

# Accuracy of Pediatric Triage at Siriraj Hospital, Bangkok, Thailand

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**Background:** Siriraj Hospital is a busy 2,500-bed hospital located in Bangkok, Thailand. It has over 1.7 million outpatients, including 120,000 emergency room visits a year, 20,000 of which are pediatric patients. The Pediatric Triage (Pedtriage) system has been in use since the year 2001, but the factors that affect the performance of triage nurse have not been evaluated.

**Objective:** To compare the performance non-pediatric nurses who are responsible for pediatric patients in the emergency room before and after pediatric triage training at Siriraj Hospital.

**Material and Method:** Pediatric Triage Training was set up for emergency room and outpatient department nurses between June and October 2006. The training consisted of 5 hours of didactic sessions on the concepts of pediatric triage and 4-5 hour sessions where the nurses were allowed to triage actual pediatric patients under the supervision of a triage-training nurse. A pre-test and post-test examination was administered. The outcome of triage performance was categorized into under-triage if the patient had an urgent or emergent condition and was triaged as non-urgent, over-triage if a patient had a non-urgent condition and was triaged as urgent or emergent. Statistical description included percent, averages, and standard deviation where appropriate. A standard 4x4 contingency table was used to calculate the sensitivity and specificity. For comparison of performance, a post-hoc analysis was done where the nurses were divided into two groups, those with work experience of less than or equal to 5 years (group 1) and more than 5 years (group 2). An independent samples t-test was used to determine the difference in performance between the two groups.

**Results:** Overall, performance on pre-test - post-test differed significantly before and after training. The nurses in Group 1 had higher pre-test scores (Group 1 mean = 62.35%, Group 2 mean = 52.41%, p-value = 0.001), were less likely to over-triage (Group 1 mean = 4.11%, Group 2 mean = 6.46%, p-value = 0.021) and had higher specificity of triage than Group 2 (Group 1 mean = 95.61, Group 2 = 92.39, p-value = 0.019). However, the nurses in Group 2 had more improvement in their post-test scores (percent of improvement from pre-test: Group 1 mean = 8.56%, Group 2 = 34.69%, p-value = 0.005).

**Conclusion:** Work experience is an important consideration in the triage knowledge and performance of non-pediatric nurses during triage training.

**Keywords:** Pediatric triage, Performance, Nurse, Work-year

*J Med Assoc Thai* 2010; 93 (10): 1172-6

**Full text. e-Journal:** <http://www.mat.or.th/journal>

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Triage is a crucial process in ensuring the quality of care patients receive in the emergency and out patient departments, especially where over-crowding of patients is a main concern. The major role of triage is to set priority for patients according to the anticipated urgency of medical care needs<sup>(1,2)</sup>. It is an

individualized process, both in the sense of the patients and their medical needs and the institution and its nature of services and proficiencies. Siriraj Hospital is a busy 2,500-bed hospital located in Bangkok, Thailand. It has over 1.7 million outpatients, including 120,000 emergency room visits a year, 20,000 of which are pediatric patients. The Pediatric Triage (Pedtriage) system has been in use since May 1, 2001<sup>(3)</sup>. The system relies on an algorithm-based checklist that has been validated<sup>(4)</sup>. There are three outcomes used in the evaluation of the triage process as developed by Department of Pediatrics Siriraj Hospital. "Expected

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triage” means that triage allocation has been appropriate and in accordance with the triage checklist. “Overtriage” means triage allocation is higher urgency than is required for patient’s presentation. “Undertriage” occurs when triage allocation is of lower urgency than required<sup>(5)</sup>. The patient waiting time until medical intervention is increased and there is the risk of an adverse patient outcome.

The Department of Pediatrics Siriraj Hospital has undertaken the training and evaluation of the triage process. By the collaboration of Department of Pediatrics, Out Patient Service Working Committee, The pediatric triage training for nurses who take care of pediatric patients in Siriraj Hospital was set up between June and October 2006.

### Material and Method

Thirty-nine nurses from the Emergency Department, two nurses from the Department of Surgery, one nurse from the Department of Orthopedics, one nurse from the Department of Ophthalmology, and one nurse from the Department of Otolaryngology participated in this study. The training was divided into two parts.

#### Didactic session

The session comprised of 5 hours of lectures on the basic concept of triage, common pediatric emergencies, and the use of the Triage Checklist. A 20-questions pre- and post-tests was administered at the start and the end of the session, respectively.

#### Triage practice session

Each trainee was assigned to triage pediatric patients at the triage station in the Pediatric OPD under supervision of a well-experienced pediatric triage. On the last day of this session, the trainees were allowed to triage additional patients without assistance. Overall, each trainee was allowed no less than 60 patients for an entire 4-day session.

The trainee triaged patients in three categories, emergency, urgent, and non-urgent. All the nurses who underwent triage training were included. Those who could not complete either the didactic or the practical sessions, or were unable to complete the pre-test and post-test were excluded from the data.

The descriptive data on performance of the trainees was evaluated by six factors, over triage, under triage, sensitivity, specificity, pre-test score, post-test score and improvement from pre-test score using percents and averages with standard deviation as

appropriate. Comparison of triage performance between Group 1 and Group 2 was done using standard 2-tailed independent sample t-tests with  $p < 0.05$  was set as statistically significant and paired-t-test was used for comparison of pre-test and post-test significant difference.

### Results

During the training 2,460 pediatric patients were triaged by 44 non-pediatric nurses. All nurses could complete the training. Table 1 demonstrates their overall triage performances while Table 2 describes their performances as categorized into work experience groups. Table 3 illustrates the triage performance categorized into group 1 ( $\leq 5$  years work experience) and Group 2 ( $> 5$  years work experience).

### Discussion

Evaluation of triage has become a vital part in the Continuous Quality Improvement (CQI)/Quality Assurance (QA) of Siriraj Hospital. When evaluating triage efficacy, multiple factors must be considered. In the present study, the authors’ main focus was the human performance and its effect on triage quality. Our endeavor to teach and train non-pediatric nurses to perform triage on pediatric patients originates from the need for risk management in the outpatient setting. As such, competency of the nurse involved becomes the key issue<sup>(6)</sup>. In other published studies, factors that have been shown to effect triage performance include number of patients and waiting time. Thus far, there has been no study that addresses the issue of work experience as it relates to triage performance.

In the present study the authors evaluated the ability of non-pediatric triage nurses in triage of pediatric patients under 6 factors(over triage, under triage, sensitivity, specificity, pre-test score, post-test score and improvement from pre-test score).

**Table 1.** Trainees’ workplace

Place of work	Frequency	Percent
ENT OPD	1	2.27
ER	39	88.64
Ophthalmology OPD	1	2.27
Orthopedic OPD	1	2.27
Surgery OPD	2	4.55
Total	44	100.00

OPD = out patient department; ER = emergency department

**Table 2.** Overall triage performance of non-pediatric nurses

Evaluation criteria	Minimum	Maximum	Mean	Standard deviation
work years	1.00	32.00	10.11	9.70
Percent of cases that were under triaged	0.00	9.09	2.61	2.50
Percent of cases that were over triaged	0.00	13.21	5.55	3.32
True Urgent	0.00	8.00	2.45	1.91
True Non-Urgent	37.00	58.00	48.93	4.94
Sensitivity of triage performance	0.00	100.00	60.37	31.70
Specificity of triage performance	84.09	100.00	93.96	3.75
Pre-test scores (%)	30.00	80.00	56.25	10.52
Post-test scores(%)	40.00	90.00	67.95	12.22
Percent of improvement from pretests	-27.27	100.00	24.60	31.07

**Table 3.** Triage performance categorized into Group 1 (< 5 years work experience) and Group 2 (> 5 years work experience)

Evaluation criteria	Work experiences				p-value
	Group 1 [< 5 years (n = 17)]		Group 2 [> 5 years (n = 27)]		
	Mean	Standard deviation	Mean	Standard deviation	
Work years	1.59	1.18	15.48	8.79	0.000
Percent of cases that were under triaged	2.69	2.67	2.56	2.39	0.863
Percent of cases that were over triaged*	4.11	2.31	6.46	3.56	0.021
True Urgent	2.41	1.37	2.48	2.20	0.908
True Non-Urgent*	50.88	3.31	47.70	5.44	0.036
Sensitivity of triage performance	59.91	29.66	60.67	33.54	0.942
Specificity of triage performance*	95.61	2.45	92.93	4.09	0.019
Pre-test scores(%)*	12.47 (62.35)	1.586 (7.93)	10.48 (52.41)	2.045 (10.23)	0.001
Post-test scores(%)	13.47 (67.35)	2.375 (11.87)	13.67 (68.33)	2.527 (12.63)	0.799
Percent of improvement from pretests*	8.56	17.30	34.69	33.74	0.005

\* Statistically significant difference with  $p < 0.05$

Contradictory to popular belief<sup>(7-9)</sup>, the present study demonstrates that nurses with less experience can perform better at triage than their more experienced counterparts.

In addition to an intrinsic factor such as work experience, extrinsic factors such as triage-training, triage system and setting, and nursing intervention have been shown to improve nurses' performance at triage. Sanddal et al reports that training of prehospital care personnel and/or school nursing personnel in pediatric triage that involves pre-test, training, post-test and follow-up test format show significant improvements of the post-test score (mean score 8.25, SD 1.65) from the pre-test score (mean score 6.22, SD 1.26) ( $p$ -value  $< 0.001$ , 95% CI of the difference

between pre-test and post-test score = 1.41 to 1.26) in pediatric triage after 1 hour lecture, discussion and case review<sup>(10)</sup>. The improvement is maintained for a period of at least 3 months because a paired sample t-test between the pre-test and the 3-month follow-up test scores (mean score 8.41, SD 1.52) was also significant ( $p < 0.001$ , 95% CI of the difference between pre-test and the 3-month follow-up test score = 1.45 to 2.93).

Another extrinsic factor that affects the triage performance is the triage system itself. Gouin et al compared the performance of a new triage protocol, the Paediatric Canadian Triage and Acuity Scale (Paed CTAS) to a previous triage protocol (PRE) before its widespread use<sup>(11)</sup>. The study uses a before and after

prospective study. Both groups are similar in chief complaints, distribution of triage levels, and mean pediatric risk of admission (PRISA) score (calculated from the information of the following variables: the triage level assigned, hospitalization, information on medical investigations, and interventions such as blood culture, complete blood count, administration of intravenous fluid bolus and bronchodilator inhalations, and other variables). The study showed that in the Paed CTAS group, more patients are triaged in the higher level (53% of patients) compared to PRE group (36% of patients) ( $p < 0.05$ ) but the percentage of admission for patients in the Paed CTAS group is comparatively lower (13% vs. 27%,  $p < 0.05$ ). The ability to predict admission is greater for the PRE tool as compared with the Paed CTAS tool (the area under the receiver operating characteristic curves: 0.82 vs. 0.69; 95% CI for difference, 0.05-0.20,  $p = 0.001$ ).

In the present study, the authors have evaluated the intrinsic factor, work experience that affected the pediatric triage performance of non-pediatric nurse in the aspect of overtriage, undertriage, sensitivity, specificity, pre-test score, post-test score, and improvement of test score.

The present study shows that nurses in Group 1 could triage more specifically (Group 1: mean = 95.61, Group 2: mean = 92.93,  $p < 0.05$ ), could triage more accurately in non-urgent patients (Group 1: mean of expected triage in non-urgent patients = 50.88, Group 2: mean of expected triage in non-urgent patients = 47.70,  $p < 0.05$ ), and could get higher scores in pre-test (Group 1: mean score = 12.47, Group 2: mean score = 10.48,  $p < 0.05$ ) compared with the nurses in Group 2.

After the training, the trainees in Group 2 can improve their post-test scores significantly (mean of pre-test score = 10.48, mean of post-test score = 13.67,  $p < 0.05$ ), therefore, the triage training had an important role in triage performance improvement. The present study highlights the need for nurses to have on-going training and job experiences regarding pediatric triage so that they will be able to improve and maintain their competency in this area.

### Conclusion

Pediatric triage performance of triage nurse is influenced by extrinsic and intrinsic factors. The intrinsic factor in the present study is work experience, which is associated with quality of triage performance. This aside, it is the extrinsic factor, the triage training, that

has shown the greatest potential for improvement that can greatly impact the quality of nursing care patients receive in the Outpatient Department and Emergency room. Thus, it is imperative that pediatric triage training is set up and regularly continued in order to standardize and maintain patient care practices.

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## ความถูกต้องของพยาบาลในการคัดกรองผู้ป่วยเด็กตามความรีบด่วนในโรงพยาบาลศิริราช

วรพันธ์ เกรียงสุนทรกิจ, บุษบา หอมชื่น, จุฬิธา โฉมฉาย, วิภาเพ็ญ เนียมสมบูรณ์

**ภูมิหลัง:** โรงพยาบาลศิริราชเป็นโรงพยาบาลตติยภูมิที่รับผู้ป่วยที่ส่งต่อมาจากโรงพยาบาลทุติยภูมิ และปฐมภูมิจำนวนมาก นอกจากนี้ยังให้บริการแก่ประชาชนทั่วไป โดยที่แผนกฉุกเฉินมีผู้ป่วยมารับบริการทั้งหมดประมาณ 120,000 คน ต่อปีซึ่งเป็นผู้ป่วยเด็ก (อายุน้อยกว่าหรือเท่ากับ 15 ปี) ประมาณ 20,000 คน ต่อปี เพราะฉะนั้นการคัดกรองผู้ป่วยจึงมีความสำคัญเป็นอย่างยิ่ง ภาควิชากุมารเวชศาสตร์ คณะแพทยศาสตร์ศิริราชพยาบาล เริ่มมีการคัดกรองผู้ป่วยเด็กตามความรีบด่วนที่แผนกตรวจโรคผู้ป่วยนอกตั้งตั้งแต่ปี พ.ศ. 2544 และเริ่มมีการสอน และนำมาคัดกรองผู้ป่วยเด็กที่แผนกฉุกเฉินตั้งตั้งแต่ปี พ.ศ. 2549

**วัตถุประสงค์:** เพื่อเปรียบเทียบความสามารถของพยาบาลผู้ดูแลผู้ป่วยเด็กที่ห้องฉุกเฉิน ในการคัดกรองผู้ป่วยเด็กตามความรีบด่วนก่อนและหลังการอบรมในโรงพยาบาลศิริราช

**วัสดุและวิธีการ:** โรงพยาบาลศิริราชจัดการอบรมเรื่องการคัดกรองผู้ป่วยเด็ก ตามความรีบด่วนสำหรับพยาบาลที่ห้องฉุกเฉิน และแผนกตรวจโรคผู้ป่วยนอกที่มีโอกาสดูแลผู้ป่วยเด็กระหว่างเดือนมิถุนายน ถึง ตุลาคม พ.ศ. 2549 โดยแบ่งเป็นภาคทฤษฎี 5 ชั่วโมง และภาคปฏิบัติเพื่อคัดกรองผู้ป่วยเด็กอีก 4-5 ชั่วโมง ภายใต้การดูแลของพยาบาลผู้ให้การอบรม และจะมีการประเมินผลการอบรมโดยให้ผู้รับการอบรมสอบข้อเขียนก่อนและหลังการอบรม ส่วนภาคปฏิบัติจะวัดจากผลของการคัดกรองซึ่งแยกได้เป็น 3 กลุ่ม ดังนี้ *under-triage* คือประเมินผู้ป่วยว่ามีอาการรุนแรงน้อยกว่าความเป็นจริง เช่น ผู้ป่วยมีภาวะรีบด่วนหรือฉุกเฉินแต่ให้การคัดกรองว่าไม่รีบด่วน, *over triage* คือประเมินผู้ป่วยว่ามีอาการรุนแรง มากกว่าความเป็นจริง เช่น ผู้ป่วยไม่มีภาวะรีบด่วน หรือ ฉุกเฉินแต่ให้การคัดกรองว่าฉุกเฉิน, *expected triage* คือการคัดกรองได้ตรงกับอาการของผู้ป่วย หลังจากนั้นจะทำการเปรียบเทียบความสามารถก่อนและหลังการอบรมในการคัดกรองผู้ป่วยเด็กของพยาบาลที่มีอายุการทำงานน้อยกว่า 5 ปี (กลุ่มที่ 1) และมากกว่าหรือเท่ากับ 5 ปี (กลุ่มที่ 2) การศึกษานี้ใช้การวิเคราะห์สถิติแบบ *independent samples t-test* และ *contingency table* เพื่อคำนวณความไว (*sensitivity*) และความจำเพาะ (*specificity*)

**ผลการศึกษา:** มีพยาบาลเข้าร่วมการอบรมทั้งสิ้น 44 คน โดยเป็นพยาบาลที่แผนกฉุกเฉิน 39 คน (ร้อยละ 88.64) แผนกศัลยกรรม 2 คน แผนกโสต ศอ นาสิก ลาริงซ์วิทยา, แผนกจักษุวิทยา, แผนกศัลยกรรมกระดูก แผนกละ 1 คน โดยเป็นพยาบาลกลุ่มที่ 1 จำนวน 17 คน พยาบาลกลุ่มที่ 2 จำนวน 27 คน ผลการอบรมแสดงให้เห็นว่า พยาบาลในกลุ่มที่ 1 มีคะแนนสอบ *pre-test* (กลุ่มที่ 1 = 62.35% กลุ่มที่ 2 = 52.41%, *p-value* = 0.001) และ ความจำเพาะในการคัดกรองผู้ป่วยเด็ก (*specificity*) (กลุ่มที่ 1 *mean* = 95.61 กลุ่มที่ 2 *mean* = 92.39, *p-value* = 0.019) มากกว่ากลุ่มที่ 2 และมีร้อยละของการประเมินอาการผู้ป่วยรุนแรงเกินจริง (*over triage*) (กลุ่มที่ 1 = 4.11% กลุ่มที่ 2 = 6.46%, *p-value* = 0.021) มากกว่ากลุ่มที่ 2 อย่างไรก็ตามพยาบาลในกลุ่มที่ 2 สามารถทำคะแนนเพิ่มขึ้นจาก *pre-test* มากกว่าพยาบาลในกลุ่มที่ 1 ในการสอบ *post-test* (ร้อยละการเพิ่มขึ้นของคะแนนจาก *pre-test* กลุ่มที่ 1 = 8.56% กลุ่มที่ 2 = 34.69%, *p-value* = 0.005)

**สรุป:** อายุงานที่มากขึ้นของพยาบาลห้องฉุกเฉิน ไม่สัมพันธ์กับความสามารถในการคัดกรองผู้ป่วยเด็กตามความรีบด่วน แต่ความสามารถนี้ จะเพิ่มขึ้นอย่างชัดเจนหลังผ่านการอบรม