogram cards to determine the asthma severity?		
<u>ERRORS:</u>		
Did they pick up on the first error demonstrated?		
Did they pick up on the second error demonstrated?		