ANNOTATED BIBLIOGRAPHY- PEDIATRIC TRIAGE LITERATURE

National Triage Scale (Australian Triage System)

Background: The NTS is a five level triage system that was adopted in Australia in 1993. It is recognized by all federal and state health departments in Australia and is widely used in Australian hospitals. The NTS asks the triage nurse to make an assessment of how long the patient can safely wait for care and a triage category of 1 (immediate care) to 5 (can wait up to 2 hours) is assigned to each patient. It is the triage system on which the British and Canadian systems were based. The system has been studied and shown to be validated in adult populations, but there is little literature on it's validity in pediatric patients.

Durojaiye L, O'Meara M. A study of triage of pediatric patients in Australia. Emerg Med 2002; 14: 67-76

This study aimed to examine the triage of pediatric patients in both mixed use (adult and pediatric) and pediatric emergency departments in Australia; and to assess the inter rater reliability of the NTS when applied to pediatric patients.

Nurses at 10 hospitals were asked to assign a triage level to each of 25 pediatric triage case scenarios using NTS criteria. In addition, each hospital was asked to provide information on all pediatric patients triaged in the ED in 1999, data collected included total number of patients, number of patients in each triage category and number of admissions in each triage category.

78 nurses responded and ED data was collected on all 10 hospital. Pediatric ED nurses were more likely to assign lower acuity levels to cases then mixed use ED nurses, and pediatric EDs saw more patients in lower acuity levels than mixed use EDs (although both types of ED saw the same proportion of category 1 and 2 patients). Of note, while the admission rates for each category fell within NTS guidelines at each hospital, the pediatric EDs tended to admit more category 4 and 5 patients than the mixed use EDs.

The study suggests that there is variability in how the NTS is applied to pediatric patients and only modest agreement and reliability when the NTS is used for pediatric patient.. There is a clear difference in the triage of patients in pediatric v mixed use EDs and this may reflect the nurses training, exposure to and comfort level with children.

Crellin D, Johnston L, Who is responsible for pediatric triage systems in Australian emergency departments: A description of the education and experiential preparation of general and pediatric emergency nurses. Pediatric Emergency Care; 18(5): 382-388

The Australian College of Emergency Medicine and the Australian College for Pediatrics have issued a joint statement on nursing qualifications for taking care of pediatric patients in the ED> These include a minimum of 12 months of "appropriate training and experience" and that the "triage nurse should normally be a registered nurse trained in pediatric nursing." Several prior ED studies in Australia suggested that experience level was not the cause of inconsistent application of the NTS,; however, nurses with less pediatric experience expressed lower comfort levels with pediatric patients. This study looked at the level of education and experience of nurses providing triage for pediatric patients throughout Australia.

9 public hospitals were surveyed. All used the NTS. The hospitals were in a mix of urban and rural setting and included both pediatric and mixed use EDs.

44% of the nurses surveyed responded. While number of years of general and ED nursing experience were similar across both groups, mixed use ED nurses reported less pediatric experience and less exposure to pediatric education. Pediatric nurses reported greater comfort with pediatric triage decisions. (p=0.004)

Although this stuffy had only a fair response rate, it did suggest that there is significant variability in the training, experience, and comfort levels of nurses providing triage to pediatric patients. The study did not attempt to show whether this affected patient outcomes, but does make an argument for standardized training guidelines for nurses who will be triaging pediatric patients.

Van Gerven R, Delooz H, Sermeus W. Systematic triage in the emergency department using the Australian National Triage Scale: a pilot project. Europ J of Emerg Med; 2001, 8: 3-7

Up until recently Belgium has not formally triaged patients in the ED. This was a pilot study looking at using the NTS in the emergency department of a university hospital in Belgium. 4 nurses received 20 hours of triage training and were then assessed on their triage of 3650 patients. Outcome markers such as admission rates and "sentinel diagnoses" were used to estimate the predictive value of the triage decisions. Inter rater reliability was only fair (0.44-0.54) among the 4 nurses, although higher triage criteria did correlate with higher admission rates. VS were rarely taken into account in triage decisions. Children under 5 were more likely to be placed in the urgent category.

This study suggests that triage decisions do correlate with admission rates and triage has a place in the ED. It also suggests however that there can be significant variability in how the NTS is applied. This argues for strict formal guidelines for both triage and the education of triage nurses.

Triage in the United States

Background: While essentially all US emergency departments use some form of triage, practices vary widely across the country. Numerous triage scales are currently in use, some of which are 3 level and some of which are 5 level scales. The ENA currently recommends that a five level triage system be used, but this is not yet a uniform practice across the country

Wuerz R, Milane L, Eitel D, Travers D, Gilboy N. Reliability and Validity of a new Five-level triage instrument. Academic Emerg Med.; 2000, 7(3): 236-242

Wuerz R, Travers D, Gilboy N, Eitel D, Rosenau A, Yazhari R. Implementation and refinement of the Emergency Severity Index. Academic Emerg Med.; 2001, 8(2): 170-176

These two studies looked at the creation, validity and implementation of the ESI, a new five level triage. The ESI is a five level triage system that looks at both urgency (i.e. "when should this patient be seen?) and resource utilization (i.e. " what does this patient need?") when making triage decisions. The ESI is a flowchart type triage algorithm that assigns patients to categories based on both acuity and expected resource utilization . The first study looked at a convenience sample of 538 patients at two hospitals where each patient was triaged by both a staff nurse using a 3 level system and an ESI research nurse using the 5 level ESI. A 2nd ESI triage rating was also retrospectively assigned to each patient by a blinded rater. The results suggested that hospitalization rates correlated well with ESI level and length of stay modestly correlated. Weighted kappa's on 20 pilot case scenarios tested on study investigators were excellent.

The second study looked at the implementation of the ESI as the triage method at 2 urban, academic emergency departments. Triage nurses received a 1.5 hour in-service on the new system

including a 20 question post test consistent of case scenarios for which they were asked to assign a triage level. A convenience sample of patients at each site was triaged by the triage nurse and retrospectively assigned and ESI level by a blinded study nurse. Data was collected on admission rates and length of stay. A staff survey on the ESI system was distributed 16 months after implementation.

Excellent kappa's were recorded for both the post test questions ((0.80) and the paired triages (0.73). Staff feed back expressed concerns over the use of vital signs and what constituted a resource. Footnotes and changes to the educational materials were made as a result.

These studies suggest that, at least in the limited setting of an academic medical center, the ESI is an effective triage tool. However, these studies looked only at patients over the age of 14, so no conclusions can be drawn about the validity of the system in pediatric patients. The revisions included age based vital sign criteria , and it is our ongoing study that aims to assess the validity of the ESI in the pediatric population.

Travers D. Triage: How long does it take? How long should it take? J of Emerg Nursing; 25(3): 238-240

The ENA states that triage should be completed within 2-5 minutes. This study looked at how long it really takes and what factors are associated with this length of time. A random sample of 260 triage assessments at a single academic ED as looked at over a 10 day period (16 triage nurses). 150/260 patients had a full set of vital signs taken (but only 53% of pediatric patients had vitals). Triage time increased with increasing age, and taking vital signs increased the length of time needed to triage a patient. Nursing experience levels did not affect triage times. The mean triage times fell within the recommended range (2.4-4 min) but the range was 0.5-11.1 min.

This study suggests that it is possible to triage patients within the 5 minute period recommended by the ENA. However, the triage system in place at the time of this study was not the ESI and so no conclusions can be drawn about triage times using the ESI system. The study does raise important questions about the use of vital signs for triage. As part of our current study it seems important that we look at the utilization of vital signs in the ESI system for pediatric patients.

Triage Assessments : Are nurses and physicians in agreement

Background: Triage is done by nurses on the patient's arrival to the emergency department, but the question arises as to how the triage nurse's judgment of the patient's acuity compares to that of the physician who ultimately sees the patient.

Maldonado , Avner J. Triage of the pediatric patient in the emergency department: are we all in agreement? Pediatrics; 2004, 114(2): 356-360

This study surveyed all pediatric emergency medicine attending, emergency medicine attendings, pediatric and emergency medicine residents and triage trained nurses at a single academic institution. Participants were asked to assign a triage level (based on a 3 level triage system) to 12 written triage scenarios. The response rate was 99% and the k levels of agreement ranged from 0.39 for PEM attendings to 0.26 for general emergency medicine nurses. General EM physicians and nurses were more likely to assign a higher acuity to patients, particularly those with high fevers outside of the neonatal period.

This study has several limitations in that it used unvalidated case scenarios and a 3 level triage scale, making it difficult to make comparisons with the ESI. That said, however, it does once again raise the issue of poor inter rater reliability when it comes to pediatric triage and points again to the differences between triages done by pediatric trained and non pediatric trained nurses and physicians.

Bergerson S, Gouin S, Bailey B, Patel H. Comparison of triage assessments among pediatric registered nurses and pediatric emergency physicians. Acad Emerg Med; 2002, 9(12): 1397-1401

This study, done in a large volume pediatric emergency department, used written case scenarios to compare triage assessments nurses and physicians with a consensus standard for each case. The triage nurses and attending physicians in pediatric emergency department were asked to assign a triage level to 55 patient scenarios using a 4 level acuity scale. The response rate was 100%. The kappa's ranged from 0.42 for physicians to 0.46 for nurses. Number of years of experience did not affect the nurses results but the physicians with more experience were more likely to agree with the consensus standard for each scenario.

This study is once again limited by it's use of unvalidated cases and a 4 and not 5 level triage system. It does have the advantages of looking only at physicians and nurses working in a pediatric emergency department. This study reinforces the concern that there is only moderate levels of agreement when it comes to assigning triage scores to pediatric patients which potentially argues for changes to either the triage systems in place or the pediatric triage education providers are receiving.

The Canadian five level pediatric triage system

Background: In 1997, the Canadian Association of Emergency Physicians and the National Emergency Nurses Affiliation jointly created the 5 level Canadian triage and acuity scale (CTAS). CTAS usage is mandatory in most Canadian provinces and several studies suggest it has good inter rater reliability in adult patients. In 2001, a pediatric version of CTAS was proposed (P-CTAS), which uses a combination of physiologic measures and symptom complexes to assign a triage score to children using a 5 level scale.

Gouin S, Gravel J, Amre D, Bergeron S. Evaluation of the pediatric triage and acuity scale in a pediatric ED. Am J Emerg Med; 2005, 23: 243-247

This study aimed to compare the newly developed P-CTAS with the 4 level triage system previously in use in the emergency department of a tertiary care children's hospital. The study was a prospective one. All patients between 0-19 years who presented to this ED between February and march 2001 were triaged with the 4 level scale by nurses with at least one year pediatric ED experience. P-CTAS was then implemented with an 8 hour training course and pocket cards for the triage nurses. 2 weeks after implementation, patients were again enrolled over a 4 month period from July-October 2001. The primary outcome measure was admission rate for each triage level (pre and post P-CTAS). The pre P-CTAS system was better both at predicting admissions and some ED interventions but not all ED interventions. Moreover, the P-CTAS resulted in more patients being assigned to higher acuity levels. Of note, the overall hospitalization rate for the P-CTAS group was only 8.6% while it was 11.3% in the pre P-CTAS group.

This study compared patient cohorts from two different times of the year and it is well known that pediatric illness and trauma has significant seasonal variation. This fact, and the differing overall admission rates between the two groups, make it difficult to draw clear conclusions about the efficacy and predictive value of the P-CTAS as compared to the prior system. This study points out some of the difficulties in assessing the validity of a pediatric triage tool (I.e. what endpoints do we use) and the difficulty in comparing patients triaged under different systems. If multi center studies are done looking at ED resource utilization this study it is important that the triage tool be the same at all the

institutions. On a larger policy level, these results argue for the importance of a single national triage system. They also suggest that, without further study, it is not clear that the P-CTAS is the best system to use.

Bergeron S, Gouin S, Bailey B, Amre D, Patel H. Agreement among pediatric health care professionals with the pediatric Canadian triage and acuity scale guidelines. Ped Emerg Care; 2004, 20(8): 514-518

This study, done in the pediatric emergency department of a tertiary care children's hospital, aimed to compare the triage level assignment between registered nurses and pediatric emergency medicine physicians and a panel of experts using the P-CTAS criteria. At the time of the study, the P-CTAS had been in use for 5 months. The study involved 55 pediatric triage scenarios that had been used in a prior study of a 4 level system at the same institution. The response rate was 85% and the kappa's ranged from 0.39 for the physicians to 0.51 for the nurses. The mean number of correct responses as compared to the panel of experts was similar for both physicians and nurses (60-64% with a SD of 22-27%).

Although this study used unvalidated cases, it used the same cases as a previous study on a 4 level triage system done in the same setting. The study has the advantage of being done in a solely pediatric setting where issues such as lack of comfort with pediatric patients are less of a concern. This study suggests that the P-CTAS needs further study and refinement prior to widespread implementation. In it's present form it is unlikely to be an ideal system to look to for possible changes to the pediatric ESI criteria.

Pediatric asthma scales

A Modified Pulmonary Index Score with Predictive Value for Pediatric Asthma Exacerbations. Carroll, CL, Sekaran AK, Lerer TJ, et.al. Ann Allergy Asthma and Imm; 94: 355359

Prospective study of consecutive status asthmaticus admissions to tertiary peds center that evaluated the reproducibility and validity of the Modified Pulmonary Index (MPIS). The MPIS uses 6 measures (O2 sat, Accessory muscle use, I to E ratio, wheezing, heart rate, resp rate) and was evaluated at admission to the hospital and at a second time point during the admission. The measures were obtained by attending physicians, nurses and respiratory therapists. The validity of the MPIS as a predictive measure of severity by comparing to pre determined outcome measures (duration of supplemental O2, duration of continuous albuterol therapy and length of stay. 30 patients were enrolled. The study revealed a very high kappa between provider groups for the MPIS and a predictive validity between high MPIS score and severity as measured by the outcome measures.

Validation of the Pulmonary Score: An Asthma Severity Score for Children. Smith SR, Baty JD, Hodge D. Acad Emer Med; 9:2, 99-104.

Prospective cohort study of children presenting to an academic Peds ED. The pulmonary score (PS) uses respiratory rate, wheezing and accessory muscle use as an indicator of asthma severity and was introduced and trained by the PI and compared to PEFR's. All subjects had multiple assessment of PS by 2 providers before and after initial albuterol treatment. 46 kids were evaluated and were found to have a negative correlation between PS and PEFR before and after treatments. The PS met both construct (degree to which an instrument measures the characteristic under investigation) and criterion

(degree to which an instrument correlates with an established criterion) validity to a moderate degree. The PS is a relatively simple measure that compares similarly to the several other predictive measures of asthma severity.

Asthma severity scores for preschoolers displayed weaknesses in reliability, validity and responsiveness, Birken CS, Parkin PC, Macarthur C. J Clin Epidemiol; 57: 1177-1181.

Analysis of 10 asthma severity scores for preschool aged children that used 19 different clinical variables. The most common clinical variables included wheezing, accessory muscle use and respiratory rate. There was an extensive discussion of the utility, strengths and weakness of the various scoring modalities. Not particularly useful for our study in that the ESI. These asthma severity measures speak to the intensity of resource use, rather than the initial use. That is, 1 neb equals 3 or 4 nebs. As with all of severity scores, the kappa between providers is fairly good for assessing the measures (resp rate, heart rate, accessory muscles, etc.)

Performance of a Novel Clinical Score, the Pediatric Asthma Severity Score (PASS), in the evaluation of Acute Asthma. Gorelick MH, Stevens MW, Schultz TR, et al. Acad Emer Med; 11:1, 10-18.

Prospective cohort study of acute asthma exacerbations. Both ED's, patients were treated and dispositioned using standardized guidelines and charts were audited for compliance with these guidelines. 6 clinical findings were assessed in all patients using a predetermined 3 point scoring system. The assessments were primarily made by registered respiratory therapist and a kappa was determined by an independent and blinded second provider (nurse, RT or physician). A 3 item score using wheezing, work of breathing, and prolongation of expiration was determined to be the best composite score for interrater reliability, ease of use, correlation with other asthma severity measures and responsiveness for changes in patient status during acute treatment.

Development of a Clinical Asthma Score for Use in Hospitalized Children between 1 and 5 yrs of age. Parkin PC, Macarthur C, Saunders NR, et al J Clin epidemiol; 49:8, 821-825.

Similar study design as the PASS study with collection of several clinical scores with evaluation of data to develop the Clinical Asthma Score (CAS). The CAS consisted of a 3 point scale measuring Resp rate, Wheezing, Indrawing (accessory muscle use), "observed dyspnea", and I to E ratio. The CAS was found to be reliable between 2 pediatricians of 0.82. The individual measure kappa ranged from 0.85 for resp rate, 0.79 for accessory muscle use, 0.64 for wheezing, 0.63 for observed dyspnea and 0.43 for I to E ratio. The validity was found to be good when compared with length of stay and negative correlation with drug dosing. The weakest correlation was associated with O2 sat. The 5 score item list was found to have better validity and responsiveness to change in clinical status.

Clinical Scores for Acute Asthma in Pre-School Children. A Review of the Literature. Van Der Windt DA, Nagelkerke AF, Bouter LM, et al. J Clin Epidemiol; 4:6, 635-644.

A review of the literature available in 1994 evaluating the asthma scores available at the time. Review is out of date and not particularly useful. It did state that the measures are relatively easy to obtain in a reproducible fashion with good interrelator reliability. The clinical scores were not particularly useful in admission vs discharge decisions, but were found to have some use in assessment of severity of the exacerbation.

Use of Respiratory Clinical Score Among Different Providers, Liu LL, Gallaher MM, Davis RL, et al. Pediat Pulm 37:243-248.

Prospective observational study of scoring in 4 clinical parameters (resp rate, retractions, dyspnea, and auscultation) for patients presenting to a pediatric emergency department with asthma or wheezing by physician, nurse an respiratory therapist to assess interrater reliability. Overall agreement for all rater pairs was 84% with a weighted kappa of 0.62 (good). In all matched and unmatched pairs the agreement ranged from 82 – 84% with weighted kappa ranging from 0.52 to 0.65. The breakdown of agreement by diagnosis were all above 80% with weighted kappas greater than 0.50. Symptom breakdown revealed lowest agreement and kappa for resp rate and highest for dyspnea.

Miscellaneous pediatric ED studies

Fast Track and the Pediatric Emergency Department: Resource Utilization and Patient Outcomes. Hampers LC, Cha S, Gutglass DJ, et al. Acad Emerg Med. 6:11, 1153 – 1159.

Prospective evaluation of resource utilization between an urgent care and acute emergency department of a single institution for similarly triaged patients. The patients were children who were triaged as non-urgent in a 4 tier system and placed into either an urgent care setting staffed by general pediatricians and an acute emergency department staffed by pediatric emergency physicians and residents (pediatric, family medicine and emergency medicine). Vital sign assessment was similar between the two groups. The study revealed that patients placed in the acute ED were more likely to be admitted, more likely to receive IVF, and had a longer length of stay from triage to discharge. Overall charges for diagnostic tests were significantly lower in the urgent care area.

Professional Interpreters and Bilingual Physicians in a Pediatric Emergency Department. Hampers LC, McNulty JE. Arch Pediatr Adolesc Med. 156: 1108- 1113.

Prospective observational study of 4146 visits to a pediatric emergency department over 2 time periods during which professional and trained Spanish interpreters were available. The study revealed that when no language barrier existed (either English speaking or when a bilingual physician is caring for the patient) that clinical evaluations were less extensive (less frequent and less expensive diagnostic testing - Likelihood of any testing OR 0.77 v 1.5, Adjusted test cost $18.11 v $22.27) and children were treated less conservatively (less IV hydration and less frequent hospital admissions- IVF OR 1.6 v 22, admission OR 1.2 v 2.6). The use of a professional interpreter was used, there was no difference between use of IVF or tests utilization. There was, however, a slight increase in admission rate did remain.

Language Barriers and Resource Utilization in a Pediatric Emergency Department. Hampers LC, Cha S, Gutglass DJ, et al. Pediatrics 103: 1253-1256.

Prospective observational study in a pediatric emergency department assessing the affect of language barrier on resource utilization. Patients that physicians felt presented with a language barrier were noted to have increased use of IVF (OR 1.8, 95% CI 1.2, 2.6), were more likely to be admitted (OR 1.6, 95% CI 1.1,2.4) and had a 28 minute longer length of stay (95% CI 15,42). Patients in both groups were noted to have similar proportions of test performed (44% vs 47%) but the language barrier group had a significant increased cost of tests ($145 v 104).

Triage education

Salk ED, Schriger DL, Hubbell KA, Schwartz BL. Effect of visual cues, vital signs, and protocols on triage: a prospective randomized crossover trial. Ann Emerg Med. 1998 Dec;32(6):655-64

The purpose of the article is to describe a study that sought to compare triage designations and the importance of visual cues and vital signs, as well as the use of protocols, between nurses who performed in-person interviews and nurses who performed telephone interviews. A prospective, observational study, it was conducted in two phases by use of a randomized crossover design at a university teaching hospital emergency department. The study reports that agreement between the two study groups was poor, and suggests that visualizing a patient is key to assigning the correct triage designation. The authors hypothesized that there would be higher agreement between in-person and telephone interviews when protocols were used; that the provision of vital signs would increase agreement between the two groups; and that the provision of vital signs would lead to more changes in triage designation for those performing telephone interview than those performing in-person interviews.

The authors accomplished their goal of describing that visual cues are important in assigning triage designation. Though the addition of vital signs also caused nurses to change, typically to a more acute, triage designation, there was insufficient evidence to validate the hypothesis that the provision of vital signs assisted in better agreement between the two study groups. Although the study numbers were small, the use of protocols was reported as less sensitive than triage without protocols.

The application of this study to clinical practice is two fold. First, it emphasizes the importance of a skilled triage nurse in the position of visually identifying a patient. Second, it suggests that one reason the agreement between the two groups regarding the use of protocols may be that the use of protocols might actually interfere with a “natural interviewing process”. These two important safety considerations should be considered when designing or reviewing the triage process.

McNair RS. It takes more than string to fly a kite: 5-level acuity scales are effective, but education, clinical expertise, and compassion are still essential. J Emerg Nurs. 2005 Dec;31(6):600-3

This article discusses three factors that may favorably impact the use of a 5 level acuity scale, education, clinical expertise and compassion or empathy. The author describes her triage company’s extensive experience in observing and training triage nurses over several years, and suggests that adopting a 5 level acuity scale is important but that it fails to fully address an effective triage system. Further, the article states that studies that suggest that the implementation of a 5 level triage acuity scale alone, are inaccurate, because they do not address the training and other systems changes that occur as the scale is introduced. The author also suggests that mistriage events are often the result of a lack of education, a lack of experience and a lack of empathy. The author suggests that nurses who are assigned to the role of triage nurse 1) receive education that includes systematic assessment, critical

thinking skills and a clinical knowledge of varied populations; 2) adhere to the Emergency Nurses Association position statement requiring a minimum of 6 months experience as an emergency nurse; and 3) that triage nurses have a "caring ethic".

While each of these items seems noble, recommendations that will require significant resources to be expended, especially in training, need study and validation. This article should be read with caution, as the author has a vested interest in making these recommendations as her triage education company provides this type of training for a fee. With all of the experience and expertise in observing and training triage nurses, it would seem realistic that the author would conduct or fund studies to validate her recommendations.

Zimmerman P. Orienting ED nurses to triage: using scenario-based test-style questions to promote critical thinking. J Emerg Nurs. 2003 Jun;29(3):256-8

This article describes a scenario-based testing methodology for orienting nurses to triage. Four sample scenarios are listed that reinforce "lessons" such as the importance of obtaining a complete history, the need to elicit more than what the patient tells you, ruling out serious etiology, and the need to avoid stereotypes and assumptions. Though this paper provides a suggestion for a simple method of educating triage nurses, its title is a bit misleading as there is no true discussion of how this type of training promotes critical thinking. In addition, while the "lessons" provide the correct answer to the questions, there is no discussion about why other answers are incorrect. Additional scenarios that include rationales for all answers may further enhance critical thinking and assist in the orientation of nurses to triage.

Cioffi J. Clinical simulations: development and validation. Nurse Educ Today. 2001 Aug;21(6):477-86

This article describes a conceptual approach to simulation development and validation as it applies to the development of assessment simulations for childbirth and triage situations. The author suggests that simulations that resemble reality are needed to best replicate true clinical practice. She further suggests that a process-based method of presenting information to the learner in the assessment phase should be incorporated from actual clinical cases. In particular, she states that in order to more fully simulate the triage environment, there needs to be varying degree of uncertainty present in the scenarios.

One of the most insightful statements in this article recognizes that triage is a complex and uncertain task where decision makers have limited ability to predict outcomes. Thus the creation of meaningful simulation scenarios in order to accurately assess patients for safe clinical care is critical. The author suggests three elements to accomplish this; 1) provision of limited information; 2) the ability of the clinician to investigate freely; and 3) the clinical information requested is given over time during the simulation. A panel of experts validated the clinical scenarios.

The application of the use of simulation to clinical practice deserves attention in the education of nurses who are assigned to the role as triage nurse. Simulations provide educators with a teaching strategy that can be used in classroom and tutorial settings, as well as allowing adult learners to have some control over the learning experience.

Stephens GS, Pokorny ME, Bowman JM The effects of inservice education on the institution of triage protocols. J Nurs Staff Dev. 1997 Jul-Aug;13(4):189-92

The purpose of this study was to examine the effects of inservice education on the initiation of triage protocols by ED nurses for patients experiencing cardiac symptoms. The study used a pretest/posttest design with a convenience sample of 40 patients with chart reviews conducted on 20

patients seen in the emergency room with suspected myocardial infarction. ED nurses were then given an inservice program on institution of triage protocols, and 20 more patient charts were reviewed. The study reported that 1) ED nurses incorporated pain and symptom distress measurement tools in physical assessments more frequently after inservice education sessions than before inservice education sessions and 2) ED nurses documented the use of triage protocols more frequently after the inservice education sessions than before the sessions. The study suggests that nursing inservice education positively affects nursing care for patients with suspected myocardial infarction.

This study has application to clinical practice, with significance beyond the recommendation of inservice education for patients with one type of disease. When implementing standardized guidelines, an educational methodology as described in this study would likely be beneficial regardless of the disease entity. It is unclear from the study what type (lecture, case study, etc) and the length of each educational session was. This could be an important factor in recommending additional educational sessions for other types of standardized guidelines.

Atack L. McLean D. LeBlanc L, Luke R. Preparing ED nurses to use the Canadian Triage and Acuity Scale with Web-based learning.
J Emerg Nurs. 2004 Jun;30(3):273-274.

This paper describes the successes and challenges of implementing a web-based learning program for the use of the Canadian Triage and Acuity Scale (CTAS). The study authors found that the time constraints involved in educating so many nurses to CTAS required an alternative to classroom based education. A web-based program was developed in response to nurse's training and technology needs, learning and work environments and learning styles. The authors report that nurses wanted quick, convenient access to education using "real-life" situations. Nurses had the option to perform the web-based training at work or at home. However, the most significant barrier to either remained time constraints. Most nurses who completed the training reported that they learned CTAS well and that they felt their triaging skills improved. Of particular interest, the nurses felt they were more appropriately "triaging up", erring on the side of patient safety. Nurses who did not report a positive experience were surveyed and a number of changes were made in the web-based learning. As noted in the paper, the ability to keep web-based learning current and relevant is important.

Though the author's reported that the reason for developing the web-based program was time constraints, the web-based program still requires a significant time commitment (over 5-6 weeks). Training of this type also gives the educator and the learner a standardized methodology for the program. When training large numbers of learners, this could be an important factor.

Mental health triage

Smart D, Pollard C, Walpole B. Mental health triage in emergency medicine.
Aust N Z J Psychiatry. 1999 Feb;33(1):57-66; discussion 67-9.

The purpose of this study was to develop and implement an emergency mental health triage scale (MHTS) tool that matches the Australian National Triage Scale (NTS), with the hopes of reducing wait times, transit times and to improve skills in assessing and triaging patients with mental health problems. The authors report that mean emergency wait times and transit times were reduced, improving patient satisfaction. More importantly, the study reports that patients with mental health problems were consistently more appropriately triaged, and that providers in both the ED and psychiatry felt better prepared to care for patients based on their triage classification. The acuity rating system would likely be applicable for pediatric as well as adult patients.

Few resources are available for assessing and triaging emergency patients with mental health problems, especially those that present to general emergency departments. The development of the MHTS with its accompanying educational packet has tremendous significance to clinical practice for many emergency care providers. The MHTS scale is consistent with one triage scale and further study of its use with other triage scales would be beneficial.

Ayliffe L, Lagace C, Muldoon P. The use of a mental health triage assessment tool in a busy Canadian tertiary care children's hospital. J Emerg Nurs. 2005 Apr;31(2):161-5

This article discusses the development of a triage assessment tool for assessing risk and determining acuity for child and youth patients in the ED. Following unit education, the tool was then implemented in the ED of a children's hospital.

While there is certainly a need for good screening tools in the ED for children with mental health problems, tools that require significant time for interviewing and documenting patient complaints and psychiatric history may not be appropriate. The tool developed for this project asks many important questions, but may not be realistic in a busy triage area. In addition, the tool may be problematic in assessing very young children. The tool also utilizes a 3 tiered acuity scale that may not be adequate.

Hooten WM, Lyketsos CG, Mollenhauer M. Use of the Brief Psychiatric Rating Scale as a predictor of psychiatric admission for non-suicidal patients. Int J Psychiatry Med. 1998;28(2):215-20

The focus of this article is the description of the determination of symptom severity and its prediction for psychiatric admission in the ED setting. The authors utilized the Brief Psychiatric Rating Scale (BPRS) to screen all non-suicidal patients. They report that 6 of 7 patients were correctly identified utilizing this method for predicting the hospitalization of non-suicidal patients.

The BPRS may be an appropriate admission screening tool to be utilized by a clinical treatment team for screening purposes, but it would be quite a cumbersome tool to be employed in triaging patients who present to the ED with psychiatric complaints. Further, the BPRS would be difficult to use when assessing young children as several of the categories require cognition and verbal skills that many younger children do not possess.

Vital signs

Keddington R. A triage vital sign policy for a children's hospital emergency department. J Emerg Nurs. 1998 Apr;24(2):189-92

This article describes the development and implementation of a policy for obtaining pediatric vital sign assessment in a pediatric ED. The focus of the article is on the amount of time (reported as an average of 7 minutes per patient prior to protocol implementation.) and that the majority of that time is spent on obtaining vital signs that may not be necessary for determining acuity ratings in pediatric patients. The author describes a policy that allows for obtaining pulse and respiratory rates, temperature and weight for all pediatric patients. Weights are obtained with babies younger than age 3 months completely undressed-no detail is provided for how other children are weighed. Blood pressure is only obtained at the discretion of the triage nurse. The author further describes that tympanic membrane thermometry in patients above age 3 months is standard in the policy, allowing for quicker assessments. Pulse oximetry is obtained only on patients with respiratory complaints or with symptoms of respiratory distress. Frequency of repeating vital signs is discussed, but it is unclear if this policy addresses reassessment of patients waiting for treatment prior to being assigned a bed.

The discussion of this policy development is interesting, particularly as it attempts to base the process on published literature and other best practices, but since there is so little available, especially in the pediatric population, it may have been more helpful for this to have been published following an analysis of triage times pre-and port- policy implementation. It is unclear if the omission of tasks such as taking blood pressures, changes in who should have pulse oximetry monitored, or the increased use of tympanic membrane thermometry, would make a significant difference in the time nurses spend triaging pediatric patients. Other variables such as interruptions in triage assessments, the need to obtain complex histories of chronically ill children who may present to a children's ED, and the implementation of treatment (ie fever control) should be factored into any discussion that involves the assessment of triage times.

Goldman RD, Mulligan C, Weisbrot J. Weighing infants in the pediatric emergency department: the diaper can stay on! Pediatr Emerg Care. 2004 Jun;20(6):382-3

This article discusses two methods-diaper on and diaper off- of weighing infants for the purpose of a medical exam and treatment that may require calculation for medication dosing. The authors hypothesized that even a diaper that is soiled would not add enough weight to affect the child's weight for this purpose. 217 infants were enrolled in the study where the study team observed that only 2% of infants weighed with a diaper on had a clinically significant variation from a naked weight. This variation was reported as 5% in the neonatal population. The authors therefore felt comfortable making the recommendation that infants could be weighed in triage with a diaper on.

In addition to the possibility of reducing triage times and increasing time to examination by a physician, weighing an infant with a diaper on reduces the risk of contamination and infection. The authors further note that the diaper area should be observed as part of the general physical examination of these infants once in the treatment area.

Worster A, Elliott L, Bose TJ, Chemeris E Reliability of vital signs measured at triage. Eur J Emerg Med. 2003 Jun;10(2):108-10

This article describes a study that was conducted to determine the reliability of vital signs measured at triage in a general population ED. The technique of vital signs were assessed and compared manually and by electronic device. Only heart rate, respiratory rate and oxygen saturation were studied. Patients age 16 and older and only those with a Canadian Triage Acuity Scale (CTAS) acuity of 4 or 5 (less seriously ill or injured patients) were enrolled in the study. 72 patients were enrolled. The study team concluded that manual measurement at triage of heart rate, respiratory rate and oxygen saturation in the adult population is as reliable as electronic measurement. Manual measurement of heart rate was reported as possibly more reliable than electronic measurement.

It is unclear what this study of adult-sized patients who already are determined to be less seriously ill or injured implies. If the assessment of vital signs of adults in triage is reliable regardless of who measures them or how they are measured, it would be dangerous to assume that this applies in pediatric patients as well. It also might assume that all electronic measuring devices for vital signs are equal, which may or may not be the case. The measurement of heart and respiratory rates and oxygen saturation in children, especially those who are unable to report any of their own symptoms or complaints is critically important. Further studies of the reliability of vital sign assessment in pediatric patients are needed.

Wallis LA, Healy M, Undy MB, Maconochie I. Age related reference ranges for respiration rate and heart rate from 4 to 16 years. Arch Dis Child. 2005 Nov; 90(11):1117-21. Epub 2005 Jul 27

This article reports a reliable evidence base for reference ranges for respiration and heart rate in children age 4 to 16 years. The authors report that their findings are not consistent with standard quoted ranges available in current texts. More than 1000 children were enrolled in this study that recorded height, weight, heart and respiratory rates. Height and weight of the study subjects fell within published 50th-75th percentiles for the UK.

Scientifically based reference ranges for blood pressure and temperature are available in published literature. This study establishes a baseline for pediatric heart and respiratory rates that were previously missing from the literature. The addition of these evidence based reference ranges is important in the establishment of triage acuity scoring when danger vital signs are considered as part of the decision making process.

Gausche M, Henderson DP, Seidel JS. Vital signs as part of the prehospital assessment of the pediatric patient: a survey of paramedics. Ann Emerg Med. 1990 Feb;19(2):173-8

This two-part study of vital sign assessment was conducted in the pre-hospital phase of pediatric care. The study team recognized a need for the study based on an initial pilot study that found significant differences between field vital sign assessment in both pediatric and adult patients. Frequency of vital signs assessment did not change during the 3 year interval between the initial and the second phase of the study.

Study results suggested that vital signs were more likely to be measured when paramedics contacted medical control base stations in all age groups, but that assessment of vital signs in adult patients was more frequent than in pediatric patients. In fact, vital signs were often not assessed at all in children less than 2 years old regardless of chief complaint. The study also included a survey of confidence levels, level of knowledge and skills of paramedics when assessing and caring for pediatric patients. Paramedics with more than 10 “runs’ involving pediatric patients were more confident in their ability to assess pediatric vital signs, regardless of their years of experience as a paramedic. Paramedics who also reported that field experience in caring for pediatric patients was useful were also more confident in the ability to assess pediatric vital signs. More than 80% of the paramedics surveyed believed that more continuing education, clinical training and field experiences in pediatric care were needed to improve the pre-hospital care of children.

This study is an important one that should receive consideration for replication in the in-hospital setting. In particular, the triage area should be assessed in a similar fashion for comparisons in clinical experience (number of patient contacts) and confidence levels in caring for pediatric patients.

Sehgal A, Dubey NK, Jyothi MC, Jain S. Comparison of tympanic and rectal temperature in febrile patients. Indian J Pediatr. 2002 Apr;69(4):305-8

This prospective study compared tympanic membrane temperatures with rectal temperatures in febrile patients presenting to a children’s hospital. Sixty children were enrolled; infants less than 6 months old were excluded. The authors reported that there was good correlation between the two methods of temperature measurement.

The study is an important one in the quest for finding ways to increase efficiency and patient satisfaction in triage. Decreasing triage times, increasing patient safety, preference of patients and clinicians for least invasive methods of vial sign measurement are all important factors in choosing techniques for recording temperature in children. As a side note, the authors also report that it is important for ambient temperature of the assessment room to be within a very narrow range in order for tympanic membrane temperatures to be most accurate.