Consistency of Triage in Victoria's Emergency Departments

Literature Review

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Foreword

The Consistency of Triage in Victoria's Emergency Departments Project was funded by the Victorian Department of Human Services and conducted by the Monash Institute of Health Services Research during 2000-2001.

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The report detailing the project has been presented in five separate documents being:

The Literature Review

The Triage Consistency Report

The Education and Quality Report

The Guidelines for Triage Education and Practice Package

The Summary Report

This report is the first in the series, the Literature Review, and can be read alone, however provides background and support for the remaining reports in the series.

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Terminology

ACEM	Australasian College for Emergency Medicine
ATS	Australasian Triage Scale (formerly the National Triage Scale)
CTAS	Canadian Emergency Department Triage & Acuity Scale
DHS	Department of Human Services (Victoria)
DRGs	Diagnosis Related Groups
ED	Emergency Department
EMTs	Emergency Medical Technicians
ENA	Emergency Nurses' Association of Victoria (Incorporated)
ESEP	Emergency Service Enhancement Program
ESI	Emergency Severity Index
MTS	Manchester Triage System
NTS	National Triage Scale for Australasian Emergency Departments
URGs	Urgency Related Groups
UDAGs	Urgency, Disposition & Age Groups
VEMD	Victorian Emergency Minimum Dataset

1 Introduction

The term "triage" originates from the French word "trier" which means to sort, pick out, classify or choose[1]. The triage principle of prioritising care to large groups of people has been adapted from its military origin for use in the civilian context of initial emergency department care[2-4]. In the emergency department (ED) context, triage is a formal process of immediate assessment of all patients who present seeking emergency care[1,5]. Triage assessment findings are then used to prioritise or classify patients on the basis of illness or injury severity and need for medical and nursing care[6,7].

An effective triage system aims to ensure that ED patients "receive appropriate attention, in a suitable location, with the requisite degree of urgency"[8]. Triage ensures that emergency care is initiated in response to clinical need rather than order of arrival[7,9]. Triage aims to promote the safety of patients by ensuring that timing of care and resource allocation is requisite to the degree of illness or injury[5,6,10].

In Australia, triage is predominantly a nursing assessment that begins when the patient presents to the ED. Triage decisions are complex clinical decisions often made under conditions of uncertainty with limited or obscure information, minimal time and with little margin for error[11,12]. Triage nurses must also be able to discriminate useful cues from large amounts of information in order to perform triage safely[11,13]. It is the responsibility of the triage nurse to rapidly identify and respond to actual life-threatening states and to also make a judgement as to the potential for life-threatening states to occur[13].

Triage decisions are made in response to the patient's presenting signs or symptoms and no attempt to formulate a medical diagnosis is made[9]. The allocation of a triage category, for example, using the Australasian Triage Scale (ATS), is made on the basis of necessity for time-critical intervention to improve patient outcome, potential threat to life or need to relieve suffering[9]. The decisions made by a triage nurse are a pivotal factor in the initiation of emergency care. Therefore the accuracy of triage decisions is a major influence on the health outcomes of patients[1,11,14]. As all of these characteristics make triage decision-making inherently difficult, it may be argued that triage nurses require advanced clinical decision making expertise[15].

The ATS was developed to prioritise patient care and provide a consistent approach to triage practice at a national level. However, its use has been extended to include measurement of ED performance, funding allocation and determination of quality of care. Therefore, it is vital that the application of the ATS is consistent by both individual triage nurses and organisations. Consequently, it is timely to review triage related literature to identify best practice, consistency of triage, educational standards and quality improvement processes. The findings of the literature review will inform the development of triage education and quality improvement strategies aimed at promoting the consistency of triage in Victoria.

2 The Triage Process

2.1 Health care professional

Triage is the point at which emergency care begins[9]. The Australasian College for Emergency Medicine (ACEM) states that triage should be performed by a "...suitably experienced and trained registered nurse or medical practitioner"[6]. The Commonwealth Department of Health and Family Services and ACEM (1997) advocate that patients presenting to the ED should be triaged by "...an appropriately skilled health care professional"[5]. ACEM acknowledges that triage is usually performed by an "...appropriately experienced registered nurse"[10]. Other authors state that the triage function needs to be performed by a "...trained nurse...", a "...highly competent health care professional..." or a "...qualified, experienced nurse..."[1,2,8]. None of the aforementioned authors however have made any definitive statements as to what constitutes "appropriately skilled", "qualified", "trained" or "highly competent".

Zwicke, Bobzien and Wagner (1982) undertook a study examining the decisions made at triage, by triage nurses and triage physician observers, regarding appropriate care provider, priority rating and preliminary investigations ordered for ambulatory ED patients[16]. The results of the study revealed the level of agreement between the triage nurses and physician observers was 81% and between the triage nurses and treating physicians it was 94%. There was complete agreement between triage nurses and physician observers' decisions in the identification of the number of patients (36%) presenting with urgent problems. Triage nurses identified a greater number of patients (19%) as having emergency problems (17%), and fewer patients (45%) as having problems of a non-urgent nature when compared to the physician observers (47%). This study concluded that experienced emergency nurses in the role of triage were safe, efficient and cost effective, with statistically significant levels of safety and accuracy of priority rating when compared to triage physicians and treating physicians[16].

2.2 Triage scales and tools

2.2.1 Australian

A number of triage scales and tools have been developed to assist the health care professional with the process of triage. In Australia, the Australasian Triage Scale (ATS), formerly the National Triage Scale for Australasian Emergency Departments (NTS), is predominantly used.

The NTS evolved from a five-category triage scale used at Box Hill Hospital and later, at the Ipswich General Hospital. The Ipswich Triage Scale was used by the ACEM as a basis for the development of the NTS[5]. The NTS was formulated by the ACEM in 1993 with the aim to "standardise the nomenclature and descriptors of those triage categories for use in Emergency Departments in Australia"[10]. Table 2.1 shows the five NTS categories.

Table 2.1. National Triage Scale for Australasian Emergency Departments

Numeric Code (where used)	Categories	Treatment Acuity
1	Resuscitation	Immediate
2	Emergency	Minutes (< 10 minutes)
3	Urgent	Half Hour
4	Semi Urgent	One Hour
5	Non Urgent	Two Hours

In 2000, the NTS was revised and renamed the Australasian Triage Scale[7,17]. The ATS remains a five category triage scale with the maximum waiting times for each of the five triage categories identical to the NTS. The major difference between the NTS and the ATS is the nomenclature surrounding the descriptions of each of the five triage categories. Table 2.2 shows the five ATS categories.

Table 2.2. Australasian Triage Scale

ATS Category	Description of Category	Treatment Acuity
1	Immediately life-threatening	Immediate
2	Imminently life-threatening; Important time-critical intervention	Minutes (< 10 minutes)
3	Potentially life-threatening; Situational urgency	Half Hour
4	Potentially serious; Situational urgency; Significant complexity or severity	One Hour
5	Less urgent; Clinic-administrative problems	Two Hours

Fundamental to the design of both the NTS and ATS is that each of the five categories reflects both the severity of the patient's illness or injury and the expected staff response time. The ACEM states that an ATS category should be allocated by the triage nurse in response to the maximum time that a patient can safely wait for medical assessment and treatment[5-7,10,17].

The primary goal of the ATS is to provide a consistent approach to triage. If there is uniform application of the ATS, a patient with a specific presenting problem should be allocated the same triage category, irrespective of the institution to which they present or who is performing the role of triage[5]. The triage decision, and therefore triage category allocation, should be based on the objective clinical urgency and not be influenced by the presence of organisational systems such as team responses, fast track systems and nurse initiated interventions[7].

2.2.2 International

The literature reveals a number of triage scales used internationally. Of note is the Manchester Triage System (MTS) used in the United Kingdom, the Emergency Severity Index (ESI) used in America and the Canadian Emergency Department Triage and Acuity Scale (CTAS).

The Manchester Triage System is a five-point triage scale based on the NTS. It was developed using a consensus approach by the Manchester Triage Group. The group was a multidisciplinary group with expertise in various aspects of emergency care[18]. Table 2.3 shows the five MTS categories.

Table 2.3. Manchester Triage System

Numeric Code (where used)	Colour Code (where used)	Triage Category	Target Time (minutes)
1	Red	Immediate	0
2	Orange	Very Urgent	10
3	Yellow	Urgent	60
4	Green	Standard	120
5	Blue	Non Urgent	240

The MTS was introduced in the United Kingdom in 1996 and is now used universally across the United Kingdom[19]. The MTS differs from the ATS in that it uses a series of flowcharts for various presentations and makes use of "key discriminators" to determine a triage category.

The Emergency Severity Index is a 5-level triage scale used alongside a simple algorithm and implemented in two major academic hospitals in the United States[20].

In Canada, the literature describes two triage scales, the first being a five-point triage scale in use at the St Paul's Hospital, Vancouver[21]. The categories used in this triage scale are as follows: Class 1 (minimal), Class 2 (moderate), Class 3 (complex), Class 4 (extensive) and Class 5 (critical). This triage scale uses lists of sentinel diagnoses rather than time to emergency care to guide allocation of a triage category.

The second triage scale is the Canadian Emergency Department Triage and Acuity Scale (CTAS)[22]. The CTAS originated from a five-point triage scale developed by the Canadian Association of Emergency Physicians using the Australasian NTS.

2.3 Triage outcomes

Triage decisions can be divided into primary and secondary triage decisions. Primary triage decisions relate to the triage assessment, allocation of a triage category and patient deposition whilst secondary triage decisions relate to the initiation of nursing interventions in order to expedite emergency care and promote patient comfort[14,23].

There are three well-recognised outcomes of triage decisions. The triage nurse may allocate a triage category that is appropriate to a patient's presenting problem. This may be termed an "expected" or "correct" triage decision as the patient will be seen by a doctor within a suitable time frame and should have a positive health outcome. Problems occur if the triage nurse allocates a triage category of higher or lower acuity than required. If a triage category of higher acuity is allocated, the patient's waiting time until medical intervention is shorter than anticipated. Although this is not detrimental to the patient in question, the effect of inappropriate allocation of resources has the potential to adversely affect other patients in the ED. This type of triage decision is referred to as "over triage". If a triage category of lower acuity is selected, the patient's waiting time until medical intervention would be prolonged and the risk of an adverse patient

outcome is increased. There is the potential for patients to deteriorate or develop life threatening complications whilst waiting and patients may be subjected to prolonged pain or suffering. This type of triage decision is referred to as "under triage"[24-27].

The ACEM expresses concern regarding the practice of systematic "over triage" or "under triage" of patients in response to funding models or incentive programs, believing this practice to be unethical[5].

2.3.1 Nurse triage and waiting times

Early studies of nurse triage predominantly focused on patient waiting times[2]. None of these studies took into account the emergency care provided by nurses whilst the patient is waiting to see a doctor. A fundamental flaw in the argument that nurse triage should have an effect on patient waiting times is that the triage nurse cannot reduce the workload of an emergency department; he or she simply re-distributes it. Triage is a function of prioritisation, whereby waiting times are decreased for those patients with serious illness or injury, but at the expense of increased waiting times for those who are considered less urgent [28,29]. Given this, it should not be expected that nurse triage would have an impact on patient waiting times.

2.4 Influences on triage decisions

A number of factors can influence the triage decisions made by an individual or between individuals. Salk, Scgriger, Hubbell and Schwarz (1998) compared triage designations derived from in person triage and telephone triage[30]. This study systematically examined the effect of visual cues, vital signs and complaint-based protocols on the triage process. During this study, a research physician met all non-critically ill, English-speaking patients on their presentation to the ED. The research physician took a brief history, obtained a set of vital signs including pulse oximetry and gained consent. The patient then spoke with two triage nurses, one via telephone and one in person. The order of triage format (telephone versus in person) was randomised by the toss of a coin. After taking a history and before being told the patients vital signs, the triage nurses were asked to select one of five triage designations. These were call 911, ED consultation within 2 hours, urgent care or physician consultation in 2 to 8 hours, physician consultation in 8 to 24 hours or home care advice. After selecting a designation the triage nurses were then told the patients vital signs and asked again to select one of the five designations[30].

In the second phase of the study, triage nurses were equipped with and trained in the use of 108 printed chief complaint protocols derived from a commercial telephone triage company. The protocols consisted of grouped criteria, in descending order of severity, to one of the five possible triage designations. The triage nurses were then asked to use the protocols to determine a patient's triage designation. They were then given the patient's vital signs and again asked to select a triage designation using the protocols. At the end of this process the triage nurses were asked which protocol they used and if their pre-vital sign designation differed from that specified by the protocol[30].

The level of agreement between telephone triage and in person triage was poor in all aspects of the study. The percent agreement ranged from 43.1% to 48.8% (κ = 0.19 to 0.26). In the non-protocol phase, the level of agreement before vital signs were known was 43.0% (κ = 0.19). The level of agreement after provision of vital signs increased slightly to 48.8% (κ = 0.26) however this is clinically insignificant as it still reflects poor level of agreement. The results in the protocol phase of the study were not much better. The level of agreement using a protocol and before vital signs were known was 45.5% (κ = 0.24). The level of agreement using protocols and after provision of vital signs decreased to 44.2% (κ = 0.22)[30].

In the non-protocol phase of the study the provision of vital signs caused the triage nurses to change their triage designation in 5.7% (κ = 0.92) of in person triage decisions and in 6.6% (κ = 0.90) of telephone triage decisions. In the protocol phase of the study, knowledge of vital signs changed 5.6% (κ = 0.92) of in person triage decisions and 11.1% (κ = 0.84) of telephone triage decisions. On the basis of these results the researchers concluded that the level of agreement between triage certified nurses, assessing the same patients is poor and that neither knowledge of vital sign data nor the use of protocols improves level of agreement[30].

3 Consistency of Triage

In recent years there has been an increase in the number of published studies examining the level of agreement or consistency of application of triage scales. Most of these studies have used the *kappa* statistic to measure level of agreement.

3.1 Kappa coefficients

To assess the accuracy of any measuring "instrument", it is usual to distinguish between the reliability of the data collected and their validity. The reliability of a measuring system is its consistency in yielding the same result when the measurement process is repeated by the same method or observer (*intra-observer variability*) or by another observer (*inter-observer variability*). Whilst validity is essentially the accuracy of the measurement. When studying the variability of observer categorical ratings, two components of possible lack of accuracy must be distinguished. The first is inter-observer bias, which is reflected in differences in the marginal distributions of the response variable for each of the observers. The second is observer disagreement, which is indicated by how observers classify individual subjects into the same category on the measurement scale. Kappa coefficient or Kappa statistics is one of the most common approaches used. Kappa is an index which compares the agreement against that which might be expected by chance. Kappa can be thought of as the chance-corrected proportional agreement and the possible value range from +1 (perfect agreement) via 0 (no agreement above that expected by chance) to –1 (complete disagreement).

Landis and Koch (1977) attempted to indicate the degree of agreement that exists when kappa is found to be in various ranges[31]. These are shown in Table 3.1.

Table 3.1. Kappa values and strength of agreement

Kappa	Strength of Agreement
< 0.20	Poor
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.80	Good
0.81 – 1.00	Very Good

3.2 International triage scales

The international literature cites studies into the consistency of application of triage scales. Whilst the triage scales in use overseas vary from the ATS, research into consistency of application may be applied to the ATS context.

Although the use of the MTS in the United Kingdom is widespread, there are no published studies validating the MTS to date. In terms of triage practice, this means that the consensus opinion of the Manchester Triage Group has not been verified in relation to clinical urgency[19]. The supporters of protocol or algorithm triage cite improved consistency with this type of tool. However, research to date does not demonstrate that the use of protocols or algorithms in the triage context increases level of agreement[30]. One significant disadvantage of protocol driven triage is that protocols do not allow for patients who present with more than one symptom, for example abdominal pain, vomiting and diarrhoea[32]. One study cites failure of application as a reason for the inability of one protocol driven triage system to detect critically ill patients[19]. This raises

questions as to the clinical applicability of such triage systems and the consequences of so called failure of application.

Wuerz et al. (1998) measured the inter-rater and intra-rater reliability of a three-point triage scale in use in the United States[24]. The categories of this triage scale are shown in Table 3.2.

Table 3.2. Triage severity scoring system

Triage Class	Severity
Class I (emergent)	Immediately life or limb threatening
Class II (urgent)	Requires prompt care, but will not cause loss of life or limb if left untreated for several hours
Class III (nonurgent)	Requires evaluation and treatment but time is not a critical factor; does not include patients with complaints of severe pain or loss of function

This study consisted of two phases. In the first phase, one of the researchers presented five scripted patient scenarios to participants at an in person interview. In the second phase participants were given the same patient scenarios in a written format, four to six weeks later. The study took place at two EDs with a combined total of approximately 80,000 presentations per year. Participants were ED triage nurses (both sites) and Emergency Medical Technicians (EMTs) (one site) who routinely performed patient triage. Neither site had a formal triage education program or selection criterion for triage. Each participant was asked to allocate each patient scenario to one of the three triage classes [24].

There were a total of 87 participants in phase one, which represented over 90% of eligible individuals at both sites. The average length of experience of the triage nurses was 7.8 years at one site and 7.1 years at the other and approximately 60% of the nurses had a Certified Emergency Nurse credential. Of the triage classes assigned in phase one, 15% were Class I (emergent), 44% were Class II (urgent) and 41% were Class III (nonurgent). The *kappa* value for level of agreement was 0.347, which represents poor agreement. There were 55 participants who completed both phases of the study due to a 63% response rate to the written survey used in Phase Two. Only 24% of participants triaged all five patient scenarios to the same class in both phases. Of the 273 episodes of triage completed by the 55 participants, there were 40 episodes of triage to a class of higher severity and 33 episodes of triage to a class of lower severity. Comparison of responses by patient scenario using the Kendall correlation statistic varied from 0.145 to 0.554 indicating "poor to fair" agreement[24].

Wuerz et al. (1998) concluded that the reliability of triage assessments using this three-point triage scale is poor and that there was inter-rater disagreement in four of the five patient scenarios[24]. This study also found that when participants were presented with the same information on two separate occasions, the majority of participants disagreed with their own prior triage assessment. On the basis of these results, the researchers advise that current triage practice is not reliable enough to advocate diversion of patients away from the ED[24].

Wuerz et al (1999) went on to develop a new 5-level scale called the "Emergency Severity Index" (ESI) with colleagues at the Brigham and Women's Hospital in Boston and implemented the scale in two major academic hospitals in the United States[20]. The 5-level scale is used alongside a simple algorithm.

In an Emergency Nurses Association (ENA) funded study, Wuerz, Milne, Eitel, Wiencek and Simonds (1999) undertook to compare the reliability and validity of the 3-level triage with the 5-level acuity[33]. The prospective, observational cohort study was conducted with a population-based convenience sample of adult patients triaged during 100 hours at two urban referral hospitals[34]. Validation by resource use and hospitalisation (criterion standards) and reproducibility by blinded paired triage assignments compared with weighted kappa analysis were assessed. Five hundred and thirty-eight patients were enrolled; 45 were excluded due to incomplete evaluations. The resulting cohort of 493 patients was 52% female, 26% non-white, and had a median age of 40 years (range 16-95); overall, 159 (32%) patients were hospitalised. Weighted kappa for triage assignment was 0.80 (95% CI = 0.76 to 0.84). Resource use and hospitalisation rates were strongly associated with triage level. For patients in Category 5, only a quarter (17/67) required any diagnostic test or procedure, and none were hospitalised (upper confidence limit, 5%). Conversely, in Category 1, one of twelve patients was discharged (upper confidence limit, 25%), and none required fewer than two resources. The findings of the project suggest that the five-level triage instrument demonstrated both validity and reliability in the authors' practice settings. It reproducibly triaged patients into five distinct strata, from very high hospitalisation/resource intensity to very low hospitalisation/resource intensity.

The project above also implemented a new five-level ED triage algorithm, the Emergency Severity Index (ESI), into nursing practice, and validated the instrument with a population-based cohort using hospitalisation and ED length of stay as outcome measures[35]. The five-level ESI algorithm was introduced to triage nurses at two university hospitals, and implemented into practice with reinforcement and change management strategies. Inter-rater reliability was assessed by a posttest and by a series of independent paired patient triage assignments, and a staff survey was performed. A cohort validation study of all adult patients registered during a one-month period immediately following implementation was performed. A total of 8,251 ED patients were studied. Weighted kappa for reproducibility of triage assignments was 0.80 for the posttest (n = 62 nurses), and 0.73 for patient triages (n = 219). Hospitalisation was 28% overall and was strongly associated with triage level, decreasing from 58/63 (92%) of patients in triage Category 1, to 12/739 (2%) in triage Category 5. Median lengths of stay were two hours shorter at either triage extreme (high and low acuity) than in intermediate categories. Outcomes followed a-priori predictions. Staff nurses rated the new program easier to use, and more useful as a triage instrument than the previous three-level triage. They provided feedback, which resulted in significant revisions to the algorithm and educational materials. The conclusions drawn from the work indicate that triage nurses at these two hospitals successfully implemented the ESI algorithm and provided useful feedback for further refinement of the instrument. The ESI used by the triage nurses' reproducibly stratified patients into five groups with distinct clinical outcomes.

Fernandes, Wuerz, Clark and Djurdjev (1999) examined the inter-rater and intra-rater reliability of a five point triage scale in use at the St Paul's Hospital, Vancouver[21]. The categories used in this triage scale are as follows: Class 1 (minimal), Class 2 (moderate), Class 3 (complex), Class 4 (extensive) and Class 5 (critical). This triage scale uses lists of sentinel diagnoses rather than time to emergency care to guide allocation of a triage category. This study used the same two-phase method as Wuerz et al. (1998)[24]. In the first phase, participants were presented with five scripted patient scenarios and in the second phase participants were given the same patient scenarios in a written format, four to six weeks later. The kappa statistic was used to measure level of agreement between participants.

There were twenty-one triage nurses who participated in this study, all of whom were ED nurses who routinely performed triage. All nursing staff had undergone the same unit based educational program prior to undertaking the triage role. This study found that inter-rater agreement by nurses using this five-point triage scale was "substantial" (k = 0.662). There were 12 triage nurses (57%) who completed both phases of the study. There were only 4 nurses (33%) who allocated the same triage categories in both phases and only 1 nurse (8%) differed by more than one triage category in any single patient scenario. The intra-rater agreement by nurses using this five-point triage scale was "substantial" (k = 0.757)[21].

Fernandes et al (1999) concluded that there was "substantial" inter-rater agreement between nurses in the allocation of triage categories using the five point St Paul's Hospital triage system[21]. They advocate the use of a five-point triage scale in preference to three or four-point scales citing less variability and greater flexibility with the use of a five-point scale. However, these results should be interpreted with caution given the small sample size and possibility of selection bias in phase two[21].

Beveridge, Ducharme, Janes, Beaulieu and Walter (1999) examined the rate of inter-observer reliability of the Canadian Emergency Department Triage and Acuity Scale (CTAS)[22]. The CTAS originated from a five-point triage scale developed by the Canadian Association of Emergency Physicians using the Australasian NTS. In this study, ten randomly selected nurses and ten randomly selected physicians reviewed fifty ED case summaries. The case summaries contained the patient's presenting complaint, vital signs, mode of arrival and triage notes. None of the participants had any formal training in the use of the CTAS. All participants were provided with a one page summary that contained the five categories used in the CTAS along with times for physician assessment, usual presentations, expected admission rates and sentinel diagnoses for each CTAS category. Each participant was asked to allocate each of the case summaries to one of the CTAS categories based on the information provided on this sheet. The *kappa* statistic was used to measure level of agreement[22].

Of the twenty participants, nine nurses and eight physicians had completed all of the data collection requirements. The overall level of agreement was "excellent" (k = 0.80). The probability of agreement between two randomly selected participants reviewing a randomly selected case summary was "moderate" (k = 0.539). The *kappa* value for nurses only was 0.84 (p = 0.598) and the *kappa* value for doctors only was 0.83 (p = 0.566). The probability of a randomly selected participant selecting the same triage category as an earlier participant was examined for nurses only, physicians only and both nurses and physicians. The highest rates of agreement were in the triage category of highest acuity (Category 1) and the triage category of lowest acuity (Category 5). On the basis of these results, this study concluded that the rate of agreement using the CTAS was excellent despite variation in the backgrounds of nurses and physicians and despite lack of formal training in the use of the CTAS[22].

The findings of these international studies suggest that a 5-point triage scale is more effective than a 3-point scale in producing consistency of triage. The role of education in achieving consistency of triage appears to be variable with some studies citing specific triage training and others having no requirement of formal training in triage.

3.3 Australasian Triage Scale (ATS) / National Triage Scale (NTS)

The ATS is similar in structure to the international scales in that it has five categories related to time to treatment. The major differences being the absence of sentinel diagnoses or protocols. A number of studies have been conducted on the ATS testing the inter-rater reliability, use of clinical characteristics and the consistency of triage related to ED activity and finally the application of the scale.

3.3.1 Inter-rater reliability and the NTS

Jelinek and Little (1996) conducted one of the first studies into the inter-rater reliability of the NTS[36]. This study resulted in 115 triage nurses from eight EDs completing 100 written patient scenarios. The researchers applied the terms "modal response" to the most frequent response for each scenario, "concurrence" to the percentage of responses in the modal category and "spread" to the percentage of responses in the modal category plus or minus one[36].

This study found that 86% of triage nurses responded within one triage category for all patient scenarios. For 96% of the patient scenarios, 95% of triage nurses responded within one triage category of the modal response. The researchers concluded that concurrence was "acceptable" as greater than 50% of triage nurses agreed with the modal response for 89% of the patient scenarios[36]. The study does not give the actual percentage of triage nurses who agreed with the modal response. The hospital type (categorised by teaching, non-teaching, rural and private) did not appear to effect the distribution of modal values for the 100 patient scenarios ($p = 0.12$). The distribution of modal values was also unaffected by triage nurse experience ($p = 0.89$)[36]. Triage nurse experience was arbitrarily categorised as less than two years, two to five years and greater than five years. Given the broadness and inequality of categories these results should be interpreted with caution.

Jelinek and Little (1996) concluded that inter-rater reliability of the NTS was "good" on the basis of the percentage of triage responses falling within the modal category plus or minus one category. This study also concluded that concurrence was "acceptable" on the basis of the percentage of triage responses falling in the modal category[36]. It may however be argued that a five-category triage scale that elicits responses across three categories (the modal category plus or minus one) is not reliable. This argument is further strengthened when the clinical consequences of this variation are considered. A discrepancy of this nature would result in gross variation in patient waiting times and this aspect was not discussed in this study. For example, if a patient case elicits responses in Category 3, Category 4 and Category 5 then the waiting time for this patient may be from 30 minutes to 2 hours. Similarly if the responses given vary across NTS Category 2, Category 3 and Category 4 the waiting time for that patient may range from 10 minutes to an hour.

Doherty (1996) also assessed the uniformity of application of the NTS both between medical and nursing triage staff and between hospitals. Two emergency physicians, two registrars and two triage nurses with greater than two years experience in "emergency medicine" *[sic]* from four EDs scored twelve written scenarios. Each scenario required the allocation of a NTS category. The researcher found that there was no scenario in which all participants agreed and ten of the twelve scenarios had triage responses ranging across three or more triage categories[37].

Triage nurses had a higher level of agreement than the emergency physicians, with 75% of triage nurses agreeing on a triage category for nine of the twelve scenarios, and 62.5% of triage nurses agreeing on a triage category for each scenario. An average triage score was calculated for each hospital, based on the triage categories allocated by the triage nurses. The average triage score varied by up to 0.45 between hospitals. This study concluded that there is variability in the application of the NTS with differences between triage practitioners and between hospitals. This study therefore questions the validity of funding allocation based on the use of the NTS and recommends the development of more comprehensive triage guidelines[37].

Dilley and Standen (1998) assessed the uniformity with which Victorian triage nurses applied the NTS[38]. Again this study used written scenarios and resulted in 188 triage nurses from fourteen EDs completing twenty patient scenarios. No patient scenario was triaged to the same triage category by all participating triage nurses. Fifteen of the twenty patient scenarios (75%) elicited responses across four different triage categories and four patient scenarios elicited responses across three different triage categories. The modal response for each patient scenario was identified. Over 50% of the triage nurses selected the modal triage category in fourteen patient scenarios (70%) and over 70% of the triage nurses selected the modal triage category in four patient scenarios (20%). Over 90% of triage nurses selected the modal triage category or the triage category adjacent to the modal category for seventeen patient scenarios (85%). The *kappa* statistic for inter-rater agreement by all nurses was 0.2537 ($p = 0.01$)[38].

The level of agreement between ED was examined using the Victorian Health Department hospital classifications of A1 (*teaching hospital, large*), A2 (*teaching hospital, other*) and B (*large regional base and suburban hospital*). The number of patient scenarios that elicited responses across four triage categories varied from seven to nine patient scenarios (35 - 45%). The modal triage category was selected by over 50% of triage nurses in sixteen to nineteen patient scenarios (80 - 95%). The number of patient scenarios in which over 70% of triage nurses selected the modal triage category varied from two to five (10 - 25%). The *kappa* values for level of agreement varied from 0.2442 ($p = 0.01$) to 0.2922 ($p < 0.01$)[38].

Application of the NTS was also examined in relation to the experience of the triage nurse. It is unclear as to whether this experience is in nursing, emergency nursing or triage. Triage nurses with more than 5 years experience had the highest number of patient scenarios with responses across four triage categories. There were ten patient scenarios (50%) in which this was the case. Triage nurses with less than 12 months had the lowest number of patient scenarios in which responses spanned four triage categories, occurring in only three patient scenarios (15%). Triage nurses with three to five years experience had the highest number of patient scenarios in which triage nurses selected the modal triage category. The number of patient scenarios in which over 50% of triage nurses in this experiential group selected the modal triage category was 19 (95%) and over 70% of triage nurses selected the modal triage category in six patient scenarios (30%). The number of patient scenarios in which triage nurses selected the modal triage category plus one triage category ranged from 14 to 16 (70 - 80%). The *kappa* values for each experiential group were similar and ranged from 0.2468 ($p < 0.01$) to 0.2907 ($p < 0.01$)[38].

The researchers concluded that more than 90% of triage nurses triaged seventeen patient scenarios (85%) to one of two triage categories. The researchers described the level of agreement between hospitals as "fair" but identified a trend for triage nurses from Group A2 EDs to under triage when compared to Group A1 and Group B EDs. The researchers

also concluded that despite differing amounts of experience, the agreement between nurses was "reasonable"[38].

A study by Considine et al. (2000) examined the responses of 31 triage nurses to ten written triage scenarios[27]. There were two scenarios designed to reflect each of the NTS categories. This triage category was termed the "expected triage category". There was no scenario in which all participants responded with the same triage category. Six scenarios elicited responses across two adjacent triage categories and the remaining four scenarios elicited responses spanning three adjacent triage categories. The most common triage category for each response was termed the "modal triage category". Of the 310 triage episodes examined in this study, the level of agreement ranged from 58% (expected triage category) to 62.5% (modal triage category).

In the same study, Considine et al. (2001) found that triage decisions were affected by the "expected triage category" of the scenario. Expected triage decisions were more common when the predicted triage category was Category 3 ($p<0.001$)[26]. "Over triage" decisions were less common when the expected triage category was Category 2 ($p<0.001$). The frequency of "under triage" decisions decreased when the expected triage category was Category 3 ($p<0.001$) or Category 4 ($p<0.001$). When triage decisions were examined in relation to the postgraduate qualifications of the triage nurse, there was no correlation found between the frequency of expected triage decisions and qualifications in the "nil", "emergency nursing", "critical care nursing" categories. A midwifery qualification demonstrated a positive correlation with "expected triage decisions" ($p = 0.048$) as did a tertiary qualification ($p = 0.012$). A midwifery qualification also demonstrated a negative correlation with "under triage" decisions ($p = 0.012$)[26].

Studies conducted evaluating the inter-rater reliability of the ATS have had varying results with some studies concluding that the ATS achieves good inter-rater reliability between triage nurses whilst others demonstrated variability in application of the ATS and consequently, fair inter-rater reliability between hospitals and reasonable inter-rater reliability between practitioners. Again the role of education in achieving consistency in triage appears to be variable, however, it is questionable as to how well this has been evaluated.

3.3.2 NTS and identification of clinical characteristics by triage nurses

As part of a larger study, Whitby et al. (1997) examined the inter-rater reliability of the NTS using actual occasions of triage[9]. This study measured variability between triage nurses in the identification of clinical characteristics of patients and in the allocation of triage categories. When a patient presented to one of the participating EDs, they were triaged independently by two different triage nurses. The triage nurses were asked to record the clinical characteristics of a patient's presentation that they regarded as influential in their triage decision and to allocate one of the triage categories. Each triage nurse was blinded as to the other triage nurse's responses. Data was collected from a total of 41 pairs of triage nurses from three EDs and detailing 299 triage episodes. The *kappa* statistic was used to measure level of agreement between the pairs of triage nurses. The level of agreement between triage nurse pairs was examined for each of the triage categories and this is shown in Table 3.3.

Table 3.3. Level of agreement in the application of the NTS

NTS Category	% of Agreement
1	75.0
2	74.4
3	78.8
4	79.6
5	75.5
	k = 0.675

Although the level of agreement varied between triage categories, these variations were relatively small ranging from 74.4% (Category 2) to 79.6% (Category 4). The *kappa* value of 0.675 indicates a good level of agreement between the triage nurse pairs in the application of the NTS[9].

The level of agreement between the triage nurse pairs in relation to the identification of clinical characteristics was examined. The characteristics that elicited lower levels of agreement ($k < 0.4$) are seen in Table 3.4.

*Table 3.4. Clinical characteristics with lower levels of agreement (*k*< 0.4)*

Clinical Characteristic	% of Agreement	Kappa Statistic
Sweaty skin	30.0	0.259
Dry skin	28.8	0.224
Anxious behaviour	47.7	0.395
Normal speech	64.2	0.282
Irritability (paediatric)	33.3	0.277
Crying (paediatric)	50.0	0.327
Dull pain	46.0	0.379
Crushing pain	0.0	- 0.004

The characteristics that elicited good levels of agreement ($k > 0.8$) are seen in Table 3.5.

Table 3.5. Clinical characteristics with good levels of agreement (k > 0.8)

Clinical Characteristics	% of Agreement	Kappa Statistic
Aggressive behaviour	100	1.0
Threat to others	100	1.0
Lethargy (paediatric)	100	0.875
Abdominal pain	87.8	0.822
Pregnancy	85.3	0.921
Haematemesis	100	1.0
Malaena	100	1.0
Overdose - ingestion	100	1.0
Eye presentation	100	1.0
Seizures	100	1.0

The researchers concluded that concordance between pairs in the application of the NTS was high even though a *kappa* value of 0.675 is associated with a good level of agreement[9]. The researchers also describe the agreement between triage nurse pairs in the identification of clinical characteristics as having "high concordance in identifying the same significant characteristics in the patient"[9].

3.3.3 Consistency of triage and ED activity

Hollis and Sprivulis (1996) conducted a study to determine if NTS category allocation was influenced by ED activity. The NTS admission rate guidelines were used as a measure of triage accuracy. All of the triage nurses in this study had greater than two months experience at triage, with supervision by an "experienced triage nurse for at least their first three shifts"[25]. The number of ED presentations in the two hours prior to patient presentation was used to identify three levels of ED activity during which a patient may present. These were termed "quiet", "normal" and "busy". Triage category distribution and admission rate for each NTS category was ascertained for each of the activity levels.

This study identified a relationship between ED activity and time of shift. The 0000-0800 shift encountered the majority of "quiet" periods and the 1600-2400 shift encountered the majority of "busy" periods ($p < 0.001$)[25]. This study found that the number of patients assigned to Category 1, Category 2, Category 3 and Category 4 did not vary significantly with changes in ED activity. Allocation to Category 5 was greater when the ED was "quiet", and less when the ED was "busy". An analysis of NTS category distribution did not identify the practices of "over triage" during "quiet" periods. The practice of "under triage" during "busy" periods was also not evident. There were no significant differences between admission rates during "busy" (43-45%), "normal" (42-45%) and "quiet" (43-47%) activity levels ($p = 0.471$)[25].

Admission rates for Category 1, Category 2 and Category 3 patients were all found to be within the NTS guidelines. The admission rate for Category 4 patients, whilst similar across all levels of ED activity (35-37%), exceeded the NTS guidelines (20-30%). The 14%

admission rate for Category 5 patients also exceeded the NTS guidelines (5-10%) during "quiet" periods. However there was a higher admission rate for Category 5 patients during "normal" (13-19%) and "busy" (13-20%) periods[25].

The increased proportion of Category 5 patients and a lower admission rate for this group during "quiet" periods were explained by the researchers to be a possible consequence of decreased availability of overnight medical services as most "quiet" periods (68%) were between 0000-0800 hours. When the NTS guidelines for admission rates were considered, the researchers drew two possible conclusions. Either, 10% of Category 4 patients and 5% of Category 5 patients warranted a higher triage category or the NTS guidelines on admission rates were in need of review[25].

Hollis and Sprivulis (1996) concluded that application of the NTS was not influenced by ED activity level[25]. This study also concluded that via admission rate analysis, triage Categories 1, 2 and 3 were allocated consistently and appropriately but that the allocation of triage Categories 4 and 5 could be improved. On this basis, the NTS was described as "...stable and reliable"[25].

A study by Richardson (1998) had similar results[39]. Richardson (1998) studied the effect of ED activity on triage decisions[39]. This study examined 94,681 triage episodes over a two-year period. "Busy" weekdays were defined as one in which greater than 140 presentations were recorded in 24 hours and a "busy" weekend day was defined as one in which over 100 presentations were recorded in 24 hours. "Non busy" days were defined as days during which the number of presentations was less than defined for "busy" days. Again admission rates per triage category were used to evaluate accuracy of triage decision and these are shown in Table 3.6.

Table 3.6. Admission rates by triage category and ED activity level

NTS Category	"Busy Weekday" Admission Rate (%)	"Non-busy Weekday" Admission Rate (%)
Category 1	93.2	91.4
Category 2	67.6	68.3
Category 3	43.6	43.7
Category 4	15.4	15.6
Category 5	1.6	2.0

There was no statistical significance between admission rates on "busy" versus "non busy" weekdays and no significant difference between admission rates on weekdays versus weekends. On this basis the researchers concluded that allocation of NTS category does not change with level of ED activity[39].

3.3.4 The application of the NTS

One of the largest studies examining the process of application of the NTS to date is that by Whitby, Ieraci, Johnson and Mohsin (1997)[9]. This study involved ten hospitals of varying size and services across Australia and examined 11,169 episodes of triage over a two-week period in November 1996. Triage nurses were required, during actual occasions of triage, to record the features of the patients' presentations that impacted on

their triage decision. This study then examined concordance between triage nurses both in the identification of clinical characteristics and application of the NTS.

Distribution of patients by NTS category was examined and the results are displayed in Table 3.7.

Table 3.7. Distribution of patient presentations by NTS category

NTS Category	Frequency (%)
1	1.6
2	8.8
3	32.4
4	40.7
5	16.6
	100.0

NTS Category 4 had the highest proportion of attendance (40.7%) and the lowest proportion of attendance was in NTS Category 1(1.6%). Males were more likely to be allocated to Category 1, Category 2 and Category 3 whilst females were more likely to be allocated to Category 5. Patients over 65 years were more likely to be allocated to the most urgent triage categories and less likely to be triaged to the lower triage categories. This study identified that age of the patient was a factor in triage decisions with both children and the elderly less likely to be allocated to Category 5[9].

When triage category was examined in relation to the departure status of patients, this study concluded that there was a correlation between triage category and clinical outcome. Of those patients admitted to a critical care area, 94% were allocated to Category 1, Category 2 or Category 3 with the largest proportion of patients admitted to a critical care area initially being triaged to Category 2 (45.2%). Of those patients who died in the ED, 55% were triaged to Category 1, 25% to Category 2 and 15% to Category 3. Death was the outcome in 6.3% of Category 1 patients but only 0.5% of Category 2 patients died and the proportions of patients in Category 3, Category 4 and Category 5 in whom death was the outcome was negligible. Of those patients discharged from the ED (with or without GP referral), 95% were allocated to Category 3, Category 4 or Category 5 with the largest proportion of patients discharged initially being triaged to Category 4 (46%)[9].

3.3.4.1 Distribution of clinical characteristics by triage category

The distribution of clinical characteristics identified by triage nurses as influential in the triage decision was examined in relation to the triage categories. The results of this component of the study showed that indicators of patient safety (normal clinical characteristics) were used the most frequently by triage nurses. "Normal respiration" was the characteristic commonly reported and this was identified in 62% of triage episodes. "Normal mobility" was identified as influential in 53% of triage episodes and "normal colour" was a factor in 52% of triage decisions. Half of the triage episodes studied identified that the patient was "calm" or "not distressed" and the colour was reported as influential in 77% of triage decisions[9].

Observations were found to be useful and measurable indicators of clinical urgency. The most frequently reported abnormality of respiration was "respiratory distress" which was reported in 5% of triage episodes[9]. Features of respiratory rate were found to impact on triage decisions. Over half (53.3%) the patients with respiratory distress were triaged to Category 1 as were 32.4% of patients with a respiratory rate of less than 10 respirations per minute. Of patients with a respiratory rate of greater than 41 respirations per minute, 51.4% were triaged to Category 3, 25.7% were triaged to Category 2 and 17.1% were triaged to Category 1[9]. The measurement of oxygen saturation was also found to be influential in triage decisions with an oxygen saturation of ≤89% being a characteristic of high acuity. Of the patients with an oxygen saturation of ≤89%, 50% were triaged to Category 3, 39.1% were triaged to Category 2 and 8.7% were triaged to Category 1[9].

Heart rate was reported as influential in 25% of triage episodes and abnormalities of heart rate were found to impact on triage decisions. The majority (81.2%) of patients with normal heart rates (between 50 and 100 beats per minutes) was predominantly triaged to Category 3 or Category 4. Patients with tachycardia or greater than 101 beats per minutes were predominantly triaged to Category 3 whilst patients with tachycardia of greater than 150 beats per minute were predominantly triaged to Category 2. Over half (54.5%) the patients with bradycardia of less than 49 beats per minute were triaged to Category 2 however 27.3% of patients were triaged to Category 3 and 9.1% of patients were triaged to Category 1 and Category 4[9].

Patients with systolic blood pressure of between 91 and 200 mmHg were predominantly triaged to Category 3 and Category 4. Of those patients with a systolic blood pressure of ≤90 mmHg, 37.1% were triaged to Category 2, 32.9% were triaged to Category 3 and 15.7% were triaged to Category 1. Of those patients who were hypertensive with a systolic blood pressure of ≥201 mmHg, 58.8% were triaged to Category 3, 23.5% were triaged to Category 2 and 8.8% were triaged to Category 4[9].

Neurological observations were reported to be influential in 25% of triage episodes. Of the patients who were "unresponsive" on arrival to the ED, 58.6% were triaged to Category 1. Over half (53.1%) the patients who were responsive to pain only were triaged to Category 2[9]. The most common abnormality of patient behaviour was that the patient was distressed (12.3%) or anxious (11.7%)[9]. When paediatric presentations were examined, the most common factor reported as influential in the triage decision was level of activity (9% of total presentations / 56% of presentations < 14 years)[9]. The severity of a patient's pain was identified as influential in 63% of triage episodes[9].

3.3.4.2 Number of clinical characteristics used by triage nurses

The number of clinical characteristics identified by triage nurses as influential in the triage decision was examined. The mean number of clinical characteristics used by triage nurses in this study was 9.566. The median number of clinical characteristics identified was 9.0 and the modal number of clinical characteristics was 7.0. The minimum number of clinical characteristics was 0 and the maximum number was 29. When the number of clinical characteristics identified by triage nurses was examined in relation to each of the NTS categories, there were variations identified between NTS categories. Category 5 had the lowest mean number of clinical characteristics identified (8.13) closely followed by Category 1 (8.8). Category 2 and Category 3 had the highest mean number of clinical characteristic (10.23) identified[9].

3.3.4.3 Combinations of clinical characteristics and NTS categories

The researchers used logistic regression to establish whether NTS categories could be distinguished by one or more clinical characteristics. Odds ratio was calculated for each of the clinical characteristics with an odds ratio of greater than 10, indicating a high probability of association with the specific NTS category. For Category 1 and Category 2 there were a small number of single characteristics that were statistically significant or had odds ratio of greater than 10 (or both). These clinical characteristics are displayed in Table 3.8 & Table 3.9.

Table 3.8. Clinical characteristics associated with NTS Category 1

Odds Ratio > 10 & Significant	**Odds Ratio < 10 & Significant**	**Odds Ratio > 10 & Not Significant**
Stridor / at risk airway	Haematemesis	Major trauma
Cardiac arrest	Unresponsive	Overdose / poisoning
Weak pulse		Systolic BP < 90 mmHg
Respiratory arrest		RR > 40 / min
RR < 10 / min		Prolonged seizure

Table 3.9. Clinical characteristics associated with NTS Category 2

Odds Ratio > 10 & Significant	Odds Ratio < 10 & Significant	Odds Ratio > 10 & Not Significant
Cardiac chest pain	Clammy skin	
Severe blood loss	Using accessory muscles	
	Aggressive behaviour	
	Suicidal	
	Aphasic	
	Drowsy	
	Nasal flaring (paediatrics)	
	Allergic reaction	
	HR < 50 / min	
	HR > 150 / min	
	BSL < 3 mmol / L	

For NTS Category 3, the clinical characteristics were less powerful. There was no clinical characteristics with an odds ratio of greater than 10. The clinical features that reached statistical significance for NTS Category 3 are displayed in Table 3.10.

Table 3.10. Clinical characteristics associated with NTS Category 3

Odds Ratio 1-2	Odds Ratio > 2
Flushed color	Altered output (paediatric)
Distressed / withdrawn behaviour	Previous seizures
Acutely disturbed	Systolic BP > 200 mmHg
Analgesia required	Postural drop in BP
Moderate / sharp pain	SaO_2 90 - 95%
Chest pain - non cardiac	BSL > 16 mmol / L
Abdominal pain	Limb motor deficit
Pelvic pain	
Lethargy / quiet (paediatric)	
Irritable / crying (paediatric)	
Eye presentation with reduced vision	
Head injury	
T > 38.6^{0}C	
HR 50 - 150	
RR 11 - 30	
SaO_2 > 96%	
Altered limb sensation	

For NTS Category 4, there continued to be a decline in the power of clinical characteristics. Only one clinical characteristic (vomiting) had an odds ratio of greater than 2. The clinical features that reached statistical significance for NTS Category 4 are displayed in Table 3.11.

Table 3.11. Clinical characteristics associated with NTS Category 4

Odds Ratio < 2	
Anxious behaviour	Eye inflammation
Normal activity (paediatric)	Foreign body in eye
Slight / colicky / dull pain	T 37.6 - 38.6^{0}C
Diarrhoea	Limb with absent peripheral pulse
Slight blood loss	Limb with loss of movement
Vaginal blood loss	

The clinical features associated with Category 5 are displayed in Table 3.12.

Table 3.12. Clinical characteristics associated with NTS Category 5

Odds Ratio 1-2	Odds Ratio > 2
Calm behaviour	Existing related illness
Normal speech	Normal colour
Limb pain	Chronic pain
Minor trauma	Now asymptomatic
Blood loss from wound	T < 37.5 ^{0}C

At this point in time, physiological data seems to demonstrate the highest degree of objectivity and consistency in the triage context. Research has shown that observations were found to be useful and measurable indicators of clinical urgency and that indicators of patient safety (normal clinical characteristics) are used frequently by triage nurses[9]. The use of physiological criteria as a basis for clinical decisions is also supported by research. Many studies report that the majority of patients exhibit physiological abnormalities in the hours preceding cardiac arrest and adverse events[40,41]. This approach is highly applicable to the triage context given that it is the responsibility of the triage nurse to rapidly identify actual life-threatening states, and to make a judgement as to the potential for life-threatening states to occur[13].

3.3.4.4 Other influences on triage decisions

Anecdotally there is concern that factors other than the clinical condition of the patient are impacting on triage decisions and are a source of inconsistency. The study by Whitby et al. (1997) asked participants to identify other factors not related to clinical characteristics of the patient that impacted on their triage decision[9]. "Other" factors were identified as influential in 30% of triage episodes. When these factors were examined separately, the most common were significance of patient history (49%), potential for treatment (28%) and mechanism of injury (15%). It may be argued that along with potential for self-discharge (2%) that these factors are patient related and are therefore valid components of the triage assessment. The other factors identified were related to ED operational issues and not to patient's clinical conditions. These were ED activity levels (3%), nursing skill mix (1%) and medical skill mix (2%). If the last three factors are examined in relation to the 11,169 triage episodes studied, they influence only 1.8% of triage episodes.

Many studies have identified varying degrees of inconsistency of the application of the ATS[9,27,36-38]. It is also evident in the literature that triage decisions are unaffected by type of hospital (teaching, non-teaching, rural and private), triage nurse experience and ED activity[25-26 36 38-39].

Consistency of application of the ATS has been shown to vary depending on the specific clinical characteristics identified by the triage nurse[9]. Patient age has also been shown to affect consistency of triage with males being more likely to be allocated to Category 1, Category 2 and Category 3 whilst females were more likely to be allocated to Category 5. Older patients (over 65 years) were more likely to be allocated to the most urgent triage categories and less likely to be triaged to the lower triage categories. Both children and the elderly were also less likely to be allocated to Category 5[9].

4 Extended use of the ATS

The ATS was developed to prioritise patient care and provide a consistent approach to triage practice at a national level. However the use of the ATS has now been extended to measurement of ED performance, funding allocation and determination of quality of care. Ongoing strategies to ensure consistency in the application of the ATS by both individual triage nurses and organisations should be in place, if the ATS is continued to be used for this purpose.

The ACEM states that patient waiting times for emergency care should be continuously monitored[6]. In the current health care climate, patient waiting times are a focus of measurement of the quality of care. Prolonged patient waiting times are viewed as representing poor access to and sub-standard quality of emergency care. Despite the anecdotal evidence that prolonged waiting times are a direct result of inadequate resources to cope with workload, patient waiting times in relation to the ATS are still used as a measure of quality of care and ED performance.

Multiple studies have been undertaken to determine a suitable tool for use in ED casemix funding. At the current time, Diagnosis Related Groups (DRGs) are used for inpatient units however these were shown by Jelinek in Whitby et al. (1997) to be inappropriate for use in the emergency care context[9]. Clinical urgency (triage category), patient outcome and major diagnostic category were then used to develop Urgency Related Groups (URGs)[9]. The Flinders Emergency Department Costing Study used clinical urgency (triage category), patient outcome (disposition) and patient age group to develop the Urgency, Disposition and Age Group (UDAGs). Analysis found that UDAGs were better cost predictors than UDGs. Irrespective of which casemix system is in use, Whitby et al. (1997) point out that clinical urgency (triage category) is the "most subjective" and "least precise" variable in use by both systems[9].

The Emergency Service Enhancement Program (ESEP) was introduced in 1995 by the Victorian Department of Human Services in collaboration with the Victorian emergency medicine community[42]. The aim of this program was to provide a system of bonus payments for EDs meeting defined standards of performance. The ESEP was implemented in a total of 21 Victorian public hospitals with a 24-hour ED and greater than 4000 - 5000 emergency presentations annually. The performance standards set by the ESEP included the monitoring of occasions of ambulance bypass, patient-waiting times in relation to their ATS category and length of ED stay of patients admitted to hospital. Patient waiting times in relation to ATS category has also been incorporated into national access performance indicators for EDs and is used by the Australian Council for Hospital Standards[42]. At the present time, EDs are required to provide medical care to 100% of Category 1 patients, 80% of Category 2 patients, 75% of Category 3 patients, and 70% of Category 4 and Category 5 patients within their requisite time frames. Failure to achieve these targets results in a reduction in ESEP bonus payments[42].

A study by Cameron et al. (1999) into the effects of bonus payments on ED performance reviewed the data from the first three years of ESEP[42]. This study demonstrated that the attendances of Category 1, Category 2 and Category 3 patients increased from 23% of total ED attendances to 31% of total ED attendances. Despite this increase, the waiting time targets for Category 1 patients were achieved consistently and there was improvement in waiting times for Category 2 ($p < 0.001$, $R^2 = 0.74$) and Category 3 ($p = 0.035$, $R^2 = 0.37$) patients. The effect of ESEP on the waiting times for NTS Category 4 and Category 5 patients was not analysed, as the majority of EDs were able to demonstrate improvement in waiting time targets despite higher proportions of Category 1, Category 2 and Category 3 patients. Cameron et al. (1999) concluded that EDs are not triaging

patients to lower triage categories to meet waiting time targets and cite improved triage education and process as possible reasons for more appropriate application of the NTS. Cameron et al. (1999) also raises the issue of variation of work practices in EDs to improve patient waiting times in relation to the ATS[42]. The investigators give the example of a doctor who may see a patient immediately and perform a brief consultation but comes back some hours later to perform a full consultation. For all intents and purposes the ESEP waiting time target has been met for this patient but Cameron et al. (1999) questions whether this is an improvement in emergency care[42].

As the ATS is now used as a measure of quality of care, ED performance and as a basis for ED funding, the need for uniform application of the ATS is becoming even more important. Given that nurses are usually the triage decision makers, more so than any other group of health professionals, it is of paramount importance that nurse triage decisions and decision making practices are examined.

5 Triage Education

The requirement for triage nurses to be specifically prepared for the triage role, either in terms of experience or education is well documented in the literature[1,2,5,6 8,10,43-45].

Purnell (1993) surveyed EDs across the United States to examine the educational preparation of triage nurses[45]. This study found that only 9.5% of hospitals required emergency nursing experience in order to perform the triage role and the amount of ED experience varied from three months to three years. Less than half (43.3%) the EDs required specific educational preparation for nurses performing the triage role. There was also great variation in the length and type of educational preparation required. One ED required triage nurses to have one year of ED experience and undergo three days of formal classes and a three-day triage orientation prior to performing the triage role. The most extensive prerequisites for triage was the requirement to have three years ED experience, Advanced Cardiac Life Support certification, Certified Emergency Nurse certification, completion of a three day triage course and five days of preceptored triage experience. Another ED simply required attendance at an inservice education session of one-hour duration, prior to undertaking the triage role[45].

In a study of Victorian triage nurses, Standen and Dilley (1997) assessed the degree of uniformity in relation to triage nurse experience, triage guidelines and physical observations recorded at triage in fourteen Victorian EDs[46]. Guidelines other than those developed by ACEM were in use at ten EDs (71%). These guidelines were generally found to be broad and were developed by senior ED nursing and medical staff to suit the individual needs of the ED. Four EDs (28%) had developed predetermined triage categories for specific presentations[46].

Experience required of emergency nurses prior to undertaking the triage role was again demonstrated to be variable. Whilst most EDs (93%) required that the triage nurse had at least three months emergency nursing experience prior to undertaking the triage role, the length of emergency nursing experience to precede the triage role varied from three months to twelve months. Six EDs required the triage nurse to hold a Certificate or Graduate Diploma in either emergency or critical care nursing and two hospitals insisted that only a qualification in emergency nursing was adequate educational preparation for the triage role[46].

All EDs in the study had a specific triage education programme. The strategies used to educate emergency nurses for the triage role included workbooks (57%), inservice education sessions (50%) and competency assessment program (29%). All EDs utilised supported practice whereby the novice triage nurses worked along side a more experienced triage nurse. The level of experience of the experienced triage nurse varied from senior ED nursing staff to the ED clinical nurse educator. No mention was made of the level of the educational preparation of the experienced triage nurse[46].

This study concluded that the data collected at triage and the educational and experiential preparation of triage nurses varied widely across Victoria. The study revealed that many EDs had elaborated on the ACEM NTS guidelines for adaptation to their specific needs. The researchers further concluded that the uniformity of application of the NTS may be improved by more comprehensive guidelines and advocated a more consistent approach to the education by the development of a statewide or national education package[46].

A more recent study by Gerdtz and Bucknall (2000) also found variation in the educational and experiential preparation of emergency nurses for the triage role. This study found that of the 172 triage nurses surveyed, only 57.6% had a post graduate qualification in emergency or critical care nursing[23]. Over half (55.2%) were employed in EDs with no unit based orientation programme specific to triage. A further 37.8% had less than one week orientation to triage whilst only 13.4% of triage nurses were provided triage orientation that was of one week of greater[23].

A postal survey of nurses in charge of all emergency departments accredited for specialist emergency physician training by the ACEM in Australasia was conducted recently by Kelly and Richardson (2001)[49]. The study aimed to characterise the prerequisite experience and training undertaken by nurses for the role of triage. The study found the duration of experience required prior to undertaking the triage role was variable and a wide variety of educational methods were used in preparing nurses for the triage role[49].

The Emergency Nurses' Association of Victoria (Inc) (2000) Position Statement: Educational Preparation of Triage Nurses recommends that emergency nurses be prepared for the triage role "via structured unit based education programmes informed by nationally established triage standards"[44]. ENA also recommends that triage nurses are "competent and able to function independently in all aspects of emergency nursing prior to undertaking the triage role"[44].

Whilst these notions are widely supported by the emergency nursing community, there is wide variation in the experiential and educational requirements of Victorian triage nurses[23,45,46]. Not surprisingly, there is a call for a consistent approach to triage education and uniform triage guidelines[27,36-38].

6 Triage Quality Improvement

There is very little literature regarding quality measures and triage, particularly the evaluation of triage decisions or application of triage scales such as the ATS. Whilst the primary function of the ATS is to prioritise patient care, ACEM acknowledge that acceptable levels of inter-rater reliability are necessary for comparison of ED performance and casemix purposes[7].

6.1 Waiting Times

Each ATS category has an associated "performance indicator threshold" that represents the percentage of patients in each ATS category who actually receive medical assessment and treatment within the time designated by their triage category[17]. These are shown in Table 6.1.

Table 6.1. Performance indicator thresholds for each ATS category

ATS Category	Performance Indicator Threshold
1	100%
2	80%
3	75%
4	70%
5	70%

The ACEM considers waiting times of greater than two hours clinically and ethically unacceptable and views prolonged waiting times as a failure of both access and quality[17].

6.2 Admission rates

One of the methods used to evaluate the consistency of application of triage scales is the rate of hospital admissions associated with triage category. Many studies have been conducted exploring the validity of admission rates as a quality measure.

Brillman et al. (1996) compared physician triage with nurse triage and computer guided triage to determine the ability, at triage, to predict the need for admission[12]. This study demonstrated that nurse triage had the highest positive predictive value of need for admission (30.2%) compared to physician triage (24.4%) and computer guided triage (13.0%). Nurse triage also had the lowest negative predictive value of need for admission (96.1%) when compared to physician triage (97.1%) and computer guided triage (97.6%)[12]. This study concluded that none of the three-triage methods could accurately predict the need for admission[12].

Whilst Brillman et al. (1996) identifies the need for standardised triage practice, it is acknowledged that there is no "gold standard" for triage at this point in time[12]. This study recommends the need to formulate triage guidelines and to eliminate triage that has an economic or financial basis. This study also raises further questions as to the validity of the use of admission rates to evaluate triage performance.

Other studies also had similar findings. Wuerz et al. (1998) examined the ability of triage personnel to predict need for admission in a study using a three-point triage scale in the United States[24]. This study presented participants with the same five patient scenarios on

two separate occasions and in different formats. In the first phase of the study, participants were presented with scripted patient scenarios at an in-person interview. Four to six weeks later participants were given the same patient scenarios in a written survey. Each time, participants were asked to estimate the likelihood of hospital admission from (0 - 100%). The mean estimates of likelihood of admission varied greatly for all five patient scenarios. For example, one patient scenario in which the patient was a 25 year old female with an itchy rash and normal vital signs elicited a mean estimation of admission likelihood of 6% with a standard deviation of 18% and range of 0 - 85%. On the basis of these results Wuerz et al. (1998) concluded that this three-point triage scale did not reliably predict the need for hospital admission[24].

Fernandes et al. (1999) examined the inter-rater and intra-rater reliability of a five point triage scale in use at the St Paul's Hospital, Vancouver using a similar method[21]. There were 37 participants in this study (21 triage nurses and 16 emergency physicians). The kappa statistic was used to measure level of agreement regarding the probability of admission. The overall inter-rater agreement regarding probability of admission was "moderate" (k = 0.560). When the levels of agreement between nurses only and physicians only were examined, there was little difference. The *kappa* value for level of agreement between nurses was 0.452 and the *kappa* value for level of agreement between physicians was 0.516. Both of these *kappa* values indicate "moderate" agreement[21].

Fernandes et al. (1999) also examined the intra-rater level of agreement regarding the probability of admission[21]. Of the 37 participants, 19 (51%) participated in both phases of this study. The intra-rater agreement regarding probability of admission among nurses was "substantial" (k = 0.709). The intra-rater agreement among physicians regarding probability of admission was (k = 0.818).

There were 21 triage nurses who participated in this study, all of whom were ED nurses who routinely performed triage. All nursing staff had undergone the same unit based educational programme prior to undertaking the triage role. This study found that inter-rater agreement by nurses using this five-point triage scale was "substantial" (k = 0.662). There were 12 triage nurses (57%) who completed both phases of the study. There were only four nurses (33%) who allocated the same triage categories in both phases and only one nurse (8%) differed by more than one triage category in any single patient scenario. The intra-rater agreement by nurses using this five-point triage scale was "substantial" (k = 0.709) whilst the intra-rater agreement of physicians was "excellent" (k = 0.818)[21].

Cooke and Jinks (1999) examined whether the Manchester Triage System (MTS) could reliably detect patients who will subsequently require admission to critical care areas[19]. The researchers identified those patients who presented to the ED and then required admission to critical care areas. The patients' original MTS category was elicited. The researchers relied on the assumption that the vast majority of patients who were admitted to critical care areas (intensive care, coronary care or high dependency units) would have been seriously ill on arrival to the ED and hence should have been triaged as Category 1 or Category 2. Using computerised medical records, all patients admitted to critical care areas were identified. In cases where the triage category was not Category 1 or Category 2, the patient's medical record was obtained. To determine whether non-urgent triage category allocation had occurred due to system or coding error, each patient was retrospectively allocated a MTS category by a nurse researcher trained in the MTS and using the information that could have been available to the triage nurse. This information consisted of the initial history and simple observations. It also included elements of the patient's history that the researchers determined could have been elicited by the triage nurse[19].

The results of this study found that there were 91 patients admitted to critical care areas during a one-month period. Of these, 61 patients (67%) were triaged to Category 1 or Category 2. Of the six patients (6.6%) who were allocated to Category 3, Category 4 or Category 5, there were five patients in whom the original MTS category was deemed to be correct and in whom deterioration occurred after arrival to the ED. The remaining patient sustained a myocardial infarction but presented with epigastric pain of moderate severity and with no cardiac symptoms or past history. The researchers concluded that this type of patient could not be detected by a triage system without over triage of high numbers of patients who present with abdominal pain. There were 18 patients (19.7%) who were initially allocated Category 3, Category 4 or Category 5 and who were allocated to Category 1 or Category 2 by retrospective analysis. Of these cases, 12 patients were identifiable to the researchers as having cardiac pain. On the basis of these results, the researchers concluded that the MTS was sensitive in detecting patients who required critical care but also acknowledged that sensitivity calculations were not possible due to sample size and that specificity could not be determined using these methods. Failure of application of the MTS is cited as the major reason for the errors identified in this study[19].

The results of these studies are not surprising given that both studies are based on the assumption that the need for admission is directly related to acuity of triage category. Inherent in this assumption is that patients with a higher acuity of triage category are more likely to require admission when compared to those with a less acute triage category. In reality, there are many practice examples that refute this assumption. In a scenario where a patient presents to the ED with respiratory arrest due to narcotic overdose, the patient is normally allocated a high acuity of triage category. Once a narcotic agonist has been administered, these patients seldom stay for observation or admission. A patient who presents to the ED fitting will be allocated to a triage category of high acuity. However, if the cause of the seizure is found to be a febrile convulsion or a typical episode of epilepsy these patients may in fact be discharged from the ED. Conversely, a patient who presents with a problem such as cellulitis will have a less acute triage category. However this patient's condition may warrant admission for intravenous antibiotics.

Whilst the findings of these studies demonstrate variation in admission rates by triage category, the ACEM cite the measurement of admission rates per ATS category as a means of triage decision validation. For example, low admission rates for Category 1 patients is indicative of over triage of patients to this triage category[6,10]. It is acknowledged however that variation in admission rates occurs between health care institutions and is noted to be as great as 35% in tertiary referral hospitals[6,10]. The admission rates determined by ACEM for each of the ATS categories are displayed in Table 6.2.

Table 6.2. Admission rates for each ATS category

ATS Category	Admission Rate
1	75-90%
2	60-70%
3	50-60%
4	20-30%
5	5-10%

6.3 Sentinel diagnoses

The ACEM advocates the use of sentinel diagnoses or diagnosis related "typical presentations" to assist triage nurses to determine which presentations should be allocated to specific ATS categories.

Anecdotal evidence suggests there are significant limitations to the use of sentinel diagnoses and are likened to retrospectively auditing triage decision-making. Triage decisions made by nurses are made in relation to the patients presenting signs and/or symptoms and no attempt is made to formulate a medical diagnosis. This raises questions as to the validity of assessing a decision that occurred at triage by using a diagnosis that may have been formulated after many hours of clinical assessment and aided by the use of diagnostic investigations[9].

Another limitation of the use of sentinel diagnoses is that many diagnostic groups have a spectrum of illness that varies in acuity and this is not reflected by the use of sentinel diagnoses, which try to confine each diagnosis to one ATS category. For example, a patient with asthma may present in severe respiratory distress that may warrant an ATS category of high acuity. Another patient with asthma may present with no respiratory distress and may be simply seeking a prescription for his or her usual asthma medication in which case an ATS category of lower acuity is warranted.

6.4 Retrospective chart audit

Goodacre et al. (1999) examined the level of agreement between senior medical staff when asked to review the decisions of triage nurses using retrospective case audit[32]. Four senior ED medical staff conducted three reviews, each of 50 triage decisions. Each review used a different process. In all cases the medical staff were blinded to the identity of the triage nurse and the triage nurse's decision in terms of NTS category allocation. The *kappa* statistic was used to measure level of agreement between medical reviewers and between the medical reviewers and triage nurses. The first review was conducted without any preparation and using reliance on the knowledge and experience of each individual medical reviewer. There was complete agreement between the four medical reviewers in 15 cases (30%). A three out of four majority agreement was achieved in 19 cases (38%) and there was no agreement between reviewers in 16 cases (32%). The level of agreement between medical reviewers in the first review was fair to moderate (k = 0.27 – 0.53) as was the level of agreement between the medical reviewers and the triage nurses in this review (k = 0.23 – 0.45)[32].

The second review was conducted following a meeting whereby the medical reviewers discussed the cases from the first review and identified cases where a unanimous decision could not be made. This information was used to develop a "common theoretical approach" that was subsequently used to underpin the second review. There was complete agreement between the four medical reviewers in 12 cases (24%). A three out of four-majority agreement was achieved in 24 cases (48%) and there was no agreement between reviewers in 14 cases (28%). The level of agreement between medical reviewers in the first review was fair to moderate (k = 0.29 – 0.57) however the level of agreement between the medical reviewers and the triage nurses in this review was moderate (k = 0.38 – 0.60)[32].

The third review was conducted with the medical reviewers' decisions made by strict adherence to the protocols of the Manchester Triage System. There was complete agreement between the four medical reviewers in 22 cases (44%). A three out of four-majority agreement was achieved in 15 cases (30%) and there was no agreement between reviewers in 13 cases (26%). The level of agreement between medical reviewers in the

first review was fair to substantial (k = 0.31 – 0.63). The level of agreement between the medical reviewers and the triage nurses was not measured in this review[32].

The audit of triage nurse decisions by retrospective case review by medical staff is inappropriate for many reasons. Assessment of a nurse's triage decisions using this method is based on the unproven assumption that the triage decision of the medical reviewer is the "correct" triage decision and should be the standard against which the triage nurse's decision is judged. The level of agreement between medical reviewers in this study was fair to moderate indicating a large degree of inconsistency between medical reviewers [32]. The medical reviewers have access to information that the triage nurse did not, for example, the results of x-rays and blood tests. This means that the decisions of the triage nurse and the medical reviewer were based on different information and therefore could not be fairly compared[32].

There is an increasing requirement for health services to demonstrate and improve the quality of healthcare delivery[47]. Various terminologies have been attached to quality activities, such as CQI (Continuous Quality Improvement), and TQI (Total Quality Improvement). There is a paucity of literature regarding quality measures and triage, particularly the evaluation of triage decisions or application of triage scales such as the ATS. Woolwich (2000) suggests that maintenance of quality standards can be ensured by audits of the triage system[48]. However, key performance indicators such as consistency of triage, admission rates according to triage category, sentinel diagnoses and retrospective chart audits have limitations.

7 Summary

Triage is a formal process of immediate assessment of all patients who present seeking emergency care[1,5]. Triage assessment findings are then used to prioritise or classify patients on the basis of illness or injury severity and need for medical and nursing care[6,7]. Triage ensures that emergency care is initiated in response to clinical need rather than order of arrival[7,9]

In Australia, triage is predominantly a nursing assessment that begins when the patient presents to the Emergency Department. Triage decisions are made in response to the patient's presenting signs or symptoms and no attempt to formulate a medical diagnosis is made[9]. The allocation of a triage category, for example, using the Australasian Triage Scale (ATS), is made on the basis of necessity for time-critical intervention to improve patient outcome, potential threat to life or need to relieve suffering[9]. The decisions made by a triage nurse are a pivotal factor in the initiation of emergency care. Therefore the accuracy of triage decisions is a major influence on the health outcomes of patients[1,11,14]. As all of these characteristics make triage decision-making inherently difficult, it may be argued that triage nurses require advanced clinical decision making expertise[15].

The ATS was developed to prioritise patient care and provide a consistent approach to triage practice at a national level. However, its use has been extended to include measurement of ED performance, funding allocation and determination of quality of care. Therefore, it is vital that the application of the ATS is consistent by both individual triage nurses and organisations.

Numerous studies have been conducted on triage to identify the most effective and accurate method for triage. Consensus suggests that a five-point triage scale, similar to the ATS, is more effective in producing consistency of triage. A number of studies have been conducted on the ATS testing the inter-rater reliability, use of clinical characteristics and the consistency of triage related to ED activity and finally the application of the scale. Many of these studies have identified varying degrees of inconsistency of the application of the ATS[9,27,36-38]. It is also evident in the literature that triage decisions are unaffected by type of hospital (teaching, non-teaching, rural and private), triage nurse experience and ED activity[25-26,36,38-39].

Consistency of application of the ATS has been shown to vary depending on the specific clinical characteristics identified by the triage nurse[9]. Patient age has also been shown to affect consistency of triage with males being more likely to be allocated to Category 1, Category 2 and Category 3 whilst females were more likely to be allocated to Category 5. Older patients (over 65 years) were more likely to be allocated to the most urgent triage categories and less likely to be triaged to the lower triage categories. Both children and the elderly were also less likely to be allocated to Category 5[9].

The role of education in achieving consistency of triage appears to be variable with some studies citing specific triage training and others having no requirement of formal training in triage. However, the requirement for triage nurses to be specifically prepared for the triage role, either in terms of experience or education is well documented in the literature[1,2,5,6,8,10,43-45].

The Emergency Nurses' Association of Victoria recommends that nurses be competent and functioning autonomously in all aspects of emergency nursing prior to undertaking the triage role and that all emergency nurses be prepared for the role using structured unit based education programmes based upon nationally established triage standards[44].

Whilst these notions are widely supported by the emergency nursing community, there is wide variation in the experiential and educational requirements of Victorian triage nurses[23,45,46]. Not surprisingly, there is a call for a consistent approach to triage education and uniform triage guidelines[27,36-38].

There is an increasing requirement for health services to demonstrate and improve the quality of healthcare delivery[47]. Various terminologies have been attached to quality activities, such as CQI (Continuous Quality Improvement), and TQI (Total Quality Improvement). There is a paucity of literature regarding quality measures and triage, particularly the evaluation of triage decisions or application of triage scales such as the ATS. Woolwich suggests that maintenance of quality standards can be ensured by audits of the triage system[48]. However, key performance indicators such as consistency of triage, admission rates according to triage category, sentinel diagnoses and retrospective chart audits have limitations.

Triage is a complex health care activity and the achievement of best practice is based upon adequate education of triage practitioners and the implementation of quality improvement strategies and monitoring of triage outcomes. A consistent approach to triage throughout hospitals in Victoria will enable equity of access for patients and enable benchmarking of hospitals to inform opportunities for improving performance.

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