DECISION MAKING OF TRIAGE NURSES IN DETERMINATION OF PATIENTS' LEVEL OF URGENCY IN ACCIDENT & EMERGENCY DEPARTMENTS IN HONG KONG

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Abstract

This thesis documents a descriptive study using non-experimental design to explore the process of decision making of the triage nurses in determining patients' level of urgency in the Accident & Emergency Department (AED), and identifies factors influencing the triage nurses in this process. Fifty-three (N=53) Registered Nurses (RN) currently working in 14 AEDs participated in the study. The subjects were required to triage five simulated patients using a notebook computer containing the self-developed Computer-assisted Simulated Patient Scenarios (CSPS) programme, and to answer a questionnaire to identify factors influencing the triage decision making. The usability level of the CSPS was assessed in various aspects, namely software interface, screen layout, and documentation. The overall mean score for usability test was 3.3 (above GOOD). The content validity index of the questionnaire was high (0.81). The results indicated that:

1. triage was a difficult nursing duty in the AED;
2. formal triage education should be enhanced;
3. the triage decision process was generally led by objective data e.g. blood pressure readings;
4. the triage decision was conservative as evidenced by high rate of over-triage;
5. the attributes of the patient, the physical structure of the triage station, the triage nurse, and the management were considered as important influencing factors; and,
6. senior nurses could handle the decision making process confidently, independently, decisively and felt less stress compared to junior nurses.

The findings are discussed within the local context of AED clinical practice focusing on the triage work. Future directions for study on decision making are recommended. The limitations of the present study are discussed.

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Chapter 1

Introduction

It is believed that the manner in which decisions are reached affects all aspects of human behaviour (Lyneham, 1998). Most hospitals in Hong Kong have adopted the classical nursing decision model – the nursing process, with varied degrees of modification amongst individual wards or departments (Wong, 1995). However, there has been no formal adoption of the nursing model in the nursing practice in the local Accident & Emergency Departments (AED). Due to the unique characteristics of emergency services, for example, high patient volume and very short but dynamic patient stay, emergency nurses need to make rapid decisions frequently in order to meet the patients' needs (Sheehy, 1997).

In the emergency setting, triage nurses are the first health professional members a patient may meet in the hospital. They are often responsible for the initial assessment of patients that attend the AED for emergency medical attention, actual or perceived. The triage nurses need to determine rapidly the level of urgency, which reflects the priority of care of all the patients attending the AED, upon their arrival. The decision can be reached with reference to the very limited information or data that is collected during the initial assessment. The foundation of the present study rests on this type of decision making.

The scope of the present study was confined to the major function of triage nurses – determination of patients' level of urgency. The purpose of the present study was to explore the rapid decision making of triage nurses in determination of patients' level of urgency in the AED.

Objectives of the study

The objectives of the study are as follows:

1. To explore the pattern of decision making strategies employed by triage nurses in determining patients' level of urgency in the AED in Hong Kong; and
2. To identify influencing factors that triage nurses consider relevant in determining the level of urgency of patients attending AEDs.

The research questions

Several research questions have been framed:

1. What are the decision making strategies of triage nurses when they determine patients' level of urgency in the AED?
2. How long would it take to complete a triage process?

3. How accurate are the triage decisions?
4. What are the influencing factors upon triage?
5. How do personal, contextual, and task attributes combine to influence the decision of triage nurses?

<u>Variables</u>

With reference to the objectives of the study, several independent and dependent variables were determined and listed below:

Independent variables

- Age group of the subject
- The total years of AED experience
- The highest level of education attained
- The perception of difficulty of triage work

Dependent variables

- The level of agreement with regard to those influencing factors listed by the researcher
- The accuracy rate of triage decisions achieved in the simulated triage scenarios
- The pattern of decision making demonstrated by the subjects

Definition of terms

For the purpose of this study, the following terms were defined:

Accident & Emergency Department (AED)

The 24-hour operated Accident & Emergency Department in the hospitals under the governance of the Hospital Authority in Hong Kong.

Triage nurse

A registered nurse or nursing officer who was assigned to perform triage duty when he or she was on-duty in the AED.

Triage decision making process

The process of determining the patient's level of urgency conducted by triage nurses, upon arrival of the patient at the AED. Several nursing observation tasks would be conducted during the process including the collection of subjective and objective data, and the determination of the patient's level of urgency.

Triage decision

The determination of the level of urgency performed by the triage nurse. This is in fact the outcome of the 'triage decision making process'.

Influencing factors

Factors that the subject considered to be those influencing the triage decision making processes.

Assumptions

The study is based on the four major assumptions described below:

1. Decision making is an important function in emergency nursing practice.
2. Triage nurses make triage decisions with limited information.
3. Decision making is a skill that can be learned.
4. Decision making can be studied by the simulation method.

Limitation of the study

The findings are limited to subjects from those participating hospitals within the local context. The content of the self-developed computer programme 'Computer-assisted Simulated Patient Scenarios' (CSPS) was derived from selected real patient history of local patients. As a result, generalization of the findings to other populations (for example, non-Hospital Authority owned AEDs or AEDs in other countries) may not be appropriate. Nurses of the non-participating hospitals in the local context may carry varied patterns of decision making in the triage work. Fortunately, their market shares are small. Thus the generalizability is maintained within the domain of local emergency nursing practice.

The researcher recognizes that the present study may contain some common limitations for decision studies that employ patient simulation technique as their research tools. Several aspects in the real life situation can not be easily replicated in a computer simulation e.g., individuals' (both the nurse and the patient) emotional reaction to the clinical situation, ethical considerations, and the time factor (Bourbonnais & Baumann, 1986; Henry, 1991; Wong, 1995; Gerdtz & Bucknall, 1999). The researcher also believes that even though the time factor has been addressed in the CSPS by recording the time used in triaging individual 'patients', the sense of time pressure in the real situation of rapid decision making cannot be truly simulated.

Organisation of the thesis

The rest of this thesis is organised in the following way. Chapter 2 describes the background of the study. The historical overview of the development of local emergency nursing is introduced. Chapter 3 presents a review of the relevant literature on theories of decision making and some relevant studies. Chapter 4 introduces the preparatory work undertaken by the researcher to enhance the external validity of the self-developed Computer-assisted Simulated Patient Scenarios (CSPS). The development process and the usability testing of the CSPS are also described. Chapter 5 describes the procedure of constructing and validating the second research instrument, the questionnaire, for identification of influencing factors. Chapter 6 reports the process and results of the pilot study. Chapter 7 illustrates the administration and results of the main study. The sampling procedure is described. Finally, Chapter 8 presents the discussion and conclusion of the results. Recommendations for future research directions are also documented in this chapter.

Chapter 2

Background to the study

Historical overview of emergency nursing in Hong Kong

Accident & Emergency medicine (formerly called *Casualty*) is a young clinical specialty with fifty years of development in the history of local medicine. Emergency nursing, parallel to the short history, is also a young branch of nursing service (Lau, 1997). In 1983, in response to suggestions from the Platt Report (1962) which was presented in the United Kingdom, local Casualty was renamed 'Accident & Emergency Department' (AED) which described its role and function more appropriately (Lau, 1997).

The Queen Mary Hospital has been regarded as the pioneer institute in establishing the first casualty unit in 1947 while the Tseung Kwan O Hospital commenced the newest emergency medical service in July 2000. There are totally fifteen 24-hour operated AEDs in the hospitals under the governance of the Hospital Authority. Some other institutes (either government or privately owned) also provide emergency medical services but serve only a minority of the population.

Similar to most cosmopolitan cities round the world, the total number of AED patients in Hong Kong has evidenced an increasing trend in the last decade (Figure 2.1). In order to meet the need of the community, some new AEDs started their services in the middle of 1990s. Thus a record high increasing rate (23.8%) resulted in 1994. In general, the increasing trend has fluctuated steadily at a rate below 10% after 1995.

Fig. 2.1: Total number of yearly AED attendance in Hong Kong, 1990-1999

Year	Total Attendance	Increasing/Decreasing Rate
1990	1,100,000	-
1991	1,114,000	1.3%
1992	1,286,500	15.5%
1993	1,342,080	4.3%
1994	1,661,694	23.8%
1995	1,920,532	15.6%
1996	2,074,214	7.4%
1997	2,033,851	-2.0%
1998	2,210,403	8.7%
1999	2,268,879	2.6%

(Information provided by the headquarter of the Hospital Authority)

In line with the rapid development of health knowledge, technology and people's livelihood in recent decades, roles and functions of AED nurses have also undergone enormous changes. In the early years, they were expected to act as hospital based first-aid care providers and make subordinate to doctors. Nowadays, natural evolution of roles is inevitable. Their roles and functions are widely expanded and extended. Very often, they need to provide nursing services and interact with patients independently, for example, counseling of patients and/or significant others, performing minor surgical procedures, initiating diagnostic investigations like blood sugar level and triaging patients.

The concept of triage in the Accident & Emergency Department

The Hospital Authority officially introduced the 'Triage' system in 1990. The word 'triage' came from the French word, which described the sorting of coffee beans (Weinerman & Edwards, 1964; Pink, 1977; Budassi, 1979; Grossman, 1999). In the actual practice of emergency nursing nowadays, the triage nurse encounters a large variety of patient conditions, such as life or limb threatening situations, as well as others' relatively trivial health problems. Under the triage system, all the patients attending the AED before being seen by the doctor have to be classified rapidly by the triage nurse into different categories reflecting their level of urgency and priority of care. The prioritizing of medical care is based on the nature and severity of the illness or injury, history, signs and symptoms, general appearance, vital signs, and a very brief health assessment. In short, triage is a system of sorting patients seeking medical care in the AED. A nurse's capacity to make relevant observations, to identify actual and potential patient problems, to intervene appropriately and to prioritise care, requires decision-making ability (Tanner, 1987). The triage nurse, after collection of subjective and objective data, needs to make a triage decision on the basis of the level of urgency of treatment that is needed for the patient.

The triage process

Patients may go through a triage process before being attended by doctors. The triage process always includes the chief complaint and a very brief past history, additional information related to the existing health problems, vital signs, and a very brief health assessment. The triage nurse needs to determine the level of urgency of the patient based on those subjective and objective data. All patients, after going through the triage process, will be treated in the AED. In local practice, refusing patients by the triage nurse is not encouraged. The patient with less urgent or non-urgent medical conditions would not be directed to another separately operated clinic inside or outside the hospital.

According to the latest triage guidelines issued by the Hospital Authority (Hospital Authority, 1999), there are five different levels of urgency namely Category I (Critical), Category II (Emergency), Category III (Urgent), Category IV (Semi-urgent) and Category V (Non-urgent). Conditions and implications for each category are shown in Table 2.1. The Hospital Authority has also established performances pledge for patients of different categories. For patients with critical conditions (Category I), 100% of them may receive immediate attention by a team comprising medical and nursing staff. Zero waiting time is promised. For patients suffering from emergency conditions (Category II), 95% of them may receive medical attention within less than fifteen minutes. It is also promised that 90% of the urgent patients (Category III) may wait less than 30 minutes; not more than 90 minutes for 90% of semi-urgent patients (Category IV); and not more than 180 minutes for 90% of the non-urgent patients (Category V).

Table 2.1: Conditions and implications for each category of level of urgency

Category	Condition	Implication
I (Critical)	• Life-threatening conditions caused by a major event • Patients with unstable vital signs requiring immediate resuscitation	100% of cases may receive immediate attention by a team of medical and nursing staff
II (Emergency)	• Potentially life threatening conditions • Borderline vital signs but with potential risk of rapid deterioration • Require immediate treatment and continuous close-monitoring	95% of cases may receive medical attention < 15 minutes
III (Urgent)	• Suffers from a major condition with potential risk of deterioration • Stable vital signs	90% of cases may receive medical attention < 30 min.
IV (Semi-urgent)	• Suffers from acute but stable condition • Stable vital signs • Can afford to wait some time without serious complications	90% of cases may receive medical attention < 90 min.
V (Non-urgent)	• Suffers from minor and stable condition • Stable vital signs • Can afford to wait without deterioration	90% of cases may receive medical attention < 180 min.

(Hospital Authority, 1999)

Clinical decision making of triage nurses

Marquis and Huston (1998) define 'decision making' as a complex cognitive process to choose a particular course of action from among alternatives. A definition found in Webster's dictionary (1993) 'to make up one's mind; to judge or settle' is another view of decision making. Both definitions indicate that there would be doubt about several courses of action and that a choice was required. The triage nurse needs to quickly determine the level of urgency or priority of care with limited information. The choices are limited to the five categories mentioned in Table 2.1. Triage is an assessment decision making process, not a diagnostic evaluation (Budassi, 1979). They are not making decisions under uncertainty. A relatively clear outcome is expected – to assign the level of urgency to a patient.

In actual practice, the triage nurse may experience multiple decision making processes before reaching a triage decision. The triage nurse needs to perform various observations and assessments in order to collect supportive information to justify the triage decision. There are several triage activities such as measurement of blood pressure, pulse rate, respiratory rate, body temperature, and the oxygen saturation level of haemoglobin that can generate objective data which in turn aid in understanding the current health status of the patient. The triage nurse can also gain subjective data by asking the patient or the person accompanying him questions like the level of perceived discomfort, duration of the unwell feeling, past health and medical history. Physical examination of a patient may also be a way to provide extra information. All those objective and subjective data ensure the legitimization of the triage decision. On top of such subjective and objective data, the triage nurse may exercise some sort of 'gut feeling' or intuition (Budassi, 1979; Benner & Tanner, 1987) during the decision process. This happens especially if the patient is under a deadly critical situation, and the triage nurse may make a triage decision rapidly without any sort of supportive data.

Summary of this chapter

The history of local emergency nursing; the official performance pledge related to triage; and the nature of clinical decision making of triage nurses have been acknowledged in this chapter.

Chapter 3

Literature Review

What is triage?

> *Get the right patient to the right place at the right time with the right care provider*
>
> Emergency Nurses Association, 1995, p.3

The word 'triage' is derived from the French word 'trier', meaning to pick, sort, select, or choose of agricultural products e.g., coffee beans (Weinerman & Edwards, 1964; Pink, 1977; Budassi, 1979; Grossman, 1999). Nowadays, the concept of triage has been widely adopted in the AED worldwide to sort out those patients who are in need of emergency services first (Pink, 1977; Emergency Nurses Association, 1995; Holleran, 1996; Emergency Nurses Association, 1997; Grossman, 1999; Selfridge-Thomas, Hall & Rea 1999).

The concept of medical triage evolved during a battle when Napoleon's surgeon developed a system that 'sorted out' the wounded soldiers on battlefields. Victims were sorted and classified according to the type and urgency of their conditions. During the Crimean War, Florence Nightingale went out during the nighttime after battles with her oil-fueled lamp to 'sort out' the remaining soldiers and offer them care (Holleran, 1996). The military triage concept was put to full play during various major wars round the world, such as World War I, World War

II, the Vietnam War, and the Korean War. Primary triage of the injured occurred on the battlefield. The secondary triage was conducted at the battalion station, the final destination being a medical unit at the most rear side away from the battlefield. Combat triage, unlike civilian hospital triage, was guided by the adage 'the best for the most with least by fewest' (Simoneau, 1985). Wounded soldiers were classified into categories that would separate those most salvageable (i.e. to be more quickly returned to the war front) from those that required extensive care (i.e. to be delayed and/or transported). Critical patients requiring extensive resources received delayed medical care. The idea was to spend resources on those soldiers who were most likely to survive and return to fight again. The goal of wartime triage was to maximize survival rates (Emergency Nurses Association, 1997).

After these wars, the triage concept has been widely applied in various civilian sectors like organizing medical care available during disasters and multi-casualty situations, and in AEDs, at offices of the medical general practitioners, over the telephone, and via cyber (the world-wide-web). The first reference to the use of triage in an AED comes from Yale, Newhaven Hospital, USA (Jones, 1994). The triage process emerged in hospitals during the late 1950s and early 1960s in the USA (Rund & Raush, 1981) and appeared in the UK in the 1980s (Jones, 1994). In a study conducted by the Emergency Nurses Association in 1995, 94% of emergency departments in the USA adopted some type of triage system (Emergency Nurses Association, 1997). In Hong Kong, triage has been formally operated in all the AEDs under the management of the Hospital Authority since the early 1990s.

The triage process used in civilian hospitals began in the early 1960s in response to two distinct trends happening in AEDs. Firstly, there was a huge increase in the number of patients treated in the AED. Secondly, many non-urgent patients were seeking medical services from the AED (Weinerman & Edwards, 1964). Overcrowding of the AED had been a problem for several decades. Study conducted in the early 1960s proved that one-third to one-half of the patients who used emergency rooms could be classified as having non-urgent conditions (Weinerman & Edwards, 1964). Albin, Wassertheil-Smoller, Jacobson and Bell (1975) identified that 36% of the patients seen in the emergency room were considered to have non-emergent illnesses regarding final diagnosis. The problem persisted even when the triage system had been in operation for ten years. Wong and his colleagues (1994) noted that 65.9% of patients attending an urban AED were of non-urgent category. Inappropriate use of the AED seemed to be a universal problem all over the world over time. Liggin (1993) documented that abuse of casualty hospital services started as early as 1849. The problem has persisted for more than 150 years.

An overload of non-emergency patients may result in increased and unacceptable delays in rendering care to true emergencies (Albin et al, 1975). A triage system was expected to be able to sort out patients who were really in need of emergency medical attention.

The current use of triage concepts in the AED is 'to sort out' those in need of priority treatment and care (Emergency Nurses Association, 1995; Manchester Triage Group, 1997; Hospital Authority, 1999). The goals of triage include:

(1) early patient assessment,
(2) brief overall assessment,
(3) determination of urgency,
(4) documentation of findings during patient assessment,
(5) control of patient flow,
(6) assignment of patients to the appropriate care area,
(7) initiation of diagnostic and/or therapeutic interventions,
(8) infection control,
(9) promotion of good public relations, and
(10) health education for patients and families.

However, the goals and their implementation vary between individual AEDs according to their characteristics and social expectation (Holleran, 1996). The present study will focus on the major function of triage – determination of patients' level of urgency.

In the early stage of development, triage was initially done by doctors, but nurses quickly assumed primary triage responsibilities (Holleran, 1996). Most researchers believed that the most appropriate person to carry out triage is a nurse who has wide experience and knowledge in emergency nursing (Budassi, 1979; Jones, 1994). De Angelis and McHugh (1977) studied the effectiveness of various health personnel as triage agents. They compared the effectiveness amongst physicians, nurse practitioners, registered nurses, and receptionists and concluded that registered nurses would be the safest and most cost-effective personnel to perform triage.

Role of the triage nurse

The goals of triage were described in the previous section. It is understood that in actual practice, the goals and their implementation vary from hospital to hospital. Manchester Triage Group (1997) proposed that the triage nurse's main role is to accurately prioritize patients, and this must be the prime objective of triage. However, Harris and Hendricks (1996) reconsidered the prime position of the triage nurse as a front line mediator. The role of the triage nurse is far beyond pointing to the waiting room clock and a leaflet that informs clients of the purposes of the AED. The triage nurse is a key person to humanize the triage system and must demonstrate confidence in her abilities but flexibility in her approach. Triage nurses are encouraged to communicate with the patients waiting for consultation proactively, to let them know the reasons for waiting. It is important to provide a conducive and educationally sound environment in the waiting area because complaints and disputes are time consuming and costly. Harris and Hendricks (1996) propose making use of the waiting time in a positive and supportive way, so that patients would understand the situation clearly and match themselves to the pace of work of the AED.

In Hong Kong, an official triage guideline has been issued and is updated regularly by the Hospital Authority. Patients would be classified into five categories, reflecting their level of urgency and priority of treatment and care to be received, by the triage nurse (Hospital Authority, 1999). However, the triage guideline put only limited emphasize on the triage decision making process. The Emergency Nurses Association (ENA) proposed a 6-step systematic triage process in 1995 (Table 3.1).

Table 3.1: A 6-step systematic triage decision process

Step 1	Observe patient – visual survey
Step 2	Determine chief complaint and perform primary survey
Step 3	Perform focused assessment, complete subjective and objective assessment related to the present condition
Step 4	Consider 'worst case scenario' as hypotheses, and collect data to narrow the range of possibilities. Consider current condition, potential for deterioration, speed of flow within the department, and the availability of resources.
Step 5	Determine the acuity category (i.e., triage decision)
Step 6	Reassess and reassign acuity as necessary.

ENA (1995), p.37

Benefit of triage in the AEDs

Benefits of the application of triage systems in AEDs have been well documented. There are several commonly described benefits highlighted in the literature (Slater, 1970; Zwicke, Bobzien & Wanger, 1982; Mallett & Woolwich, 1990; Lai, Ip, Kong & Pang, 1994; Wong, Tseng & Lee, 1994), such as:

(1) The giving of rapid attention and treatment to patients suffering from critical or emergent medical conditions.

(2) The reassurance of professional assessment on arrival for all patients, with the giving of information on likely waiting times.

(3) The reduction of waiting time between arrival and doctor consultation.

(4) The increase of client satisfaction because of improved communication.

(5) The cost-effective deployment of nurses, and increased nurses' job satisfaction in the AED.

(6) The reduction of congestion in the AED because of improved patient flow and optimized use of space and human resources.

However, the benefits of the triage system have been queried by some researchers. George, Read, Westlake, Williams, Fraser-Moodie and Pritty (1992) conducted a research to compare formal nurse triage with an informal prioritization process for waiting times and patient satisfaction. They identified that nurse triage might impose additional delay for patient treatment, particularly for patients needing most urgent attention. The median waiting time to see a doctor was significantly longer for the most urgent patient in the formal triage group than those of the non-formal triage group. However, only half of the story was told because patients from 9pm to 8am were excluded from the study. The researcher of the present study believes that their findings reflected only the performance during the daytime. A complete picture of the situation could not be drawn. George et al (1992) also failed to differentiate the nurse who was doing the formal and non-formal triage. Thus, it would be inappropriate to conclude that the triage system imposed significant delays for the most urgent patients.

Brillman and colleagues (1996) advocated that triage decisions should not be used to determine the timeliness of access to emergency care because of their limitation in predicting need for emergent care and hospital admission. They used a crossover method to check the inter-observer agreement on the level of urgency assigned by a nurse, a computer-guided triage programme, and a physician. The sensitivity for predicting at triage the need for hospital admission, compared with data from patients actually admitted after treatment, was 68%. The researcher of the present study would argue that retrospective categorization by physicians would not be a fair method to assess the accuracy of triage decisions. The triage nurse, very often, could not collect complete information from the patient or his escort during the short triage interaction. The physician who was doing retrospective categorization was able to access the complete medical records such as results of laboratory tests and physical examinations. It would be understandable that clinicians holding different data might result in different decisions. Thus retrospective categorization may not be appropriate for benchmarking purposes.

Decision making in clinical nursing

In a general sense, decision making is simply defined as information search and choice while some theorists use a broader term 'problem solving' (Carroll & Johnson, 1990). Regardless of terminology debates, decision making is an essential and integral part of nursing practice. Nurses are expected to evaluate, discriminate, interpret, and critically appraise alternatives. On top of professional knowledge, skills and experience, sound judgement can be achieved with both thought and intuition (Mackway-Jones, 1997). Nurses make decisions daily in their practice. If a patient tells the nurse that he/she has feels feverish, the nurse will consider checking his body temperature to see whether the patient is in a state of fever or not. Then, the nurse has to decide what to do next when the body temperature result is available. If the temperature reading is slightly above normal, the nurse will administer mild cooling measures without a doctor's prescription e.g., encourage intake of cool fluid, and remove excessive clothes. Nurses will prioritize their actions if a patient's temperature is abnormally high, and in addition to cooling measures, may call the doctor for further examination to prevent deterioration and promote comfort.

Undoubtedly, decision making is an integral part of clinical nursing practice. It is not only of internal necessity, but also a demand from our clients/patients. Health care seekers do not seek the services of professionals just for their actions, but for the professional decisions on which those actions are based (Carnevali, 1984). Hughes and Young (1990) suggest that clinical decision making is the nurse's most critical clinical function. They consider it as the skill that differentiates professional nursing from ancillary or technical workers.

Eddy (1996) proposes that the quality of health care has to be determined by two major factors: the quality of the decision to determine what actions to take, and the quality of actions executed. In short, either wrong actions chosen, or correct actions implemented with poor skill, may hinder the quality of work which may bring disastrous consequences - endangering patients' lives. Nurses are making efforts to ensure the quality of execution e.g., enhancing training of psychomotor skills. In contrast, little has been done to develop and evaluate the decision-making process. In order to have a complete picture of decision making, it is important to review the components of a decision.

In general, the goal of a decision related to health care practice is to place an action that is likely to deliver the outcomes that patients find desirable (Eddy, 1996). Eddy identified two main steps of a decision (Fig. 3.1). The initial step is to estimate the outcomes of the alternative practices; then followed by comparison of desirability of the outcomes of each option. Eddy's model considers the benefits, harms, and cost of each option during the process of decision making. The researcher of the present study notes that Eddy's model contained some similar notions from the health belief model. In the health believe model, people might decide to perform or reject some health, illness, or sick-role behaviour depending on the result of two evaluations they make, such as the threat of a health problem, and the advantages and disadvantages of taking the action (Sarafino, 1990). For example, a healthy woman might consider the benefit of early detection of breast cancer and the potential hazards of carcinogenic effect of radiation from mammography.

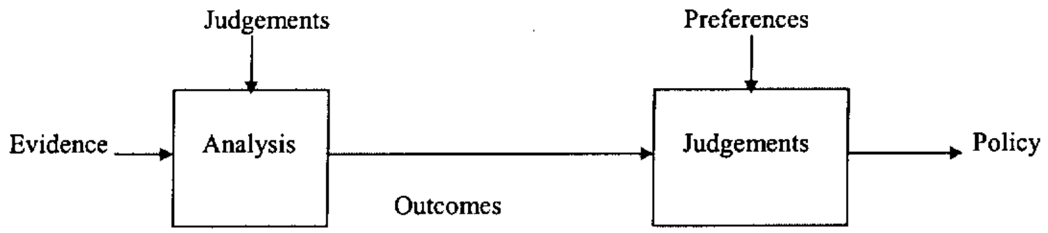


Figure 3.1: The two main steps of a decision (Eddy, 1996 p.11)

However, in emergency departments, patients are suffering from sudden onset of illness or injury. It is understandable that patients may expect quick attention regardless of the current situation of other co-existing patients. There is no triage-out policy in the local context i.e., never turn away patients. The triage nurse's decision is to determine patients' level of urgency, which reflects the priority to be seen by doctors in the AED, not to reject patients who present with trivial medical complaints. In other words, the clinical decision making of the triage nurse is important to sort out patients requiring immediate attention from those who could wait (Groosman, 1999).

Decision theory

Decision theory is a body of knowledge, incorporating analytical techniques of different degrees of formality, designed to help decision makers choose among a set of alternatives in the light of their possible consequences (Lee, 1971). It is not exclusively a psychological discipline. Mathematicians and economists initially developed it. Lee (1971) further points out that the boundaries of behavioural, economic, and mathematical decision theories are vague. A certain degree of overlap among the three disciplines exists. Clear-cut boundaries for the applicability of decision theory cannot be stated. Comparing to psychologists, economists are more concerned with choices that should be made to maximize profit or utility, while mathematicians have more concern with the development of the mathematical science.

Traditionally, in the field of behavioural decision, two major frameworks have been applied to investigate and explain decision making in nursing (Tanner, 1987). The first framework is based on a scientific or analytical approach - the rationalist perspective. The second framework relies mainly on intuitive knowledge attained by past experience - the phenomenological perspective (Tanner, Padrick, Westfall & Putzier, 1987). There are numerous individual theories under theses two frameworks. Cooksey (1995) has introduced fourteen current theories in decision research (Table 3.2).

Table 3.2: List of 14 current theoretical perspectives in decision research

No.	Decision perspective	Origin	Intended function
1	Decision theory	Economics	Prescription
2	Behavioral decision theory	Economics; Cognitive psychology	Description; Explanation; Prescription
3	Analytic hierarchy process	Eigenvalue/eigenvector mathematics	Prescription
4	Fuzzy decision theory	Set theory mathematics	Description; Prediction
5	Signal detection theory	Perception & psychophysics; Mathematics	Description; Prediction
6	Heuristic & biases/prospect theory	Cognitive psychology; Economics	Description; Explanation; Prediction
7	Requisite decision models	Economics; Social psychology	Conditional prescription; Explanation
8	Judgment analysis	Perceptual psychology & probabilistic functionalism	Description; Prediction
9	Information integration theory	Psychophysics	Description; Explanation
10	Image theory	Cognitive & self-concept psychology	Description; Prediction
11	Attribution theory	Perceptual & social psychology	Description; Explanation
12	Recognition-primed decision theory	Cognitive psychology; Human factors psychology	Description; Explanation
13	Explanation-based decision theory	Social & cognitive psychology	Description; Explanation
14	Conflict theory/constraints theory	Personality, stress, & social psychology	Description; Explanation; Prediction

Summarized from Cooksey (1995), p38-42

The researcher of the present study would like to describe some selected theories, which have been commonly applied contemporarily in the following paragraphs.

Rationalist perspectives

The rational model of decision making usually involves logical analysis. Very often, decision trees and numeric values are employed. The probabilities of every single possible outcome are assigned a numeric value, which may facilitate one to reach a sound option. Such a quantitative approach seems objective and measurable. However, it takes a considerable amount of time to go through the process and it assumes that all knowledge is available to enable the correct decision to be chosen (Miers, 1990). In AEDs, practically speaking, not all knowledge about the patient would be available upon the arrival of the patient. Triage nurses may need to decide the patient's level of urgency in conditions of a certain degree of uncertainty or even risk taking. They have to decide if the benefits outweigh the possible adverse consequences resulting from their choices. For example, when the triage nurse is assessing a patient who presented alone, with seemingly 'altered mental status' because of slow verbal response identified, the patient's presentation may be a result of organic health problems such as low blood sugar level, cerebral pathologies or head injuries. This may also be due to personal characteristics. The triage nurse needs to decide the level of urgency rapidly even in the absence of a detailed medical history. The triage nurse may consider checking the blood sugar if time is allowed and equipment is available at the triage station. Application of rational model may become time-consuming and less effective in this situation.

Decision analysis theory (DAT):

The decision analysis theory best illustrates the rationalist perspective. Decision analysis is found in its earliest applications in the fields of economics and military planning (Klassirer, 1976; Corcoran, 1985). As a result of innovation sharing, various health-related researchers (Klassirer, 1976; Grier, 1976, 1977; Corcoran, 1985; Harbison, 1991;) have applied decision analysis.

The theory provides a normative model (outcome oriented) of rational decision making. It assumes that people know not only what choices are available but also the outcome specific to individual option. After the decision maker identifies the problem and choices available to tackle the problem, an attempt is then made to assign a subjective probability to each possible consequence. This probability is the chance that the outcome will occur. Each possible outcome is graded with a value called 'utility' which reflects the patient's expressed value. If the patient is unable to assign a value, then it is the carer's responsibility to assign a value with reference to his/her perception of the patient's best interest (Harbison, 1991; Keeney & Raiffa, 1993). Finally, a mathematical combination of probability and utility may produce a value called 'expected utility' for each alternative. The alternative with the highest expected utility becomes the prescribed choice of the decision analysis (Corcoran, 1985). All these can be accomplished under the assistance of a decision tree. A decision tree is in fact a decision flow diagram consisting of a chronological arrangement of decision forks – the choices the decision maker has, and the chance forks – events that are controlled by chance. So that when one faces choices, by knowing the chance of occurrence and utility value of specific possible outcome, one may be able to reach an optimal strategy to maximize the expected utility. In short, the best decision can be chosen at the beginning of a task, which contains alternative ways to accomplish it.

Decision analysis provides a format for describing the relationship between actions and their possible outcomes. It also provides a procedure to show the likelihood that certain outcomes will follow given actions (Corcoran,1985). There are three theoretical assumptions in the decision analysis model:

1. The client's unique response towards the nurse's interventions, the nurse's own expertise, and the characteristics of the data the nurse uses all contribute to an uncertainty, under which nurses make most of their decisions.

2. Subjective probabilities of particular outcomes are included in the calculation of the expected values. It is assumed that both the subjective and objective probabilities observe the same law of probability.

3. Human beings are assumed to be rational decision-makers in this decision making model, and that they will choose the alternative with the best outcomes

Corcoran (1985) also highlighted limitations inherited in the decision analysis model:

1. Vigilance from the decision maker is required in reducing the decision diagram in order to maintain the best action and chance alternatives in the final decision process.
2. The assignment of values to outcomes often is presented to clients and the families.
3. The decision-maker needs to be acquainted with the client and family well to estimate their preference if the client cannot participate in assigning values for the events, for any reasons.
4. It is a common phenomenon that people often estimate probabilities of outcomes based on recent experiences or

impressive events. This jeopardizes the objectivity of assignment of probabilities to outcomes.

5. The characteristics of the alternatives included should be mutually exclusive. Many clinical decisions are not so at all especially during the triage process.

6. Spurious qualification has to be applied to the subjective data, which means a difficult job for some decision-makers.

Direct applications of decision analysis to nursing research have not been extensive (Tanner, 1983; Benner, 1984; Tanner, Padrick, Westfall & Putzier, 1987). Corcoran (1985) presents an example of applying decision analysis to clinical nursing in deciding the titration of pain relief medication. She provides a detailed explanation of the theory and applies the theory to a hospice care setting. The primary nurse has to face the controversy among pain control authorities on the direction for titration of analgesics - to start with a high dose then titrating downward or starting low and titrating upward. The patient is invited to participate in the decision making process in assigning value to chance events and possible outcomes. The researcher of the present study believes that DAT may not be applicable for all clinical decisions. Such a theory can be applied when one faces mutually exclusive options. Corcoran's example is the case. The clinician is in fact needed to choose one out of two options but there are five non-exclusive options (five different levels of urgency) in the area of triage decision.

On the other hand, decision analysis takes a considerable amount of time to go through. Nurses and patients need to perform arbitrary quantification in order to reach a health choice. It seems scientific but is, in fact, less humanistic. Triage nurses, need to decide the level of urgency of patients' condition which is a choice among five categories (i.e., critical, emergency, urgent, semi-urgent and non-urgent) based on very limited information and time - usually not more than five minutes. Knowledge of the patient may be inadequate and/or inaccurate. Hastie (1991) emphasizes the limitation of normative decision making as too simple to handle complex decisions that contain multiple contextual factors. Grier (1976) demonstrated that nurses select actions that are consistent with their expected values. The finding supports that nurses' intuitive judgements agreed with the actions prescribed by decision analysis theory in the majority of cases. It seems to support the effectiveness of decision analysis. Panniers and Walker (1994) heavily critique these findings. In their counter study, they selected a convenience sample of 31 nurses to quantify their intuitive ideas into five exclusive decision alternatives to formulate the first data set. Decision and preference analyses of these alternatives were conducted by three experts to become the second data set. In comparing the two sets of alternatives, only 35% of the nurses demonstrated an agreement between the choices produced by their intuition and those by the analytical approach. Such a low agreement rate is an indication of poor usefulness of decision analysis in nursing. They argue that if the agreement rate had been 90%, the use of decision analysis would have been totally replaced by intuitive reasoning. Grier (1976) and Panniers and Walker (1994) have presented controversial notions. Subjects in Grier's study were assigned values to possible outcomes and occurrence of possible outcomes which may be influenced by their experience and knowledge. Grier's idea seems less justifiable. For Pannier and Walker's study, Wong (1995) believed that their choice of a percentage cut-off point could not produce a definite answer to the research question and may reach an invalid conclusion.

Phenomenological perspectives

On the contrary, the phenomenological perspective model contends that action precedes rational analytical thought (Harbison, 1991). No formal strategies of judgement determination are available. This perspective agrees with a holistic view of nursing and believes that intuitive processes involve cognition, attitudes, values, and a sensory grasp of the whole within a particular context (Benner & Tanner, 1987; Tanner, 1989). Decision makers see and use patterns in the whole situation, rather than reducing the situation to discrete elements (Harbison, 1991).

Intuition, defined as 'understanding without a rationale', is a legitimate part of nursing practice in the area of clinical reasoning (Benner & Tanner, 1987). Budassi (1979) advocates the importance of intuition in triage decisions. The triage nurse may focus on the obvious information e.g. a fractured ankle, but overlook the less obvious data (the syncopal episode which caused the patient to fall from the ladder and fracture his ankle). With the sense of 'gut-feeling' or intuition, the triage nurse may be able to sort out real emergency conditions rapidly and accurately. The authors agreed that intuitive judgement although difficult or impossible to teach or quantify, develops as the nurse becomes an expert.

Benner (1982; 1984) has described five stages a nurse passes through from novice to expert and suggested how decisions made depend upon the stage of the nurse. Benner's work has been influenced by the work of Dreyfus (1983). Dreyfus suggests that with the acquisition and development of a skill, an individual proceeds through five levels of proficiency: (1) novice, (2) advanced beginner, (3) competent, (4) proficient, and (5) expert. Skill acquisition process is a progression from abstract, detached, analytical reasoning to concrete, involved, holistic reliance upon experience. Benner (1984) has adopted Dreyfus' model into the nursing domain and concluded that the novice nurses make up decisions based upon taught procedures and guidelines, while experts reached decisions intuitively based upon experiences. She found that experts operated at a higher level of reasoning with basic principles having been internalized with experience. The novices applied only rigid rules and guidelines in making decisions. They were not able to integrate knowledge acquired, which in turn hindered their attempts to reach a sound decision.

Benner, Tanner & Chesla (1992) applied a hermeneutic approach to study the development of expertise in a critical care setting. Subjects were chosen from nurses practicing in adult, child or newborn intensive care units. They employed both group and personal interviews. Their findings indicated that nurses at different levels of expertise experience a different clinical world. According to these researchers, this clinical world is shaped by experience that teaches nurses to make qualitative distinctions in practice. Beginner nurses were more task-oriented while experienced nurses focused on understanding their patients and their illness states.

The researcher of the present study believes that it would be difficult to classify nurses applying Benner's model of a five-stage evolution from novice to expert. There is a lack of hard and fast rules to define different categories. Years of experience may not be able to operationalize the classification because there are numerous factors, like the level of education and the knowledge of particular clinical conditions, affecting the process and outcome of decision making. The same individual could be a novice in a particular situation but an expert in another.

Interestingly, Hamm (1988) considers analytical and intuitive thinking as a continuum. Most thinking or decision making takes place somewhere along that continuum. Decision making will comprise both analytical and intuitive aspects. The analytical and phenomenological perspectives may not be mutually exclusive. Hamm proposes that the more time and information that are available, the nearer to the analytical end of the continuum the decision will be, and vice versa. However, Hamm's study is medically focused.

After reviewing theories originated from different frameworks (rationalist perspectives and phenomenological perspectives), the researcher of the present study considers 'from novice to expert' (Benner, 1982) to be the most relevant theory to emergency nursing. To the personal observation and experience of the researcher, nurses possessed different AED experience performed differently in their clinical competency.

Factors influencing the decision making process

According to Tanner (1983), factors that influence both the process and the outcome of clinical judgement are:- Task variables (e.g., complexity of the situation), contextual variables (e.g. physical structure) , clinician variables (e.g. confidence), and risk/benefit variables.

Amongst those variables, 'experience' (a clinician variable) has received much attention and discussion from many researchers and scholars (Ford, Trygstad-Durland & Nelms, 1979; Carnevali, 1983; Tanner, 1983; Benner, 1984; Thompson & Sutton, 1985; Wolley, 1990; Watson, 1994). Benner (1984) comments that clinical experience affects decision-making ability. Prior experience with specific clinical cases supports decision-making proficiency in that clinical situation (Wolley, 1990). Thompson and Sutton (1985) studied the decision process of 20 nurses working in a Coronary Care Unit (CCU). They conducted semi-structured interviews to explore the subject's decision against a case study, which was a patient suffering myocardial infarction. The subjects were also asked to prioritize five given influencing factors in order of perceived importance. It was concluded that experience was one of the most important factors influencing decision making, and nurses made many rapid decisions in emergency situations prior to seeking medical assistance.

However, Jones and Beck (1995) argue that a nurse could be an expert in one particular clinical situation and make a sound decision on behalf of the patient. She/he could be a novice in a different or unfamiliar clinical situation and therefore demonstrate less decision-making proficiency. They believe that exposure to and observation of an expert practitioner provides the novice with an invaluable frame of reference for decision making.

Tanner (1994) suggests that experience itself may become a source of bias to decision makers. She believes that bias will be linked to the number of previous encounters of similar problems and the recentness of that experience. Their amount of previous exposure and frequency of episodes or occurrences of a given situation observed within that time may preoccupy decision makers. Tanner (1984) further argues that a nurse who has just cared for a patient with a particular problem is more likely to assign a higher probability for the recurrence of that same problem when caring for the next patient.

Watson (1991) subdivides experience into three criteria: a passage of time; gaining skills or knowledge; and exposure to an event. With Watson's concept, the three things may not necessarily occur simultaneously. One may not be able to gain specifics even after exposure with specific situations. Total years of experience itself may then not be a valid base to determine competency. Even so, Watson's observational study in 1994 was able to prove that the effect of experience was one of the main factors influencing decision making.

Employment of simulated patients in clinical judgement research and education

It has been common to employ simulations in clinical judgement studies (Benner, 1984; Jorgenson & Crabtree, 1986; Sherman, Miller, Farrand & Holzemer, 1979; Tanner, 1983). The subject is presented with a simulation of varying degrees of fidelity to a real patient situation. The simulation may be in various formats such as an actor trained to provide a history and to present signs and symptoms of a real patient; a videotaped vignette, portraying a part of the patient-carer encounter; and a written case study (Tanenr, 1983). The use of simulated patients allows control over cues presented as well as comparison of performance across subjects.

Many researchers have employed various forms of patient simulation in their decision studies. Gordon, Sanson-Fisher and Saunders (1988) employed an actor-simulated patient in their study in a casualty setting. The 'patient' presented a pre-instructed history to various emergency doctors. They concluded that even experienced clinicians could not differentiate between real and simulated patients in the process of evaluating history and physical examination. Bourbonnais and Baumann (1986) used a paper-type case study simulating a cardiac patient to investigate the decision making of Coronary Care nurses in Canada. Other researchers (Thompson and Sutton, 1985) adopting the same approach replicated the study in the United Kindom. Wong (1995) developed a computer-aided patient simulation package, the Clinical Simulation System (CSS). It was a computer programme written with HyperCard, which was a Macintosh based hypertext system. Several patient scenarios with different medical conditions were included. The subjects were required to attempt to reach a nursing care plan by going through various stages of selected scenario. Then, their decision making processes were examined against their approach of study.

Elstein, Shulman and Sprafka (1978) established the reliability and validity of simulated patients to be employed in research on cognitive processes in diagnosis. Wong (1995) advocates that using simulations may eliminate potential hazards incurred due to unsound decisions. The problem of ethical consideration could also be eliminated. All these further legitimized the use of simulation in decision researches.

In recent years, the latest development of simulated patients would be the use of computer-controlled mannequins. Under the modern technology of virtual reality, various types of training mannequins are available for clinical teaching purposes. Mannequins are able to 'respond' with altered physiological parameters (e.g., blood pressure, pupils' reaction) upon stimulation. They can be tailor-made with an aim to meet the requirements of specific training needs e.g., acute trauma patients, patients under anaesthesia and so on.

Even though simulated scenarios claim to be safe to use without harming patients in case of unsound decisions, learners are lacking the contact with real people. The sense of real urgency can not be replicated. A well-protected environment may not be good enough to develop clinical suspicions, which are important for triage nurses at an emergency department. During triage, patient-nurse interaction time is short and usually lasts for less than five minutes each time. Patients would feel stressful when suffering from sudden physical/psychological discomfort and visiting a strange environment, the AED. Triage nurses would be given very limited or even untrue information from patients or informants. To a certain extent, nurses need to work busily with few cues. A high degree of clinical suspicions is important for them to reach sound triage decisions. The situation agrees with Tanner's (1983) that although efforts are made to simulate real-life clinical encounters, it limits the capacity to examine the influence of contextual variables e.g. time factor. Because of its nature of no-harm-result, users may not consider balancing the risk-benefit variables upon decision making. To overcome such limitations, Thompson and Sutton (1985) allowed only one minute for their subjects to go through a paper-type case study. This was then followed by a semi-structured interview to explore their decisions.

Apart from research work, simulated patients have also been widely adopted in educational activities such as teaching clinical decision making. Simulated patients seem to be a rich and flexible teaching approach that allows students to develop skills in a safe structured environment. Edwards, Franke and McGuiness (1995) developed simulated patients in the 1980s for teaching clinical reasoning in Australia. Simulated patients have the advantages of allowing teachers the flexibility to manipulate the programs, environment and level of content according to individual learner's needs while being safe, ethical, economical and reproducible. Employment of simulated patients has been gradually becoming a mainstay of the teaching approach in clinical judgement as evidenced by adoption of the term 'standardized patient' in the USA (Ewards et al,, 1995). The word standardized' itself reflects the level of scientific basis, public acceptance and popularity of the use of non-real patients.

Ethical considerations

Estimate of risk to the subjects

The research procedure included two different parts: the use of notebook computer to triage simulated patients, and to answer a pencil-and-paper type questionnaire. The researcher identified no tangible risk to the subjects. The researcher also gained approval from the University in respect of ethical review of research project involving human subjects.

Written informed consent

Consent from the two parties included the hospitals and the individual subjects. The researcher obtained institutional consent with the assistance of the university and was thus able to gain official approval from the participating hospitals. Letters of request for permission to conduct research (Appendix 1) were sent to the Hospital Chief Executives by mid 1999. A second letter reminded the non-responding hospitals three months after the first one.

Subjects were briefed on the day of data collection, a written consent form (Appendix 2) was obtained from individual subjects before commencement of the research procedure to ensure voluntary participation. The individual subject signed an agreement form (Appendix 3) to show promise to keep the content of the scenarios and questionnaire confidential.

Protection of personal data

In respect of the 'Personal Data (Privacy) Ordinance' (Office of the Private Commissioner for Personal Data, Hong Kong, 1997), each subject was assigned a personal code which was only known to the researcher. The subjects' identity would not be connected to data under any circumstances. The accuracy of performance for each subject during the computer session would not be reported to his or her supervisors. All the data was kept in a locked place accessible only to the researcher.

Summary of this chapter

The history of development of the concept of triage has been examined in this chapter. Regarding the theory of decision making, the two major schools of thought: the rationalist and the phenomenological approaches have been introduced and discussed. The researcher has also explored the potential influencing factors as well as the merits and dismerits of using simulated patients in clinical judgement research.

Chapter 4

The Method of the Study - Part I:

Construction of the Computer-assisted Simulated Patient Scenarios (CSPS)

Introduction

Coolican (1990) proposes that no laboratory experiment can be considered a true and valid test due to the absence of naturally occurring behaviour in a real clinical setting. A decision study would be more convincing if it were conducted in a real clinical environment (Wong, 1995). However, in the true practice of emergency nursing, there are numerous uncontrollable variables, which may jeopardise the internal validity of a study. Determination of the level of urgency directly affects the priority of treatment and patient outcome. Patient care will be adversely affected if the subject inaccurately decides a decision. It is deemed unethical and unrealistic to conduct the study in real clinical situations. Thus the researcher decided to develop a series of computer-assisted simulations of patient scenarios for assessing the subject's decision making.

Use of simulations in clinical judgement studies has been justified as a common and acceptable method (Tanner, 1983; Benner, 1984; Jorgenson & Crabtree, 1986; Carroll & Johnson, 1990). Carroll and Johnson (1990) and Wong (1995) advocate the importance of selecting representing cases in the development of simulations. Only findings incurred by highly selective cases can justify the conclusion and enhance generalizability. Under the assistance of the administrator of some AEDs, the researcher managed to select cases with a high degree of representativeness.

Selection of representative patients

The researcher decided to randomly select five patients from the Clinical Management System-Accident & Emergency (CMS-AE) employed by an AED. Simulated situations employed in most decision studies were designed to approximate as closely as possible those occurring in 'real practice' with an aim to maintain the reality and validity of their content. Some researchers developed virtual scenarios from patients' medical records (Wong, 1995; Cioffi, 1998).

The Clinical Management System-Accident & Emergency(CMS-AE)

The CMS-AE is a computer programme, capable of constructing a database for providing information to both clinicians and administrators, employed currently in most AEDs since 1997 (Chan, 2000). It is designed in a way such that patients' demographic and clinical information such as diagnosis, medications used, and number of sick leave days granted can be retrieved instantly via computer terminals within the network. Reports of the trend of occurrence of specific diseases can be generated. By knowing the epidemiology, resources could be mobilised wisely under the direction of evidence based guidance. The epidemiological statistics generated by the CMS-AE acted as important references for selecting representing cases.

Case selection for CSPS

The patient cohort was determined to be all the patients attended in 1998 in one of the local AEDs currently employing the CMS-AE. Five pieces of patient records were selected randomly to formulate the blueprints for the content of the CSPS (Table 4.1). According to the real clinical records, only one patient (Scenario C) was documented as unconscious so that all other four patients (Scenario A, B, D and E) were assumed to be in a conscious state.

Table 4.1: Summary of the content of the five scenarios

Scenario	Sex/Age	Chief complaint	Standard triage decision
A	Female/37	Simple stomach-ache just now	Cat. V (Non-urgent)
B	Female/2	Cough for one day, attended the AED the day before. Visit the AED again because of persistent coughing	Cat. V (Non-urgent)
C	Male/68	Neck pain and suspected convulsion 10 minutes ago at home, unconscious now	Cat. I (Critical)
D	Male/40	Right side of face (a 6cm wound) and neck (a 15cm wound) lacerated by electric saw while at work, mild bleeding, alert	Cat. III (Urgent)
E	Female/82	Shortness of breath for 2 hours, no chest pain, 7 o'clock in the morning now	Cat. II (Emergency)

Gold standard for triage decisions

Many triage studies adopted a physician-directed approach to determine the gold standard in order to assess the accuracy rate of triage decisions. However, this approach may not be relevant to judge the nurse's decision in this study for two reasons. Firstly, triage is traditionally considered as a nursing duty by many authors and authority (Budassi, 1979; Jones, 1994; Hospital Authority, 1999). Secondly, physicians are not educated and expected to perform triage in local AEDs. They may not necessarily possess actual triage experience. So that the researcher introduced a new model - the nurse-directed approach. A panel of three senior nurses (one nurse specialist and two nursing officers from different hospitals) was established to determine the gold standard for the simulated patient scenarios (Table 4.1). All of them were experienced nurses with at least seven years of clinical experience in AED. They also acquired Certificate in Emergency Nursing offered by the Hospital Authority. A three-people panel was considered to be a manageable size to the researcher. The panel was provided with identical amount of information that would be presenting to the subjects.

Constructing the CSPS

After completing the case selection and determination of gold standard, computing technology with interactive multimedia features was adopted to construct the CSPS. A programming software called 'Authorware' version 4.0 was selected as the major tool to develop the CSPS.

Authorware version 4.0

Authorware is a set of commercially available computer software to help users design and construct interactive programmes with multi-media presentation (Macromedia, 1997). The software provides designers with a powerful and user-friendly authoring environment for creating and publishing interactive information. It allows storage and retrieval of data and enables authors to create links between associated ideas. Authorware 4.0 can also be used to access text, movie/video images, graphics and auditory information. Using all those functions, visual and auditory information can be displayed in response to subjects' performance. For example, blood pressure readings would be shown only if the subject hit the button 'Blood Pressure' over the screen. For the present study, the researcher will be able to know the time consumed for each attempt and trace back their strategies in reaching a triage decision after subjects finished the CSPS. In short, the subject's performance – 'when' to do 'what' – could be automatically recorded and retrieved by the researcher.

The programme created by application of Authorware 4 is of cross-platform compatibility. The programme can be packaged in such a way that it can be operated on both Windows and Macintosh platforms. With its binary file compatibility, designers can author on either platform and use one file for playback on both platforms (Macromedia, 1997).

Authorware provides the tools for creating multimedia pieces that use digital movies, sound, animations, text, and graphics to engage the user in the learning process. The authoring function is accomplished by several major authoring components, which include a design window, a presentation window, a menu bar and a toolbar containing basic tools for common word processing, and an icon palette with various multimedia tools appearing in the format of specially designed icons.

The Authorware consists of four major authoring components namely the design window, the menu bar and the toolbar, the icon palettes, and the presentation window. Each of the authoring components is further elaborated in the in the following paragraphs.

1. Design window

   The design window is the major backbone of the authoring component. Inside the design window, there is a flow line that allows the designer to organise various multimedia objects along the logical sequence of presentation as desired (Appendix 4). The designer may easily rearrange the expected presentation effect by dragging icons along the flow line within the design window. The user may make use of different levels of design windows to control the interactive response of the CSPS.

2. The menu bar and the toolbar

   The menu bar and the toolbar of the Authorware provides the designer with commonly used and powerful word processing icons, such as 'save as new files', 'cut and paste', font size and style determination, and texts modification. The icons in the toolbar do inject insights to the designer for art work construction.

3. The icon palette

The icon palette, inside the design window (Appendix 4), contains various multimedia features that appeared as specially designed icons, such as display icon, interaction icon, and link icon. With these specially designed icons, multimedia files including sound, digital pictures, digital movies and graphics can be linked or arranged to display in the sequence desired by the designer. The icons in the palette can be used freely and repeatedly even inside one single file by dragging them.

4. Presentation window

After completing the design procedures, the product is called a piece instead of file. The designer is able to play back the actual programme in the presentation window immediately with pressing some special comment keys on the keyboard. This function enables the designer to modify or refine the programme easily with immediate evaluation.

After completing the design work, the Authorware file can be packaged as an execute file. The file can be operated under either the Windows or Macintosh systems in the absence of the software 'Authorware'.

After four weeks of self-study, the researcher managed to master a minimal programming technique sufficient to construct a series of computer-assisted patient scenarios with interactive presentation. Apart from studying both the official and unofficial manuals related to the use of Authorware, the researcher spent a considerable amount of time to gain programming knowledge and skills using cyber methods. Many electronic communication were conducted by visiting various web sites and e-mailing to and fro with experienced Authorware users world-wide.

Presentation of the CSPS

The self-developed CSPS file was packaged in a way that made it executable in most of the commonly used personal computers. There are four major themes in the presentation of the CSPS namely users login, instruction to users, triage scenarios and performance record. Unidirectional interactive icons accomplish the page-to-page and theme-to-theme linkage.

1. User login

   The first page of the piece is designed to lead the subject starting the CSPS by entering a unique user code assigned to individual subjects by the researcher (Appendix 5). The subject will move on to the second page automatically after entering the user code.

2. Instruction to users

The second page (Appendix 6) contains statements of welcome and rules of the triage game. The subject is instructed to attend a total of five simulated triage patient scenarios one by one. Free choices of triage observations throughout all the scenarios are allowed. Triage decision can be made even when no triage observation is selected. The subject can start triaging the next patient scenario by clicking a designated area on this page.

3. Triage scenarios

An example of a patient scenario has been attached in this thesis (see Appendix 7). Each scenario begins with a minimal profile describing the patient's age, sex, and chief complaint. It is followed by a series of six interactive buttons, which representing various triage activities (e.g., checking blood pressure, body temperature, oxygen saturation level, respiratory rate, and asking for more information) that the subject could select as desired. If a button has been clicked, then appropriate information would be displayed immediately e.g., parameter of pulse rate per minute would be shown if 'pulse' button was clicked. The subject was allowed to make free choices of triage activities that the subject believed to be appropriate and in a sequence of perceived importance for that particular simulated patient. When the subject believed that sufficient information was available to justify his or her triage decision, the subject would click the 'triage decision' button. Then, five buttons representing the range of urgency (Critical, Emergency, Urgent, Semi-Urgent, and Non-Urgent) would be shown to let the subject determine the level of urgency of that particular 'patient' (Appendix 8). In order to impose a real feeling of triage work, the CSPS did not allow the subject to go back to select triage activities again at this stage. After the triage decision had been determined, clicking the button 'next patient' completed the scenario.

4. The performance record

After completing the five scenarios, the final page containing a track record of the subject's performance in the CSPS will be displayed (Appendix 9). There is complete information displayed in this final page including 'time used', 'sequence of selection of triage activities', and 'triage decision' for all five scenarios.

Validity of the CSPS

According to Gerritsma and Smal (1986), validity measures for complex simulations are considered to be not easy to address. As all the information including chief complaint, past medical history, and various physiological parameters for each simulation was copied from real triage notes of the AED attendance records, ecological validity was assumed.

Usability of the CSPS

Concept of usability

Apart from pricing, there is a common question frequently asked by customers whenever new computer software or operating systems are available in the commercial market – is it user-friendly? In a general sense, usability seems to mean the degree of user-friendliness. The definition of usability varies but all evolve from the concept of the capability of the system to be used by humans easily and effectively (Shackel & Richardson, 1990). Thus testing of usability received much attention from researchers employing newly introduced or self-developed computer programmes (Wong, 1990; Wong & Wong, 1994; Wong, 1995) in order to pave the way towards popularity. Wong and Wong (1994) conducted a vigorous study to investigate the usability of a newly introduced computing system – Clinical Information System (CIS) which was introduced by the Hospital Authority. The CIS was designed for clinicians to record the types and frequencies of various nursing or medical activities as well as patient movement e.g. admission, discharge, inter and intra-hospital transfer. The authors employed the Human-Machine Interaction Checklist developed by the Human Science and Technology Centre, University of Technology, Loughborough, United Kingdom. The checklist contained 73 questions that were grouped under seven sub-groups checking different aspects of usability.

In the early stage of the computer era, computer designers focused on the development of reliable, cost-effective hard-ware and soft-ware, and little effort was spent on studying human factors (Gaines, 1985). Users' concerns had not been fully addressed. As a result some very powerful programmes did not gain popularity. Usability has been addressed gradually amongst programme developers. Some propose that usability for individual users are determined by subjective assessment of ease of use and by objective performance measures of effectiveness in using the system (Chapanis, 1981; Shackel, 1984; Eason, 1988). Shackel and Richardson (1990) further profess that an operational definition of usability is required for every single system developed. In order to enhance and ensure a high level of usability, programme developers adopted an iterative approach in the process of system development (Eason, 1988). Developers will send a prototype of the system to some possible end-users for comments. Then developers will refine the system taking feedback from the test users into account. The draft version will again be sent to possible users for comments. For some time, the system will go between the developers and some end-users to and fro until the final version has been determined.

Computerization has been widely exercised in the local context of day-to-day nursing practice since the early 1990's. The Hospital Authority considered that the use of information technology could provide a valuable contribution to the management of modern hospital services and to the improvement of patient cares (Hospital Authority, 1992). Apart from operating various automated machines (e.g. Non-invasive blood pressure measuring machines, electronic thermometers), nurses were required to enter various data into different computing systems by key-stroking, mouse-clicking or infra-red scanning. Thus the researcher believed that all nurses might have experienced different degrees of computer operation, and none of them would be ignorant of computers. With an aim to ensure that the subjects could finish the CSPS with minimal or no stress and to establish user-friendliness, it was decided to assess its level of usability by using a checklist modified from Wong (1990) with oral permission. The modification work was accomplished by removing several non-applicable items. The content validity and reliability of the original form were established when it was constructed. With reference to the nature of real triage work, the features of the CSPS were designed intentionally in a unidirectional information flow and with only minimal interactive elements. Thus Wong's (1990) usability checklist would be appropriate. Wong (1990) developed and used the checklist to establish usability for his Interactive Nursing Diagnosis Expert System (INDEXS). The INDEXS was an interactive computing system written in the HyperCard environment to assess the process of users' decision making in determining nursing diagnosis.

Content of the usability checklist

The original checklist consisted of 23 criteria (which were divided into four sub-groups) and one open question. Each sub-group focussed on one aspect of usability. They were namely content, software interface, screen layout, and documentation. The checklist was designed to collect comments from subjects reflecting their rating against individual criteria. All those criteria were reflecting the major dimensions of functionality and usability, that was, ease of use and ease of learning of a particular computing system. Considering the orientation and the aims of the present study, the content sub- group, which held three criteria, was eliminated for the evaluative study. The modified checklist contained 12 criteria in three sub-groups (see Table 4.2). The software interface sub-group contained four criteria exploring the ease of use and the controllability of the system. The four items in the screen layout sub-group examined how the information was presented to the users on the screen. The last sub-group comprised four criteria checking the quality of documentation.

Procedure of Usability Testing

Ten AED nurses (n=10) were invited to join the usability testing. To prevent contaminating the results of the main study, they were excluded from the main study.

Hands-on testing of the prototype of the CSPS was arranged for them in the nursing laboratory in the University. At the beginning of the tests, the purpose of the study and the testing procedure were explained by the researcher. A quick demonstration on how to operate the CSPS using a notebook computer with particular emphasis on manipulation of the mouse was conducted before commencement of hands-on testing. A notebook computer containing the CSPS was given to individual participants when they showed understanding of the briefing and demonstration contents. Similar to the main study, they needed to work through the five simulated patient scenarios one by one independently applying the triage process as for real patients. They were encouraged to raise questions with the researcher anytime during the test but communication amongst the subjects was not allowed. The usability evaluation forms were given to them after completing the CSPS. All the 12 criteria and the task were explained thoroughly. Then they were required to indicate the rating value of the system being examined in respect of these criteria. The rating value was used to indicate the subjects' opinion of the quality of the system. They were reminded again to consider the ease of use and ease of learning while rating each criterion. The evaluation forms were collected on the same day.

Results of the usability test

Most of the subjects completed the CSPS in not more than 15 minutes and finished the usability form within another 10 minutes. The rating scale, which measured the level of acceptance of the prototype in terms of the criteria listed, was in fact reflecting the level of usability and user-friendliness of the CSPS. The mean rating of the prototype was given a spread from 3.0 to 4.0 (see Table 4.2). The mean rating for the first criteria 'software interface' was 3.7. The second criteria 'Screen layout' achieved a mean at 3.5 while the third criteria 'documentation' scored 3.4.

As a result, the overall mean rating for the whole usability testing was 3.5. This was the mid-point between 'good' and 'very good'. It was concluded that the subjects were satisfied with the software interface, screen layout and documentation of the prototype CSPS. The subjects found the CSPS prototype acceptable and usable up to the level of higher than 'Good'. The usability testing of the CSPS was completed with positive and encouraging result.

Table 4.2: The usability checklist with the mean rating indicated by the subjects

Criteria	Mean Rating
1. Software Interface	
1.1 Clarity of prompts	3.8
1.2 Handling of errors in your input	3.5
1.3 Ease of learning commands	4.0
1.4 Consistency of terminology	3.5
2. Screen layout	
2.1 General ease of reading layouts	3.5
2.2 Attractiveness of layouts	3.0
2.3 Avoidance of overcrowding	4.0
2.4 Clarity of presentation	3.5
3. Documentation	
3.1 Clarity of information	3.5
3.2 Adequacy of instructions for operating the system	3.0
3.3 Consistency of terminology and layout in all sections	3.5
3.4 Consistency of terminology used in instruction sheet and the system	3.5

Overall mean = 3.5

Rating Scale: 1=Poor, 2=Fair, 3=Good, 4=Very Good, 5=Excellent

Chapter 5

The Method of the Study – Part II: Development of the Questionnaire, Sampling of Subjects, and the Research Method

Development of the questionnaire

Clinical reasoning in nursing has received increasing research attention in recent years. Influencing factors upon decision making in some critical care areas e.g. coronary care, intensive care (Baumann & Bourbonnais, 1981; Henry, 1991) have been widely studied. However the emergency care setting is an exception. The present study is the first of its kind in the local context. The researcher decided to design a self-administered type questionnaire to identify influencing factors that triage nurses would consider relevant in the triage process.

Formulation of the building blocks of the questionnaire

In addition to the personal experience of the researcher, together with information gathered from the literature search, the researcher had to solicit ideas and opinions from front line nurses. A discussion group was formed in order to gain further insights into the range of opinions and to identify possible potential influencing factors.

Five RNs from various AEDs were invited to form a discussion group. The group held meetings in the nursing laboratory of the University so that they could have a better meeting environment. The researcher led the meeting in a semi-structured way with the aim of consolidating wisdom and intelligence to formulate building blocks for the questionnaire. To encourage the free flow of ideas, the researcher stimulated brain storming amongst group members by asking them open-ended questions. During the meeting, the researcher discussed with the group members about potential factors that triage nurses would consider relevant in making triage decisions. The role of the researcher was to promote interaction and ensure that the discussion remained on the topic of interest.

Based on the information collected during the meeting, literature search, and personal experience, a number of influencing factors were drafted. A total of 35 factors under six subgroups namely 'factors related to the patient', 'factors related to physical structure of triage stations', 'factors related to triage nurses', 'factors related to the management aspect', 'factors related to the environment', and 'other factors' established. An open-ended question was set to let respondents suggest any other factors. The group members were consulted again to comment and confirm the content of the draft listing. Refinement of the listing was accomplished by removing some overlapping ideas and by rewording some ambiguous terms. The refined listing formed the backbone of the questionnaire.

Prototype questionnaire

The researcher used the above results to develop a prototype questionnaire. A five-point likert scale (1=strongly agree, 2=agree, 3= not sure, 4=disagree, and 5=strongly disagree) was employed in the questionnaire against each individual factor. Respondents were expected to indicate their levels of agreement to those listed factors.

Content validity of the questionnaire

In order to ensure that the measurement tool (questionnaire) and the items it contained were representative of the content domain the researcher intended to measure, a validation process was mandatory (LoBiondo-Wood & Haber, 1990, 1998; Portney & Watkins, 2000).

The prototype questionnaire was sent with a covering letter explaining the purposes of the study and an assessment form to a panel of three AED nurse specialists from three different hospitals for evaluation of content validity. The assessment form was specially designed to suit the particular purpose. A four-point rating scale ranging from 'very relevant', 'quite relevant', 'slightly relevant' to 'not relevant' was adopted. Raters were requested to grade each factor individually. Spaces were also provided on each line to let raters add open comments on individual factors. The expert panel returned the assessment forms in one week. Content validity index (CVI) was calculated and determined to be 'high' (0.81). Some of the factors were modified in wording as suggested by the panel. Generally speaking, the content validity of the prototype questionnaire was established.

Reliability of the questionnaire

Test-retest reliability assessment was carried out with an aim to establish that the instrument (questionnaire) was able to measure variables with consistency (Polit & Hungler, 1991; Portney & Watkins, 1993, 2000). The questionnaire was sent to ten nurses from both clinical and scholarly areas for reliability testing (see table 5.1). They were invited to answer the prototype questionnaire two times at a two weeks' interval. The Pearson product-moment coefficient of correlation was applied to assess the reliability of the instrument. It was accomplished by comparing both the pre-test and post-test data to check the level of consistency. The reliability of the questionnaire was established (r=0.75).

Table 5.1: Composition of the nurses participating in the reliability testing

Category	**Rank**	**No. of nurses**
Clinical nurse	Nursing officer	1
	Registered nurse	1
Scholarly nurse	Assistant professor in a local university	1
Learner nurse	Undergraduate nursing students (3rd year)	7
	Total	***10***

After establishment of reliability and validity and minor modification of some wording, a final draft of the questionnaire was compiled (Appendix 10). A total of 32 factors were retained under five sub-groups namely factors related to patients, factors related to the physical structure of triage stations, factors related to triage nurses, factors related to the management aspect, and other factors.

Sampling of subjects

In order to determine the sample size from a representative group of subjects, it is essential to identify the number of accessible population; the inclusion criteria; and an appropriate sampling method.

Accessible population

There are totally 15 AEDs under the management of the Hospital Authority in Hong Kong. It was estimated that a total of 560 Registered Nurses (RNs), to the best of the researcher's knowledge, was employed in the third quarter of 1999. They were hired under five different grades namely department operation manager, ward manager, nurse specialist, nursing officer and registered nurse (see Table 5.2). All of them have attained the same professional qualification – RN. The department operation manager and the ward manager perform administrative and managerial functions. The nurse specialist assumes professional responsibility, such as staff training, research, clinical audit, and quality management. The nursing officer and the registered nurse carry out their role as front line workers. It is the Hospital Authority's policy to assign RNs to perform triage duties in the AED. The focus of the present study was to investigate the triage decision making process, which were normally accomplished by frontline nurses. Thus only nursing officers and registered nurses were included in this study.

Table 5.2: Total number of RNs employed in the 15 AEDs in Hong Kong

No.	Employment rank	Professional qualification	Quantity
1	Department operation manager	RN	15
2	Ward manager	RN	14
3	Nurse specialist	RN	8
4	Nursing officer	RN	108
5	Registered nurse	RN	390
		Total	***535***

One AED did not participate in the study. The RNs of that particular non-participating AED were considered to be inaccessible and therefore eliminated for the sampling procedure. Thus, the total number of accessible population was 520.

Inclusion criteria

In actual clinical practice, the triage duty would be normally accomplished by two grades of nurses (the nursing officer and the registered nurse). Considering the context of the study and to improve generalizability of the research results to the accessible population, only subjects meeting the following inclusion criteria would be selected.

1. They must be at the employment ranks of 'nursing officer' or 'registered nurse' at the time of sampling procedure and data collection; and
2. They must be currently working in one of the 14 participating AEDs at the time of sampling procedure and data collection.

Exclusion criteria

Nurses who participated in the discussion group for questionnaire development, the test-retest of the questionnaire, the usability testing of the CSPS, and the pilot study were excluded from the main study.

Sampling procedure

Probability sampling strategy using simple random sampling technique was adopted. The rationale for choosing the simple random sampling technique is described below:

1. It is more likely to result in a representative sample (LoBiondo-Wood & Haber, 1990, 1998; Portney and Watkins, 1993, 2000).
2. Randomization increases the internal and external validity of the study (Bailey, 1997).

3. As the researcher himself has been a senior nurse in the field of AED, random selection might eliminate the possibility of subconscious biases of the researcher.

Some have considered that simple random sampling is time consuming and labour intensive (LoBiondo-Wood & Haber, 1990, 1998). The task of achieving a comprehensive and accurate listing of the target population is considered to be difficult or even impossible. For the present study, the target population was relatively small (520 nurses). In addition, the researcher also gained assistance from the nurse managers of the participating AEDs, so that simple random sampling could be employed with fewer difficulties.

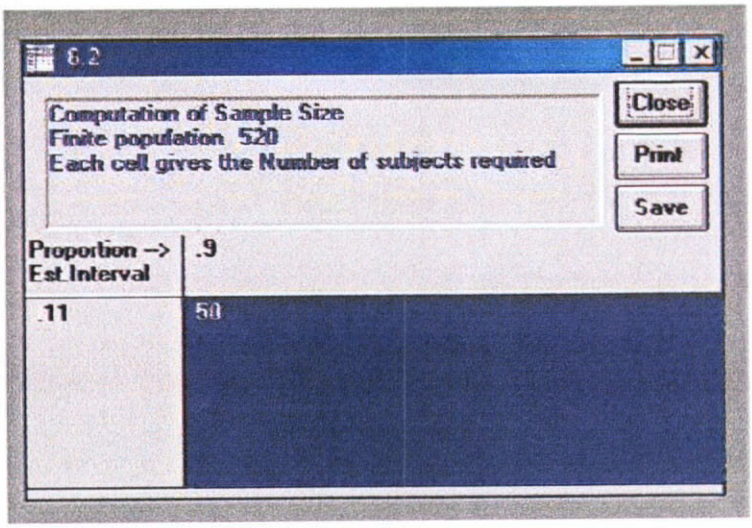
Determination of sample size

The sample size determination process was computed by using a computer software titled 'Sample Size 2.0'. Considering the size of accessible population (520) and its power for data analysis, the sample size was determined to be 50. The estimation was accomplished based on the following assumptions –

1. Use of simple random sampling, non-replacement
2. 90% of the nurses exhibit some sort of clinical decision making
3. Confidence interval was 95%

Thus the estimated interval was 0.1 / 0.9 = 0.11 and the sample size was 50 (Figure 5.1).

Figure 5.1: Screen printout of the sampling procedure



On top of the sample size derived from computing, the researcher decided to select 10 extra subjects to safeguard having a sufficient number of subjects for data analysis. As a result, 60 subjects were randomly selected under the assistance of the nurse managers. Three subjects did not meet the inclusion criteria. The rest of them agreed to join the study voluntarily. However, by the time of data collection, one of the subjects was promoted to administrative grade and therefore rejected for data collection. After completing data collection, it was found that three subjects had not completely finished the questionnaire as required, so that they were finally rejected for data analysis. Thus the actual sample size for the main study was fifty-three (N=53).

The research method

After the sampling procedure, the selected subjects were informed of the date and time of data collection via their nursing managers. For the convenience of the subjects, the researcher visited the AED in person to collect data. The researcher, under the assistance of the nurse manager of the participating AED, would select a convenient date and period of time in order to meet the maximum number of subjects available in that particular AED. The process was described in this section under the sub-headings 'Modes of data collection', 'Research kit', 'Procedure', and 'Data analysis'.

Modes of data collection

As all the subjects were currently front-line nurses and the majority of them needed to work shift duties with irregular hours, it might not be possible to meet all the selected subjects in one particular AED in a single visit. Considering the special needs of the subjects, the researcher devised two modes of data collection procedure namely the 'On-AED data collection' and the 'On-campus data collection'. The former mode was the first choice in the light of the convenience of the subjects. If the subjects did not turn up in the On-AED mode, they were given an appointment to attend the On-campus mode data collection.

1. On-AED data collection

   The researcher met the subjects in their working place for data collection in the light of subjects' convenience. This effort reflected the researcher's courtesy and sincerity, which might in turn gain co-operation from the subjects. Data collection was conducted inside the conference room or seminar room available in the AED. It is a common physical structure that a multi-purpose room is reserved in the AED area for staff training activities. Such a facility is usually located independently from the noisy clinical area and equipped with teaching equipment. It is considered, to a certain extent, as comparable to a standard classroom. Thus it was a suitable venue for data collection.

2. On-campus data collection:

   If the subjects were not available during the scheduled on-AED sessions, they were contacted by telephone to arrange on-campus sessions. The data collection sessions were carried out inside the nursing laboratory of the university.

Research Kit

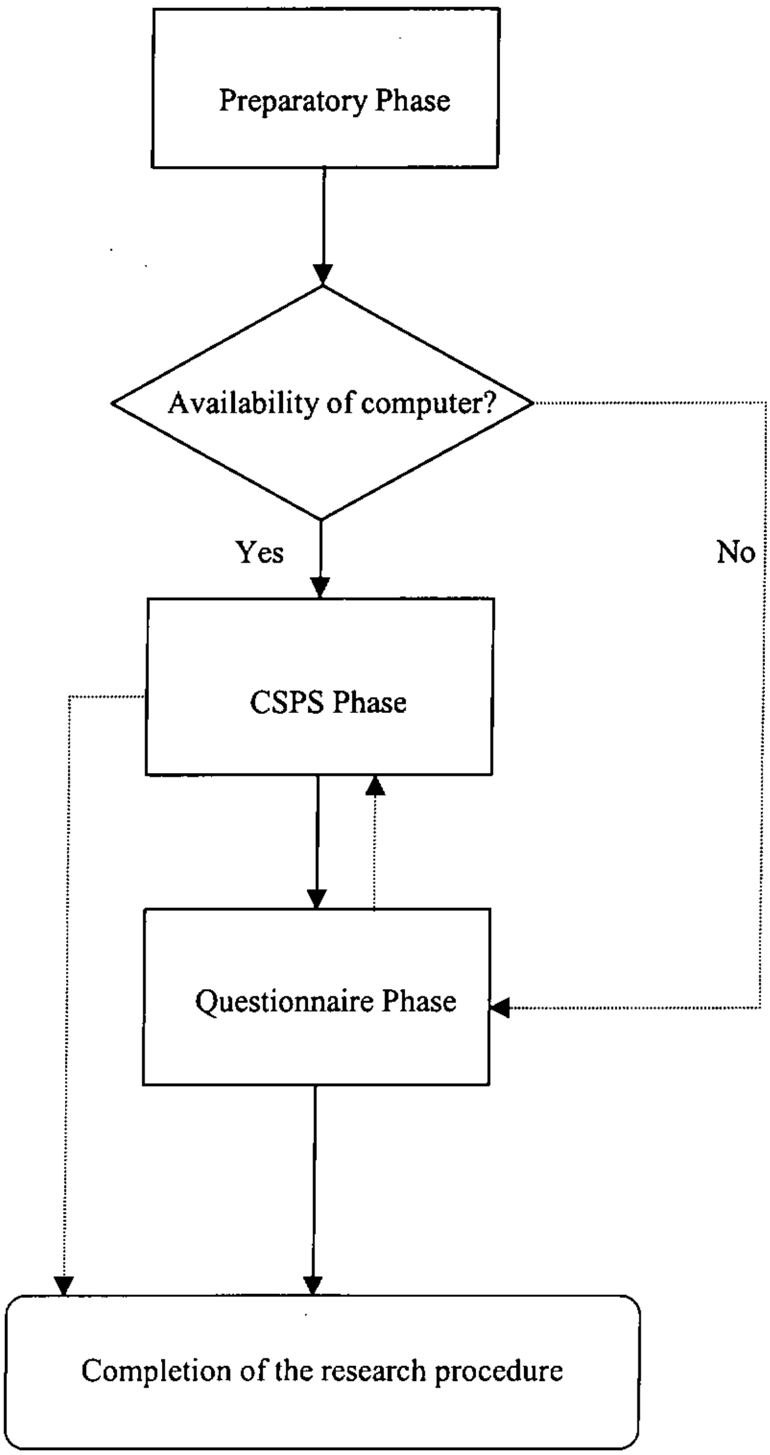
As the researcher needed to travel to different venues for data collection, a research kit was designed to facilitate smooth operation of the research procedure. The kit contained:

- one notebook computer with CSPS installed in the hard disc;
- two floppy discs containing the CSPS for back up purposes;
- one set of relevant documents: the subject listing with unique personal codes assigned, a manuscript for briefing and a flow chart illustrating the research procedure;
- one set of forms: a sufficient amount of consent forms, agreement forms (for keeping confidential the contents of the CSPS and the questionnaire), CSPS tracking forms and questionnaires; and
- miscellaneous items such as paper clips, mini staplers, two pencils and two black ball-pens, correction fluid, and rubber bands.

Procedure

The research procedure was identical at all On-AED and On-campus sessions. The procedure was divided into three phases, namely the preparatory phase, the CSPS phase and the questionnaire phase. A flow chart had been developed for explaining different phases of the research procedure (Figure 5.2).

Figure 5.2 Flow chart explaining the research procedure



1. Preparatory Phase

After welcoming conversation, the subjects were briefed about the purpose of the study and the task required during the whole research procedure. Each subject was informed of the personal code assigned by the researcher. It was because two sets of data, one from the CSPS and one from the questionnaire would be produced by each subject. A personal code was used to match the two sets of data. They were also reminded that the researcher would strictly follow the Personal Data (Privacy) Ordinance (Office of the Privacy Commissioner for Personal Data, Hong Kong, 1997). To ensure voluntary participation, the subjects were required to sign a consent form reflecting their willingness to participate in the study voluntarily. In order to achieve reliable results, the subjects were required to sign an agreement form reflecting their promise to keep confidential the contents of the CSPS and the questionnaire. The subjects were encouraged to raise queries to the researcher at any time during the research procedure but discussion amongst subjects was not allowed.

2. CSPS Phase

The CSPS phase began after completing the preparatory phase. Each subject was required individually to triage five simulated patients using the CSPS. Before commencement of CSPS, the researcher demonstrated how to use the CSPS and informed them of the rules of the game. After clarifying questions, the subjects were separated individually. One nurse would be assigned to perform CSPS while others were doing the questionnaire. To prevent long queues waiting for CSPS, the researcher managed to install the programme into another desktop computer, which was available inside the venue and compatible for running the CSPS, so that two nurses could attend the CSPS simultaneously and independently. The operating flow of the CSPS Phase is illustrated in detail below:

i) The researcher started the programme by clicking the activating icon;

ii) Welcoming statements appeared on the first page of display, the subject entered the personal code to a prompted area in the same page and pushed the key 'enter';

iii) The triage game started;

iv) Following the instructions on the screen, the subject could finish triage tasks for all the five simulated patient scenarios one by one in a unidirectional way, and page back function was intentionally removed;

v) The final page of the CSPS was a track record of the subject's performance, which produced the time used, the decision making process, and the triage category assigned for individual patient scenario;

vi) The researcher then would copy all the information from the final page and restart the programme for the next subject.

3. The Questionnaire Phase

The subjects were required to answer a questionnaire, which was designed to identify factors influencing the triage decision. It was a pencil-and-paper type self-administrated questionnaire consisting of totally 33 questions. The first 32 questions were distributed into five sub-groups reflecting different aspects of influencing factors. The answer column employed a 5 point *Likert* scale ranging from 'strongly agree', 'agree', 'not sure', 'disagree' to 'strongly disagree'. The last question was an open-ended question allowing the subject to suggest factors that should be considered but were not listed in the questionnaire. The personal code had to be recorded on the first page of the questionnaire. Again, they needed to complete it individually and no discussion amongst the subjects was allowed. No time limit was set for this part.

Data analysis

Several On-AED and On-campus sessions were conducted until all the subjects had completed the data collection process. A computer software SPSS 10.0 (Statistical Package for Social Studies, version 10.0) was employed to establish the database and to compute the descriptive and influential statistics.

Summary of this chapter

In summary, this chapter has illustrated the process of developing the questionnaire; the equipment required for collecting data; and the detail of the research procedure.

Chapter 6

The Pilot Study

Introduction

After completing all the preparatory work, a pilot study was conducted. The pilot testing not only gave the researcher actual experience with the research procedure but also helped him identify any unforeseeable problems with the research design. The research procedure was the same as that planned for the main study but sample size and sampling method varied.

Method

Convenience sampling

As a common practice, the sample size for a pilot study should be one-tenth of that for the main study. Convenience sampling technique was adopted because validity and reliability of the research instruments had been established. With reference to the number of subjects required for the main study, which was determined to be 50, five nurses (n=5) with similar inclusion criteria were invited personally to participate in the pilot study. In order to eliminate the possibility of contaminating the results of the main study, these five nurses were excluded from it.

Procedure of the pilot study

As in the main study, the researcher met the pilot subjects individually at a time and venue convenient to both parties and suitable for data collection.

1. Preparatory Phase

   After a brief introduction of the study, a unique personal code was assigned to each subject. They were required to sign written consent forms before commencement of the research procedure. Since the main study would be conducted in one to two months after the pilot study, the pilot subjects were also requested to sign an agreement form reflecting their commitment to keep the content of both scenarios and questionnaires confidential. They were reminded not to discuss any aspect of the study with their fellow colleagues, who might be selected to participate in the main study.

   By using a separate simplified version of CSPS, the researcher performed a CSPS demonstration to explain the whole operating procedure including the user log-in procedure and the triage decision making procedures. The subjects were encouraged to ask questions throughout the demonstration in order to clarify the tasks required.

2. CSPS Phase

Using the researcher's notebook computer, each subject was required to triage five simulated patient scenarios independently by going through the CSPS.

3. Questionnaire Phase

After CSPS, they needed to answer a pencil-and-paper type self-administered questionnaire, which was designed to identify influencing factors upon triage decision. The subjects were encouraged to clarify with the researcher any hesitation related to the research procedure during the course of data collection.

Results

The purpose of data analysis in a pilot study is to give the researcher an impression of the results which may be obtained in the main study (Christensen, 1991; Portney & Watkins, 2000). However, in view of the small sample size (n=5), only descriptive statistics were performed to analyze the pilot data.

Demographic Characteristic

Five ladies (three registered nurses and two nursing officers) participated in the pilot testing. Three of them belonged to the age group 26-30 years old, one was 31-35 years old, and another one was 36-40 years old. Four of them had been working in AED for 6-10 years while the junior one had less than two years of AED experience. Most of them (n=4) had received tertiary education and attained baccalaureate nursing degrees and one had received hospital based nursing diploma training. Again, the majority of them (n=4) had received no formal training on triage. Four out of the five subjects considered triage as a difficult duty in the AED.

Performance in the CSPS

There were totally 25 (5 subjects times 5 scenarios) decisions recorded. In comparison with the suggested category agreed by an expert panel consisting of three experienced AED nurses (one nurse specialist and two nursing officers), 52% (n=13) of the decisions were assigned a correct triage category by the pilot subjects. Ten decisions (40%) were over-triaged. That means this group of cases was given a priority higher than they deserved. Two (8%) cases were under-triaged and given a lower priority than they should obtain.

All the subjects were able to complete the whole procedure within 30 minutes. The time consumed in triaging each scenario is tabulated below (see Table 6.1). On average, the subjects were able to triage one patient in the CSPS in less than 50 seconds.

Table 6.1: Time (seconds) expended in triaging simulated patient scenarios (n=5)

Scenario	Mean time (sec.) used for triage scenario
Patient A	58.0 (SD=37.5)
Patient B	48.8 (SD=16.4)
Patient C	34.6 (SD=16.8)
Patient D	59.8 (SD=21.0)
Patient E	35.4 (SD=11.6)

Influencing factors

Seven out of the eight statements in the sub-group 'Factors related to the patient' were agreed to be influencing factors by all the subjects. Only the statement 'Absence of significant others' received disagreement from two subjects (see Table 6.2).

All the subjects agreed with all five statements in the sub-group 'Factors related to the physical structure of the triage station' (Table 6.2).

In the sub-group 'Factors related to the triage nurse', the subjects agreed eight out of the nine statements. The statement 'Emotional/psychological well-being' received four disagreements.

Subjects agreed with all three statements in 'Management/administrative aspect'.

For other factors, four out of the seven statements namely 'long queue waiting for triage', 'presence of other patients nearby', 'presence of other accompanying personnel e.g. police, reporters, journalists', and 'challenges from co-workers (doctors/nurses) on your triage decision' received more than one disagreement. Since influential statistics were not computed for such a small subject group (n=5), the relationship between variables cannot be established.

Table 6.2: Results of the questionnaire for identifying influencing factors (n=5)

Sub-groups	No. of statements provided	No. of agreed statements (≤1 disagreement)	No. of disagreed statements (≥ 2 disagreements)
Patient factors	8	7	1
Physical structure factors	5	5	0
Nurse factors	9	8	1
Management factors	3	3	0
Other factors	7	3	4
Total	**32**	**26**	**6**

Implications for the main study

In order to achieve as realistic a research environment as possible, the researcher decided to visit the subjects at their working places for data collection. As a result, the researcher had to bring along all the necessary items e.g. a notebook computer, and various forms and questionnaires to the AED. He also needed to repeat the briefing and introductory contents at the beginning of each session. To maintain consistency and to ensure smooth operation of the main study, it was decided that a number of adjunctive tools should be developed.

As a result, a work-instruction sheet containing steps of the research procedure and contents for briefing and introduction (Appendix 11), and a checklist for the research kit (Appendix12) were developed.

A minor technical problem in one of the scenarios was detected during the pilot study. The record of one of the triage actions in the scenario could not be transferred to the final page of the CSPS. The problem was solved immediately, and fortunately the data collected had not been affected.

Conclusion

The researcher had to visit various AEDs with bulky equipment and documents for data collection, and this gave the researcher some inconvenience. Fortunately with the support and co-operation from the nurse managers and the subjects of the participating AED, the pilot study was challenging but uneventful. This indeed gave the researcher actual experience in putting the research procedure into practice. To conclude, the research procedure for the main study was feasible and usable for both the researcher and the subjects. The minor problem of the CSPS was fixed immediately. No amendment of the questionnaire was made.

Chapter 7

Results of the Main Study

The researcher selected sixty subjects using simple random selection technique as described in Chapter 5. However, seven of the selected subjects were excluded due to various reasons such as inclusion criteria not met, and incomplete questionnaires. Thus the number of usable data retained for statistical procedures was fifty-three (N=53). Data collection for the main study was conducted from September to December 1999. With the co-operation of the subjects and co-ordination of the nurse managers, data collection could be accomplished uneventfully. The results were presented under four headings namely characteristics of the subjects, CSPS performance, influencing factors, and influential statistics.

Characteristics of the subjects

Age-group and sex distributions

Thirty-eight (71.7%) out of the 53 subjects were female. This corresponds to the female dominant nature of the profession. In age group distribution, three nurses (5.7%) were in the age group of 21-25 years old. Twenty-one (39.6%) subjects were in the age group of 26-30 years old while another 24 (45.3%) subjects were in the group of 31-35 years old. Three subjects

(5.7%) were in the group of 36-40 years old and two (3.8%) in the 41-45 years old group.

Employment rank

In terms of employment ranking, 44 (83.0%) subjects were employed at 'registered nurse' grade while nine (17.0%) were at 'nursing officer' grade. The relationship between rank and age group is shown in Table 7.1. Most of the Nursing Officers (n=7) were in the age group 31-35 years old.

Table 7.1: Relationship between rank and age group

Age group	Number of Registered Nurses	Number of Nursing Officers
21-25	3	0
26-30	21	0
31-35	17	7
36-40	2	1
41-45	1	1
Total	**44 (83.0%)**	**9 (17.0%)**

Years of experience

More than half (n=35, 66.1%) of the subjects possessed less than five years of experience in the AED. Comparing to Cioffi's study conducted in 1998, this group of subjects was considered to be relatively junior in the field of emergency nursing. It was also noted that some (n=11, 20.8%) of those so called 'junior' AED nurses in fact possessed more than five years of total clinical exposure. Five of them have more than ten years of total clinical experience but with only recent 3-5 years practising in the AED. They were in fact, senior nurses but junior to the AED (Table 7.2).

Table 7.2: Relationship between AED experience and total experience

AED experience (yrs.)	Total years of clinical experience <1	1-2	3-5	6-10	>10	Total
<1	2	0	0	0	0	**2 (3.8%)**
1-2	0	7	1	1	0	**9 (17.0%)**
3-5	0	0	13	6	5	**24 (45.3%)**
6-10	0	0	0	11	6	**17 (32.1%)**
>10	0	0	0	0	1	**1 (1.9%)**

Education level

According to education level, twenty-nine (54.7%) subjects were Bachelor degree holders and three (5.7%) subjects had reached Masters level education. The rest of the subjects (n=21, 39.6%) reported having only basic hospital-based nursing diploma qualification (Table 7.3). It was noted that more than half of the subjects in both employment ranks (59.1% of Registered Nurses and 66.7% of Nursing Offices) attained tertiary education.

Table 7.3: Rank and education level distribution

Rank	Basic RN training	Bachelor	Master
Registered nurse	18	23	3
Nursing officer	3	6	0
Total	21 (39.6%)	29 (54.7%)	3 (5.7%)

Training in relation to triage

A majority of subjects (n=36, 67.9%) reported that they had not attended training courses related to nursing triage in the AED (Table 7.4). Such a high figure revealed the necessity to revise the existing strategy on promotion of formal training on triage.

Table 7.4: Rank and triage training distribution

Rank	Triage training attended	No triage training attended
Registered nurse	14	30
Nursing officer	3	6
Total	17 (32.1%)	36 (67.9%)

Triage is the most difficult job compared with other nursing duties in the AED

Forty (75.5%) subjects (including the 'strongly agree' and the 'agree' groups) agreed that triage was the most difficult job compared with other nursing duties in the AED (Table 7.5). Further analysis revealed that most of them (n=30) possessed less than five years of AED experience (Table 7.6).

Table 7.5: Triage - the most difficult job

	N	%
Strongly agree	5	9.4
Agree	35	66.0
Not sure	2	3.8
Disagree	11	20.8
Strongly disagree	0	0

Table 7.6: Triage difficulty Vs AED experience

	Total years of AED experience					
	<1	1-2	3-5	6-10	>10	**Total**
Strongly agree	0	1	4	0	0	**5 (9.4%)**
Agree	2	7	16	10	0	**35 (66.0%)**
Not sure	0	0	2	0	0	**2 (3.8%)**
Disagree	0	1	2	7	1	**11 (20.8%)**
Strongly disagree	0	0	0	0	0	**0**

CSPS performance

The performance of the subjects in CSPS was analyzed in a way to:

- check the time used for CSPS;
- identify the pattern of triage decision making;
- recognize the correctness of the triage decision; and
- check the accuracy of triage decisions

Time used in CSPS

The overall mean time used to complete a scenario was 53.4 seconds. The mean time used for all five scenarios is tabulated below (see Table 7.7). However, time used was not considered a variable in the present study. It was because the application of simulated patient situations lacked a sense of real urgency. The findings could only be considered as a reference in assessing the pace in reaching decisions in the scenario session.

Table 7.7: Time (seconds) used for Individual Scenarios

Simulated Scenario	Mean (SD)	Fastest	Slowest	Range
A	46.4 (15.9)	16	86	70
B	54.9 (24.5)	24	148	124
C	55.0 (20.7)	22	110	88
D	60.6 (22.9)	15	135	120
E	50.1 (36.0)	17	270	253

Total mean is 53.4 seconds

Triage decision making pattern

In the CSPS, six common triage activities were provided in each scenario (see Figure 7.1) in order to monitor the subject's performance in decision pattern. The subject could select any combination of triage activities that were perceived to be appropriate and necessary for the particular scenario, by clicking appropriate buttons on the screen. They were totally free to decide 'when' to do 'what'. The only rule for selection was that the selection sequence should reflect their perceived order of importance for the particular scenario. There was no need to select all the triage activities, and the subject could make the triage decision even without selecting any single triage activities. After clicking the button, an interactive result would display immediately. Then the subject could proceed to make a triage decision when he or she believed that sufficient data was available to support the decision. A tabular description of the six triage activities and its interactive response is shown in the Figure 7.1.

Figure 7.1: Triage Activities provided in the CSPS and it's interactive response

No.	Triage activities	Types	Interactive response in the CSPS if that particular triage activity had been selected
1	Blood pressure	Vital signs (objective physiological parameters)	Reading of blood pressure will be shown if available on the original AED attendance record
2	Pulse rate		Reading of pulse rate per minute will be shown if available on the original AED attendance record
3	Respiratory rate		Reading of respiratory rate per minute will be shown if available on the original AED attendance record
4	Level of oxygen saturation of haemoglobins		Reading of oxygen saturation level will be shown if available on the original AED attendance record
5	Temperature		Reading of body temperature will be shown if available on the original AED attendance record
6	Ask for more information	Extra information (subjective expressions from the patient or one accompanying him/her)	Extra relevant information other than chief complaint will be shown if available on the original AED attendance record
7	Triage decision	Outcome of the triage decision making process, assignment of level of urgency	A feature of correctable multiple choice containing 5 options would be provided for the subject to determine the patient's level of urgency

The sequence of triage activity selection was interpreted as the decision pattern in the present study. There were six possible triage decision patterns expected in this study (see Table 7.8). However, the subjects had not applied the fifth pattern. The first four types of decision pattern occurred in all the scenarios. The 'immediate' pattern was identified only in scenarios C and D (n=6, 2.3%). The most common (46.4%) pattern of triage decision process was to collect physiological parameters (e.g. blood pressure, pulse rate etc.) followed by soliciting more information related to the concurrent health problem. In actual practice, extra information would be presented verbally or in written format (e.g. follow-up appointment sheets, self-recorded progress sheets) by the patient or accompany upon request raised by the triage nurse. The least occurred decision pattern was 'immediate', which constituted a very low percentage (2.3%).

Table 7.8: Triage decision patterns identified in the CSPS

No.	Decision patterns	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E	Total
1	VD	7 (13.2%)	7 (13.2%)	8 (15.1%)	5 (9.4%)	10 (18.9%)	37 (14.0%)
2	VID	31 (58.5%)	31 (58.5%)	18 (34.0%)	18 (34.0%)	25 (47.2%)	123 (46.4%)
3	VIVD	3 (5.7%)	3 (5.7%)	13 (24.5%)	18 (34.0%)	10 (18.9%)	47 (17.7%)
4	IVD	12 (22.6%)	12 (22.6%)	9 (17.0%)	11 (20.8%)	8 (15.1%)	52 (19.6%)
5	ID	0	0	0	0	0	0
6	Immediate	0	0	5 (9.4%)	1 (1.9%)	0	6 (2.3%)

VD: only vital signs had been selected before the triage decision was made

VI D: vital signs had been selected and followed by asking for more information before the triage decision was made

VIVD: vital signs had been selected, followed by asking for more information, and then returning to select vital signs again before the triage decision was made

IVD: extra information had been sought and followed by vital signs before the triage decision was made

ID: only extra information had been considered before decision was made

Immediate: the triage decision was made immediately without selecting any triage activity

Correctness of the triage decision

The researcher of the present study adopted a new approach to assess the correctness of the subject's decision. It was in fact a benchmarking procedure. The subject's triage decision was compared with the standard decision, which was comprised by three senior AED nurses. Traditionally, triage accuracy has been judged using the physician's diagnosis as a benchmark to see whether a proper category has been assigned to patients (Rausch & Rund, 1981; Wong, Tseng & Lee, 1994; Leprohon & Patel, 1995). Such a traditional method was deemed unfair in judging the performance of the triage nurse. Very often, the nurse-patient interaction at the triage station has been short, usually less than five minutes (Raush & Rund, 1981; Emergency Nurses Association, 1997) and complete physical examination might not be possible. However, the physician undoubtedly was able to perform thorough history taking, physical assessment and laboratory studies before reaching the diagnosis. Thus the researcher believed that the nurse-to-nurse approach was more appropriate than the nurse-to-diagnosis benchmarking.

Speaking overall, the correctness of triage decisions was satisfactory (see Table 7.9). Only slightly more than half (55.1%) of the triage decisions could be judged as 'correct' while 34.7% were 'over triage'. The 'under triage' rate was 10.2%, which is consistent with the findings of another local study (Wong, Tseng & Lee, 1994). However, there is no universally acceptable level for over or under triage available, which made comparison to the 'gold standard' impossible.

Table 7.9: Triage scenario performance

Scenario	Correct decision	Incorrect Decision	
		Over	Under
A	19 (35.8%)	34 (64.2%)	0
B	19 (35.8%)	34 (64.2%)	0
C	48 (90.6%)	0	5 (9.4%)
D	29 (54.7%)	17 (32.1%)	7 (3.2%)
E	31 (58.5%)	7 (13.2%)	15 (28.3%)
Total	**146 (55.1%)**	**92 (34.7%)**	**27 (10.2%)**

Incorrect triage decisions should be further evaluated in order to make the story complete. In actual clinical practice, the overly triaged patients would receive a doctor's assessment earlier than they should. It seemed to be doing no harm to them but only contributed to lengthen the queue of priority patients. For the under triaged patients, they received doctor consultation and treatment later than they deserved. This was obviously unfavourable to them or even a source of medical-legal problems (Estrada, 1981). As a result, the frequency of occurrence of the over triage could be included in the correct decision group, which would make the results dramatically different. Table 7.10 showed the adjusted percentage of correctness of triage decision for the five scenarios used in the CSPS.

Table 7.10: Adjusted percentage of correctness of triage decision

Scenario	Adjusted correct triage	Under triage
A	53 (100%)	0
B	53 (100%)	0
C	48 (90.6%)	5 (9.4%)
D	46 (96.8%)	7 (3.2%)
E	38 (71.7%)	15 (28.3%)
Total	**248 (89.8%)**	**27 (10.2%)**

Accuracy of triage decision

The correctness of triage decisions has been further assessed by a Mean Accuracy Score (MAS) method. All the decisions made for the five scenarios were scored using a 0 to 2 system. A correct decision would score 2. A decision of over-triage would score 1, and zero for a decision of under-triage. Then a MAS could be computed for each subject by adopting the mean accuracy score achieved from the five scenarios. Such a MAS would reflect the subject's accuracy in the light of decision quality, the higher the MAS towards 2, the higher the triage accuracy.

The overall MAS for all the subjects was 1.5 (SD=0.3) with a range from 0.4 to 2.0. Only 46.3% (n=24) of the subjects obtained a MAS higher than 1.5. For the performance of individual subjects, there was an increasing trend that subject from the older age group, and the longer total year of experience group tended to achieve a higher MAS (Table 7.11 and 7.12). However, no significant group difference could be identified in these two and all other demographic variables.

Table 7.11: Mean Accuracy Score distribution in age group

Age group	Mean Accuracy Score
21-25	1.2
26-30	1.4
31-35	1.5
36-40	1.5
41-45	1.8

Table 7.12: Mean Accuracy Score distribution in total year of experience

Total years of experience	Mean Accuracy Score
<1	1.3
1-2	1.2
3-5	1.4
6-10	1.6
>10	1.6

Influencing Factors

One of the objectives of the present study was to identify influencing factors upon triage. The researcher managed to establish a total of 32 factors with reference to literature and suggestions from the discussion group consisting of five emergency nurses. All the factors were distributed into five sub-groups namely factors related to patients, factors related to the physical structure of the triage station, factors related to triage nurses, factors related to the management/administrative aspect, and other factors. The number of factors in each sub-group was not evenly distributed (Table 7.13). There were eight factors for the patient factor sub-group, five factors for the physical structure sub-group, nine factors for the nurse factor sub-group, three factors for the management sub-group, and seven factors for 'the other' factors sub-group. The factors in the first four sub-groups were grouped intentionally to reflect four different aspects of consideration. Therefore, the results of individual factors will not present and discuss separately. They will be considered on a cluster basis.

On the contrary, the last sub-group 'other factors' contained seven individual factors representing different aspects of consideration. The results of all these seven factors will be presented and discussed individually.

Table 7.13: SGMS for the four sub-groups of influencing factors

Factor sub-groups	Number of factors	SGMS (SD)	Range	Mode (%)
Factors related to patients	8	2.1 (0.4)	1.9	2.0 (15.0%)
Factors related to the physical structure of triage stations	5	1.9 (0.6)	2.6	2.0 (30.0%)
Factors related to triage nurses	9	1.8 (0.4)	1.8	1.6 (13.2%)
Factors related to the management/administrative aspects	3	1.7 (0.5)	3.0	2.0 (28.3%)

Sub-group Mean Score (SGMS)

SGMS was devised to calculate the subject's level of agreement to influencing factors. The subjects would gain basic scores for their answers to individual factors ranging from 1 to 5 representing a descending order of degree regarding agreement. For the basic scores, 'strongly agree' scored 1, 'agree' scored 2, 'not sure' scored 3, 'disagree' scored 4, and 'strongly disagree' scored 5.

The SGMS was the mean score of all the basic scores gained from individual factors within an identical sub-group (i.e., total scores divided by number of factors per subject in the same sub-group). However, the concept of SGMS could not be applied to the last sub-group 'other factors' because of the uniqueness of the individual factor. Only a basic score for individual factors was computed. As a result, there would be four SGMSs for each subject. Under the same logic of the basic scores, the result of the SGMS could be interpreted as the degree of agreement in that particular sub-group as a whole. The same scale and interpretation for basic scores were applicable to understand the SGMS (i.e., 'strongly agree' scored 1, 'agree' scored 2, 'not sure' scored 3, 'disagree' scored 4, and 'strongly disagree' scored 5).

Factors related to patients

There were eight factors under this sub-group. The overall SGMS was 2.1 (SD=0.4). It was interpreted that the attitude of most of the subjects rests on the 'agree' side with a little deviation towards 'not sure'. That means the subject group supported the factors within this sub-group. Individual SGMS attained ranged from 1 (n=1, 1.9%) to 2.9 (n=1, 1.9%). The level of agreement for individual factors was tabulated below (Table 7.14).

Table 7.14: Factors related to patients

	Factors related to patients	**SA**	**A**	**NS**	**D**	**SD**
1.1	Complexity of illness/injury of the patient	33 (62.3%)	20 (37.7%)	0	0	0
1.2	Level of discomfort of the patient	15 (28.3%)	36 (67.9%)	2 (3.8%)	0	0
1.3	Communication ability of the patient	8 (15.1%)	21 (39.6%)	13 (24.5%)	11 (20.8%)	0
1.4	Behaviour of the patient	4 (7.5%)	33 (62.3%)	9 (17.0%)	7 (13.2%)	0
1.5	Amount of information available	9 (17.0%)	33 (62.3%)	6 (11.3%)	5 (9.4%)	0
1.6	Absence of significant others	4 (7.5%)	8 (15.1%)	15 (28.3%)	17 (32.1%)	9 (17.0%)
1.7	Altered mental status	32 (60.4%)	20 (37.7%)	1 (1.9%)	0	0
1.8	Motive of the patient attending AED e.g., extend sick leave period etc.	10 (18.9%)	25 (47.2%)	11 (20.8%)	7 (13.2%)	0

SA = strongly agree, A = agree, NS = not sure, D = disagree, SD = strongly disagree

Factors related to the physical structure of triage station

There were five factors under this sub-group. The overall SGMS was 1.9 (SD=0.6) resting between 'strongly agree' and 'agree'. Such a score level reflected that most of the subjects supported the factors in this sub-group to a great extent. Individual SGMS attained a range from 1.0 (n=7, 13.2%) to 3.6 (n=1, 1.9%). The level of agreement for individual factors is tabulated below (Table 7.15).

Table 7.15: Factors related to the physical structure of triage station

	Factors related to the physical structure of triage stations	**SA**	**A**	**NS**	**D**	**SD**
2.1	Location of the triage station - able to view the main entrance of the AED department	20 (37.7%)	26 (49.1%)	5 (9.4%)	2 (3.8%)	0
2.2	Convenient placement of various utilities in triage station e.g., strappings, bandages	15 (28.3%)	27 (50.9%)	7 (13.2%)	4 (7.5%)	0
2.3	Sufficient working space at triage station	14 (26.4%)	32 (60.4%)	2 (3.8%)	4 (7.5%)	1 (1.9%)
2.4	Types of equipment available e.g. BP machines, electronic thermometers	21 (39.6%)	29 (54.7%)	1 (1.9%)	1 (1.9%)	1 (1.9%)
2.5	Physical layout of the station that can provide privacy to patients	14 (26.4%)	35 (66.0%)	2 (3.8%)	2 (3.8%)	0

SA = strongly agree, A = agree, NS = not sure, D = disagree, SD = strongly disagree

Factors related to triage nurses

Nine factors were assigned under this sub-group. The overall SGMS was 1.8 (SD=0.4) i.e., between 'strongly agree' and 'agree'. The factors within this sub-group gained a high degree of support from the subjects. Individual SGMS attained a range from 1.0 (n=1, 1.9%) to 2.8 (n=1, 1.9%). The level of agreement for individual factors is tabulated below (Table 7.16).

Table 7.16: Factors related to triage nurses

	Factors related to Triage Nurses	SA	A	NS	D	SD
3.1	Clinical experience	40 (75.5%)	13 (24.5%)	0	0	0
3.2	Knowledge of disease, conditions, syndromes	36 (67.9%)	17 (32.1%)	0	0	0
3.3	Documentation/writing technique	10 (18.9%)	34 (64.2%)	8 (15.1%)	1 (1.9%)	0
3.4	Communication skill/ability	16 (30.2%)	32 (60.4%)	4 (7.5%)	1 (1.9%)	0
3.5	Physical well-being	5 (9.4%)	32 (60.4%)	11 (20.8%)	4 (7.5%)	1 (1.9%)
3.6	Emotional/Psychological well-being	10 (18.9%)	23 (43.4%)	14 (26.4%)	5 (9.4%)	1 (1.9%)
3.7	Past experience in handling patients with similar problem	19 (35.8%)	28 (52.8%)	5 (9.4%)	1 (1.9%)	0
3.8	Confidence	23 (43.4%)	26 (49.1%)	4 (7.5%)	0	0
3.9	Knowledge and skills in performing health assessment	24 (45.3%)	28 (52.8%)	1 (1.9%)	0	0

SA = strongly agree, A = agree, NS = not sure, D = disagree, SD = strongly disagree

Factors related to management/administrative aspect

There were three factors under this sub-group. The overall SGMS was 1.7 (SD=0.5), which stands very near the mid-point of 'strongly agree' to ' agree'. Inididual SGMS attained ranged from 1.0 (n=8, 15.0%) to 4.0 (n=1, 1.9%). The level of agreement for individual factors is tabulated below (Table 7.17).

Table 7.17: Factors related to the management/administrative aspect

	Factors related to the management/administrative aspect	**SA**	**A**	**NS**	**D**	**SD**
4.1	Availability of extra man power at triage station when in need	24 (45.3%)	23 (43.4%)	4 (7.5%)	0	2 (3.8%)
4.2	Availability of senior or experienced colleagues for secondary opinion	12 (22.6%)	40 (75.5%)	0	0	1 (1.9%)
4.3	Departmental protocols/guidelines/ policy	27 (50.9%)	23 (43.4%)	2 (3.8%)	1 (1.9%)	0

SA = strongly agree, A = agree, NS = not sure, D = disagree, SD = strongly disagree

Other factors

There were seven factors listed in this subgroup. Unlike the previous four sub-groups, factors within this sub-group carried diversified focus of concern thus SGMS was considered inappropriate. Descriptive statistics analyzing the degree of agreement (see Table 7.18) and mean score (Table 7.19) to individual factors were tabulated below. The mean score ranged from 2.0 to 3.2. Four of the individual factors namely 'information available before arrival of patients' (2.0, SD=0.8), 'many patients queue up waiting for triage' (2.4, SD=1.0), 'physical comfort of the environment' (2.2, SD=0.8), and 'challenges from co-workers on your triage decision' (2.4, SD=0.9) gained a mean score less than 2.5. A mean score below 2.5 reflected the subjects' support for that particular individual factor because of its inclination towards the 'agree' side.

However the other three factors namely 'behaviour/attitude of accompanying person' (mean=3.1, SD=1), 'presence of other patients nearby' (mean=3.2, SD=1.1) and 'presence of other accompanying personnel e.g. police, reporters, journalists' (2.9, SD=1.0) gained a mean score higher than 2.5. The attitude of the subjects in these three factors was 'not sure' with a slight inclination towards the 'disagree' side. Thus these three factors could be considered as unimportant influencing factors.

Table 7.18: Degree of agreement to individual factors of the sub-group 'other factors'

Other factors	SA	A	NS	D	SD
Information available before arrival of patients	12 (22.6%)	30 (56.6%)	8 (15.1%)	2 (3.8%)	1 (1.9%)
Many patients queue up waiting for triage	7 (13.2%)	30 (56.6%)	7 (13.2%)	8 (15.1%)	1 (1.9%)
Behaviour/attitude of accompanying persons/friends/ relatives etc.	3 (5.7%)	14 (26.4%)	13 (24.5%)	22 (41.5%)	1 (1.9%)
Presence of other patients nearby	4 (7.5%)	9 (17.0%)	14 (26.4%)	23 (43.4%)	3 (5.7%)
Presence of other accompanying personnel e.g. police, reporters, journalists	3 (5.7%)	18 (34.0%)	11 (20.8%)	21 (39.6%)	0
Physical comfort of the environment e.g. lighting, ventilation, noise control	8 (15.1%)	33 (62.3%)	8 (15.1%)	4 (7.5%)	0
Challenges from co-workers (doctors/nurses) on your triage decision	6 (11.3%)	27 (50.9%)	11 (20.8%)	9 (17.0%)	0

SA = strongly agree, A = agree, NS = not sure, D = disagree, SD = strongly disagree

Table 7.19 Mean scores of individual items of the sub-group 'other factors'

Other factors	mean	SD	Range	Mode (%)
Information available before arrival of patients	2.0	0.8	4.0	2.0 (56.6%)
Many patients queue up waiting for triage	2.4	1.0	4.0	2.0 (56.6%)
Behaviour/attitude of accompanying persons/friends/ relatives etc.	3.1	1.0	4.0	4.0 (41.5%)
Presence of other patients nearby	3.2	1.1	4.0	4.0 (43.4%)
Presence of other accompanying personnel e.g. police, reporters, journalists	2.9	1.0	3.0	4.0 (39.6%)
Physical comfort of the environment e.g. lighting, ventilation, noise control	2.2	0.8	3.0	2.0 (62.3%)
Challenges from co-workers (doctors/nurses) on your triage decision	2.4	0.9	3.0	2.0 (50.9%)

Influential statistics

The use of the two diverse statistical procedures was due to diversity of group numbers contained in different variables, e.g. two groups for the variable 'gender', and more than two groups for the variable 'age group'. Non-parametric tests using Kruskal-Wallis and Man-WhitneyU test were adopted to assess the group differences between SGMSs as well as other factors with demography. After non-parametric test statistics, applying oneway ANOVA aiming to locate the exact location of the differences further assessed the group differences.

Significant findings

1. Sub-group Mean Scores (SGMS)

The effect of demographic variables against various SGMS was tabulated (Table 7.20). Under the SGMS of the 'factors related to physical structure of triage station', statistical significance was identified in the 'rank' (Mann-Whitney U 112.0, $p<0.05$). The mean difference of the SGMS of this sub-group between the nursing officers and the registered nurses in this study was 0.5, which was significantly ($p<0.05$) different. The notion was supported by the descriptive statistics (Table 7.21) that the nursing officers possessed a different view compared with registered nurses as evidenced by a mean score of 2.3 (between 'agree' and 'not sure') for the former but 1.8 (between 'strongly agree' to 'agree') for the latter.

Table 7.20: Effect of demographic variables against SGMS

	Factors related to patients	Factors related to the physical structure of triage stations	Factors related to triage nurses	Factors related to management
Gender (MWU)	248.5	253.5	248.5	272.5
Age Group (Kruskal-Wallis)	3.7	4.8	1.1	2.8
Rank (MWU)	197.5	**112.0 ***	195.5	176.0
Total year post-grad. (Kruskal-Wallis)	0.4	3.7	2.9	1.5
Total AED experience (Kruskal-Wallis)	1.6	3.0	2.9	1.1
Triage training (MWU)	248.0	256.5	232.0	224.0
Educational level (Kruskal-Wallis)	2.6	0.9	2.1	5.5
Triage, the most difficult duty (Kruskal-Wallis)	3.2	1.2	4.5	7.4

MWU = Mann-Whitney U test * $p<0.05$

Table 7.21: Mean difference the SGMS of the 'factors related to the physical structure of triage station' under the 'rank'

Rank	Mean	Std. Deviation
Nursing officers (n=9)	2.3	0.7
Registered nurses (n=44)	1.8	0.6

Mean difference = 0.5

2. Other Factors

For the sub-group 'other factors', all the seven factors within this sub-group were analyzed against the demographic variables aiming at identifying group difference. Again, Kruskal-Wallis and Man-WhitneyU tests were used because of varied numbers of groups. Tables 7.22, 7.23 and 7.24 (in page 107-108) show the effect of the demographic variable against all the seven factors within the sub-group 'other factors'. Significant group difference ($p<0.05$) was identified in two independent variables namely 'age-group' (Kruskal-Wallis 13.6), and 'perception of triage as the most difficult job' (Kruskal-Wallis 14.5) under the factor 'challenges from co-workers (nurse/doctor) on your triage decision'.

Table 7.22: Effect of demographic variables against other factors

	Factor 5.1	Factor 5.2	Factor 5.3	Factor 5.4	Factor 5.5	Factor 5.6	Factor 5.7
Gender (MWU)	272.0	270.0	236.0	279.5	251.5	253.5	243.0
Age Group (Kruskal-Wallis)	2.8	2.6	1.0	3.4	1.1	4.4	13.6*
Rank (MWU)	170.0	156.0	153.0	184.0	177.5	195.5	117.0
Total year post-grad. (Kruskal-Wallis)	2.3	2.7	2.6	1.2	3.2	1.6	8.8
Total AED experience (Kruskal-Wallis)	1.8	2.3	1.5	1.0	2.2	1.5	10.3
Triage training (MWU)	289.5	296.5	284.5	234.5	265.0	278.0	229.5
Educational level (Kruskal-Wallis)	3.1	0.3	0.9	0.2	3.5	0.1	1.8
Triage, the most difficult duty (Kruskal-Wallis)	2.6	3.8	7.9	1.2	4.4	4.3	14.5*

*p<0.05

MWU Mann-Whitney U test

Factor 5.1 Information available before arrival of patients

Factor 5.2 Many patients queue up waiting for triage

Factor 5.3 Behaviour/attitude of accompanying persons / friends / relatives etc.

Factor 5.4 Presence of other patients nearby

Factor 5.5 Presence of other accompanying personnel e.g. police, reporters, journalists

Factor 5.6 Physical comfort of the environment e.g. lighting, ventilation, and noise control

Factor 5.7 Challenges from co-workers (doctors/nurses) on your triage decision

Table 7.23: Mean score of age group under the factor 'challenges from co-workers (nurse/doctor) on your triage decision'

Age group	Mean score	Standard deviation (SD)
21-25 (n=3)	2.0	0
26-30 (n=21)	2.0	0.7
31-35 (n=24)	2.7	0.9
36-40 (n=3)	4.0	0
41-45 (n=2)	2.5	0.7
All groups (N=53)	2.43	0.9

Table 7.24: Table for oneway analysis of variance: Effect of age group on the factor 'challenges from co-workers (nurse/doctor) on your triage decision'

Source of variance	**Df**	**Sum of squares**	**Mean squares**	**F ratio**	***p***
Between groups	4	13.19	3.30	5.30	0.001
Within groups	48	29.83	0.62		
Total	52	43.02			

However, ANOVA did not show exactly which two groups were different, thus further analysis using Tukey's honestly significant difference (HSD) test was employed. Table 7.25 illustrates that the mean score on the factor 'challenges from co-workers (nurse/doctor) on your triage decision' was significantly different between the mature group (age 36-40) and the two relatively younger groups (21-25, and 26-30). The mean difference between the age group 36-40 and 21-25 was –2.0. The mean difference between age group 36-40 and 26-30 was coincidentally the same as the previous one (–2.0). Thus dichotomous belief between the mature group and the relatively young groups occurred. The mature subjects did not consider 'challenges from co-workers' as an influencing factor while the younger subjects did.

Table 7.25: Table of mean differences between age groups using Tukey's Honestly Significant Difference (HSD) test α=0.05)

Age group		21-25	26-30	31-35	36-40	41-45
	Mean	2.0	2.0	2.7	4.0	2.5
21-25	2.0	-	0	-0.7	-2.0*	-0.5
26-30	2.0		-	-0.7	-2.0*	-0.5
31-35	2.7	-	-	-	-1.3	0.2
36-40	4.0	-	-	-	-	1.5

* significant findings

In order to determine whether the subjects with varied perception of triage as the most difficult duty led to varied degree of agreement to the factor 'challenges from co-workers', ANOVA was performed (see Tables 7.26 and 7.27). Significant difference ($p<0.05$) was identified between the 'agree' group and the 'disagree' group. The mean score for this factor under the 'agree' group was 2.1. The level of agreement to the factor 'challenges from co-workers' was 'agree' with slight inclination towards 'not sure' (Table 7.28). The 'disagree' group gained a mean score at 3.4 resting very near to the mid-point of 'not sure' and 'disagree', which reflected hesitation of the subjects towards this factor. The mean difference is -1.3 (Table 7.29).

Table 7.26: Table for oneway analysis of variance: Effect of perception of triage as the most difficult duty' on the factor challenges from co-workers (nurse/doctor) on your triage decision'

Source of variance	**Df**	**Sum of squares**	**Mean squares**	**F ratio**	***p***
Between groups	3	12.99	4.33	7.06	0.000
Within groups	49	30.03	0.61		
Total	**52**	**43.02**			

Table 7.27: Table of mean differences between agreement groups of 'perception of triage as the most difficult duty' using Tukey's Honestly Significant Difference (HSD) test (α=0.05)

Agreement group		Strongly agree	Agree	Not sure	Disagree
	Mean	2.6	2.1	2.0	3.4
Strongly agree	2.6	-	0.5	0.6	-0.8
Agree	2.1	-	-	0.1	-1.3*
Not sure	2.0	-	-	-	-1.36

* significant findings

Table 7.28: Mean score of perception of triage work as the most difficult duty under the factor 'challenges from co-workers (nurse/doctor) on your triage decision'

Agreement group	Mean score	Standard deviation (SD)
Strongly agree (n=5)	2.6	0.9
Agree (n=35)	2.1	0.7
Not sure (n=2)	2.0	1.4
Disagree (n=11)	3.4	0.8
All groups (N=53)	2.4	0.9

Table 7.29: Mean difference between the 'agree' and 'disagree' group under the factor 'challenges from co-workers (nurse/doctor) on your triage decision'

Agreement group	Mean score	Standard deviation (SD)
Agree	2.1	0.73
Disagree	3.4	0.8

Mean difference = -1.3

Chapter 8

Summary, Discussion, Conclusion and Recommendations

In the present chapter, the results of the main study are summarized within the context of the research questions and the system of emergency nursing in Hong Kong. The chapter also presents the researcher's concluding remarks based on the research findings. The discussion part presents the researcher's explanation of them, mainly in the light of the data but to a certain extent, also influenced by his personal experience in emergency nursing. Finally, some recommendations for future study are made.

Summary of the findings

The primary focus of this research was on clinical decision making of emergency nursing. The scope was limited to triage nurses' decision making during determination of patients' level of urgency. The pattern of decision making process was explored using a non-experimental descriptive design. The perception of influencing factors upon triage was also studied.

The findings of the main study are summarized in relation to the patterns of triage decision making, and influencing factors.

Triage decision making process

(1) Most of the triage decisions were reached with reference to vital signs first, and then followed by soliciting extra health related information.

(2) Only a very small portion of triage decisions was purely driven by physiological parameters (vital signs).

(3) Only minimal decisions were reached immediately upon patients' arrival without checking vital signs or gaining extra information.

(4) Time that required in triaging a scenario varied widely.

(5) The older age group and the more experienced group reported higher estimations of correctness regarding the triage category assigned than the younger, and the less experienced group.

Influencing factors

(1) The subjects perceived 'triage' as a difficult duty in the AED. Over 75% of subjects agreed with this idea.

(2) Patient factors, nurse factors, as well as management factors have been generally regarded as influencing factors without group differences identified.

(3) The nursing officers tended not to consider the physical structure of the triage station as influencing factors while the registered nurses would.

(4) Younger nurses tended to consider 'challenges from co-workers' as influencing factors while elder nurses carried the opposite view.

(5) Those who perceived triage as a difficult job would also consider 'challenges from co-workers' as influencing factors and vice versa.

Discussion

The findings of this study have shown (a) how the process of triage decision making varied amongst the sampled nurses, and (b) the potential association between the influencing factors and personal attributes of the subjects. Theses findings are further discussed in the following paragraphs.

Triage decision making process

Triage Time There was no pre-determined time limit for the subject to complete the patient scenarios during the CSPS session. However, time spent for each of the five scenarios would be recorded and displayed to the subject at the end of the CSPS session. Thompson and Sutton (1985) conducted a qualitative study to investigate the decision process of the coronary care nurses by using semi-structured interviews. By going through a paper-type case study, the subject was required to prioritize the nursing measures that he or she would carry out for that particular cardiac patient. In order to simulate the real clinical situation, they allowed only one minute for their subjects in completing the case study.

In reviewing the literature, standard time for triaging patients varies. Standard time taken to triage has not been addressed in both the local triage guidelines (Hospital Authority, 1999) and the Manchester Triage Group (1997). The Emergency Nurses Association (ENA) of the USA calls for a comprehensive triage to be completed within 2 to 5 minutes (ENA, 1997). Some emergency departments established a 2-minute triage time standard but this proved to be unrealistic (Travers, 1999).

Although time spent in the triage scenario has not been considered as a variable in the present study due to its limitation, the wide range of time used amongst the subjects attracted much attention from the researcher.

The overall mean time to complete a scenario was 53.4 seconds. However, the range of time used to complete the five scenarios differed widely. The narrowest range of time used was that for scenario A, which accounted for 70 seconds but the widest one (Scenario E) was 253 seconds. Scenario A was a relatively straightforward, stable and simple condition. A lady complained of suffering from mild stomachache shortly before attending the AED. Some subjects could make the triage decision in less than 20 seconds while the slowest subject used 86 seconds. The Scenario E was a slightly difficult case. An old lady suffered from a sudden onset of difficult breathing for two hours early in the morning. Again, the fastest subject could reach a triage decision in less than 20 seconds but the slowest one used more than 4 minutes. The findings reflected that some subjects needed a considerably longer time to reach a triage decision. This might be the result of knowledge deficit or slow reasoning in triaging patients. This could also be due to unfamiliarity in handling the notebook computer, which was used for the simulation testing.

In Travers' (1999) work, which was a time-motion study to identify the time required for triaging patients in a level I trauma centre in the USA, the author noted that only 22% of the triage assessments could achieve the pre-determined standard – two minutes. The range of triage time was 0.5-11.1 minutes. Travers concluded that triage nurses needed to spend a longer time with older patients. Elderly patients tended to have complex medical conditions and take multiple drugs, and the severity of their illness may be more difficult to assess in a short triage interaction. In another study (Zwicke, Bobzien & Wanger, 1982), the mean triage time identified was 5.85 minutes with a range from 0-15 minutes. The wide range of triage time persisted.

It was understood that comparison between the time spent in scenario playing in the present study with the reported actual triage time (Zwicke, Obzien & Wanger, 1982; Travers, 1999) would be less appropriate. In fact, a wide range of triage times persisted in both simulations and actual practice. It is expected that the time spent in triaging patients would vary according to the unique situation of individual patients and performance of individual nurses. Individualized care should be emphasized even in a state of making rapid decision during triage. The primary role of a nurse is to humanize the health care system which is often perceived as clinical and routine.

Decision patterns An attempt was made to explore the thought process of the subjects in determining the patient's level of urgency. The sequence of triage activity selection in each scenario was considered as the triage decision pattern, which reflected the subject's thought process. During the scenario testing, the subjects were reminded that the sequence of selection should be in the order of perceived importance.

Rausch and Rund (1981) studied the triage nurses' clinical judgement in estimating urgency and determining outcomes. They found that the degree of reliance on subjective data and objective data differed. The triage nurses relied more heavily on subjective data (chief complaint and history) in determining urgency in 'illness' and more heavily on objective data (general appearance and vital signs) in 'injury'.

However, the findings of the present study did not support their notions. It was noted that the thought processes in the majority (78.1%) of the triage decisions were led by objective data e.g. vital signs, and physical findings. Starting the triage process with 'vital signs' as the first triage activity evidenced this. Subjective information was initially sought only in 21.9% of the triage decisions. The reasons for vital sign 'dominated' triage decisions are examined. Firstly, most nurses believed that objective data such as blood pressure reading and, body temperature reading might indirectly reflect part of the patient's health status and make the triage nurse answerable to challenges if any. This may be due to emphasis on physiological parameters in the local triage guidelines (Hospital Authority, 1999). Some AEDs assumed blood pressure, pulse rate and regularity, respiratory rate, and temperature as the mandatory triage observations for all patients regardless of their chief complaints evidenced this. Unfortunately, mandatory triage observations may maintain the triage nurse at novice level because of repeated and robotic nursing activities. Secondly, most AEDs have used non-invasive blood pressure monitoring machines for blood pressure determination at the triage station for many years. Blood pressure reading could be obtained in about 60 seconds using such machines. The triage nurse might make use of this golden minute to think of the patient's chief complaint thoroughly. They need time to operate their thought processes. In short, checking vital signs can buy time for the nurse to reach triage decisions.

However, further statistical analysis of the data identified no significant difference between 'illness' and 'injury' in the present study. It could be generalized that the triage nurses in the local context tended to perform objective observation initially in triaging patients regardless of the nature (illness or injury) of health problems. Their thinking during the triage process was generally led by objective physiological data. To further explore the thinking process of the subjects, an attempt was made to assess the reasoning methods they held during triaging the simulated patients.

Reasoning method

The selection of triage activities during simulated triage scenarios revealed three major types of reasoning methods held by the subjects. The three reasoning methods were, namely 'from novice to expert', 'hypothetical-deductive method', and 'use of intuition'.

From novice to expert It was identified that, in addition to the defaulted information (chief complaint) for each scenario, 14% of the triage decisions were made after vitals signs were determined and, no attempt was made to search for extra information prior to triage decision other than vital signs. It seemed that, on top of the chief complaint, the decisions were reached based on purely physiological parameters. The reasoning method was considered to be simply to follow guidelines or pre-determined protocols. Nurses employing such a reasoning method are classically novices in the profession but may work fast (Benner, 1984). They may exercise less critical thinking, and policies and guidelines lead their thought processes. They can collect many data according to guidelines but may not be able to put all the data together and relate them to the chief complaint.

Hypothetical-deductive method The majority (83.7%) of triage decision processes was made with reference to extra information on top of the chief complaint and physiological data. The subjects involved had selected 'ask for more information' during triage simulations. Apart from objective data, the subjects also directed their attention to subjective information beyond the chief complaints. Such a selection reflected the subjects' intention of testing the hypotheses and then modifying them as a result of the outcome of the test (Groen & Patel, 1985). The subject may experience mental struggle when subjective data did not support the original belief. They may amend the level of urgency frequently and perhaps need more time to reach a triage decision. However, triage duties could be accomplished in a confident way for nurses holding this thinking approach.

Intuition Intuition is defined here as deciding without a rationale. Grossman (1999) emphasizes the importance of intuition in decisions made during triage. Such an unexplained 'sixth sense' is based on the in-depth understanding of diseases and injuries, years of experience, education, and clinical exposure to a wide range of patients. In the present study, only 2.3% of triage decisions were made immediately without soliciting extra subjective information or any sort of objective data. After knowing the chief complaint, the subject decided not to select any triage activities at all and the triage decision was reached right away. The subject's quick and decisive subjective belief and knowledge justified the decision. Such a decisive action could be interpreted as deciding without clear rationale. Huston and Marquis (1995) advocated that a combination of personal knowledge, experience, and intuition might be applied when a nurse came across a situation where decision making was mandatory. However, the spontaneous reaction of a triage nurse in identifying a very critical patient allowed limited or even no time to recall knowledge and experience. The knowledge and experience were in fact internalized to become intuition. Offredy (1998) maintained that the intuition method was applied at an unconscious or sub-conscious level. It seemed to be a less legitimate approach to clinical judgment or even viewed as supernatural inspiration. Benner and Tanner (1987) argued that intuitive judgment was what distinguished expert human judgment from decisions or computations that might be made by a beginner or by a machine. They believed that intuition was a legitimate and essential aspect of clinical judgement. Even though the intuition method occurred minimally in this study, such a reasoning method should be emphasized in clinical practice.

To conclude, triage nurses may employ a variety of cognitive processes in determining the patient's level of urgency. This ability is presented in a combination of knowledge and intuition gained from experience and training. Thus, the optimal functioning of the AED depends not only on departmental policies or guidelines but also the skills, experience and confidence of individual triage nurses.

Triage accuracy and performance in the CSPS

The overall performance in the triage scenario was fairly satisfactory. Only 55.1% of triage decisions agreeing with the expert panel's decision evidenced this. The rest of decisions were judged as either 'over triage' (34.7%) or 'under triage' (10.2%). When the performance was adjusted by grouping 'correct triage' and 'over triage' together, the result changed dramatically, bringing the accuracy rate to 89.8%.

The accuracy rate of 55.1% revealed the conservative attitude of the present AED nurses in making triage decisions. Most (73.9%) of the 'over triage' occurred in the first two scenarios (Scenario A and B), which were relatively minor medical conditions. The expert panel assigned the lowest priority (non-urgent) to these two cases. However, incidentally for both cases, 34 subjects (n=34, 64.2%) decided one level higher (semi-urgent) than the expert panel. The subjects generally held a conservative attitude and categorized patients with borderline severity between semi-urgent and non-urgent as the higher priority.

Over triage It was understandable that a person attending the AED normally perceived himself as an emergency case. He may become sensitive to learn that he was judged to be 'non-urgent' when presenting to the triage station. The person, under the recognition of the patient rights, may query the triage decision and raise a complaint to either the on-duty manager or the hospital administration. To avoid facing confrontation, some nurses may prefer such a 'safe practice' to assign higher priority to patients with trivial but borderline health complaints. However, the safe practice may not be good for the emergency services. Over triage will lengthen the queue of the priority patients, the care for the patients with real severity in the same category group will be inevitably delayed. Safe practice may also encourage misuse of the emergency services, so those patients with minor health problems will visit the AED inappropriately and continuously. It is a long lasting phenomenon. Inappropriate use of medical facility was documented more than 150 years ago (Liggin, 1993). Safe practice may further extend the problem into the new millenium.

It is a real challenge to triage nurses in handling borderline patients. In facing such conditions, it is advisable for the triage nurse to consider, if circumstances allow, to further examine the patient, to consult senior colleagues, or to start the triage process again. All these can help gain further and deeper information to support the decision. The practice of simply assigning borderline patients between semi-urgent and non-urgent a higher category should be modified.

Under triage The overall under triage rate is 10.2% in this study. The occurrence of under triage is loosely distributed in the three simulated patient scenarios (scenario C, D and E) with relatively severe health problems. The findings are consistent with that of Wong, Tseng and Lee's (1994) study. Their reported rate of inaccurate triage was 9.9% when comparing the triage category assigned by the triage nurse to the discharge diagnosis made by the physician. The present study introduced a new (nurse-directed) approach to determine the gold standard for benchmarking the accuracy of triage performance. The new approach achieved similar sensitivity in detecting under triage decision as evidenced by findings comparable to the other studies using a traditional (physician-directed) approach. Although there is no universally acceptable level of under triage rate, the potential adverse effect of under triage should not be neglected. The care and treatment delivery will be delayed due to inaccurate triage decisions. The under triage rate in this study (10.2%)

revealed a potential hazard that about one-tenth of AED patients will not benefit from the triage system. The figure is alarming to the management as well as the profession of emergency nursing. Further study is deemed necessary to determine the acceptable rate of triage (Schmidt, Atcheson, Federiuk, Mann, Pinney, Fuller & Colbry, 2000).

After discussing the triage decision process, the following section will focus on influencing factors.

Influencing factors

Influencing factors were explored by using a self-administered questionnaire in this study. The researcher provided 32 factors, which were grouped into five sub-groups namely factors related to patients, factors related to physical structure of triage stations, factors related to triage nurses, factors related to the management/administrative aspect, and other factors. Significant differences among groups in some of the factors were identified.

Factors related to patients There were eight factors under this sub-group. The subjects demonstrated consistent perception in this aspect. No group difference was identified. The subjects showed a high degree of agreement in this cluster of factors as evidenced by a Sub-group Mean Score (SGMS) 2.1 (SD=0.4). There is no doubt that the triage nurse would consider the patient as an important influencing factor simply because the patient is always the center and core of the nursing service. Under the concept of holistic care, the nurse should be flexible in delivering nursing care. In order to meet the concurrent health needs of the patient, the nurse should review or amend the care plan from time to time to ensure timely modification. It is understandable that any change in attributes (e.g. complexity of illness or injury, patient's behaviour) would influence the nurse's reaction, which is the 'triage decision' in this study.

In fact, the influencing power of patient factors extends to diagnostic reasoning in other acute care settings. Szaflarski (1997) maintained that, in most acute and critical care settings, the complexity of the disease affects diagnostic reasoning skills of the nurses who need to make rapid decisions on the basis of partial data, unconfirmed data or even contradictory data. Patient factors are considered to be important influencing factors for rapid decision making by both triage nurses and nurses working in the other critical care settings.

Factors related to the physical structure of triage stations There were five factors under this sub-group. The subjects highly agreed with the factors. The low score (1.9) in SGMS evidenced this. The level of agreement was laid between 'strongly agree' to 'agree' but with an inclination towards 'agree'. Statistical significance (Mann-Whitney U

112.0, $p<0.05$) was identified in the demographic variable 'rank' with this factor sub-group. The subjects of nursing officer rank showed relatively conservative attitudes towards this cluster of factors while the registered nurses demonstrated a high degree of agreement.

The physical layout of the triage area has been considered to be an important factor in developing a triage system (Estrada, 1981). It is suggested that the triage nurse should have ready access to all equipment necessary and essential for triage assessment. Tanner (1983) considered the circumstances and setting in which the clinical judgement was made to be contextual variables, which may not be immediately apparent in the presenting situation but may influence both the process and its outcome. Undoubtedly, a properly located and equipped triage station would enhance the efficiency of the triage nurse. Most of the triage stations, in the local context, are located away from the treatment area and with little manpower. The triage nurse needs to go to and fro frequently between the triage station and the treatment area in order to hand over patients' conditions as well as relevant documents to the receiving nurse inside the treatment area. The excessive distance between them demands considerable physical exertion and creates interruption and disturbance to the triage work. Absence of necessary equipment and insufficient working space obviously frustrates the triage nurse a lot. He or she may need to go here and there to look for equipment like a peak flow meter for checking the exhalation flow rate of a patient suffering from an asthmatic attack. The subjects from the registered nurse grade held a high degree of agreement with these notions. However, the subjects of nursing officer grade carried a significantly different view. They showed less agreement than the registered nurses. The findings demonstrated that the nursing officer might possess higher flexibility and toleration towards the possible unpleasant working environment, which may be due to their mature personality, self-confidence, knowledge, and experience. When decision making is independent from the influence of the physical structure of the triage station, the triage nurse may be able to work comfortably with less stress.

Factors related to nurses Nine influencing factors were included in this cluster. The subjects expressed a high degree of agreement. The SGMS scored 1.8 (SD=0.4), which represents the mid-point between 'strongly agree' and 'agree' with a slight inclination to the 'agree' side.

Again, no significant group difference was identified. All the subjects regardless of their rank, seniority, AED experience, age, and education level shared similar attitudes towards this factor sub-group. The findings are consistent with Sanford, Genrich and Nowotny's study in 1992. They identified no significant difference in clinical judgement abilities in newly hired baccalaureate and non-baccalaureate graduate nurses. Offredy (1995) maintained that the experiences of clinicians do not necessarily influence the diagnostic strategy to be applied in reaching a clinical decision. The level of education or experience a nurse possesses may not be an influence on his or her decision making.

On the contrary, some authors (Brillman, Doezema, Tandberg, Sklar, Davis, Simms & Skipper, 1996; Cioffi, 1998; Arslanian-Engoren, 2000) recognized the importance of experience and knowledge in clinical decision making. Leprohon and Patel (1995) found that senior nurse (more than 10 years of experience) more than doubled accuracy in triage decision making. They also identified that emergency nursing experience was associated with increased accuracy. The present study also identified an increasing trend in the triage accuracy rate in the subjects of the older age group, and the longer total experience group. However, no statistical significance could be delineated between these variables. It was also noted that some nurses (20.8%) with 3-5 years of AED experience in fact possessed more than ten years of clinical experience in total. This made the effect of years of experience a bit complexes. Some of the subjects were deployed to AED after years of experience working in other areas. Therefore attitudes towards influencing factors may be affected by their pre-AED experience.

Nurses with five or more years of clinical experience in the AED were classified as senior nurses by Cioffi (1998). They tended to take their past experiences and recency of similar patients into account in the assignment of triage urgency more than did less experienced nurses (Cioffi, 1998). The experienced nurse would achieve a triage decision rapidly with supportive evidence from her own past experience. For example, if a nurse knew that she or her colleague had recently under-triaged a patient with myocardial infarction, she would be much more alert and efficient in triaging patients with chest discomfort. The triage guidelines and protocols would be overridden.

Factors related to the management/administrative aspects This group contained three individual factors, which gained high agreement from the subjects. The SGMS which was 1.7 (SD=0.5) evidenced this. The score was close to the mid-point of 'strongly agree' and 'agree'. Again, no group significant difference was identified. The subjects' responses to this sub-group were quite consistent. They shared similar attitudes towards the management.

A high SGMS in this sub-group reflected the expectation from the frontline nurses. It is understandable that frontline nurses would like to have standard triage guidelines from the administration. They believe that triage guidelines can help them reach a sound decision and can make them answerable against challenges. However, triage guidelines and protocols issued by the administration may not necessarily lead to consistent triage decisions. Salk, Schrizer, Hubbel and Schwartz (1998) found that protocols did not improve consistency in decision making in telephone triage. On the other hand, the condition of the patient varied individually, no two patients are identical in every aspect even though they are assigned the same medical diagnosis. Thus it is difficult or even impossible to establish an exhaustive standard category book suggesting the category for all medical conditions. Triage guidelines from the authority can only serve the role as a reference, not a 'bible'. The front line nurses need to exercise their clinical sense and knowledge in triaging patients.

Other Factors The researcher assigned seven independent factors in this cluster. The factors could not be linked up conceptually due to their independence from each other. Thus SGMS was not applicable.

Challenges from co-workers and demographic variables

A significant difference among age groups was noted in the perception of the 'challenges from co-workers'. It was noted that the subjects of the two relatively younger age groups (21-25 and 26-30 years old) possessed dichotomous idea towards the perception of 'challenges from co-workers' with that of the more mature group (36-40 years old). The younger nurses tended to 'agree' with this factor while the older group did not. It is reasonable to assume that older nurses would have a more mature personality and self-confidence. They would also have more clinical exposure but not necessarily pertaining to AED. Challenges from co-workers on their triage decisions would not cause undue stress for them. Triage decisions could be reached in a confident and independent way. On the contrary, younger nurses would take peers' comments into account seriously or even personally, which may cause heavy pressure to them.

The findings also revealed a positive relationship between two variables namely the 'challenges from co-workers' and 'triage as the most difficult job'. Those subjects who agreed with the 'triage as the most difficult job' also agreed with 'challenge from co-workers' as an influencing factor. Using the same loop of thinking, those who did not agree with the variable 'difficult job' would not consider 'challenges form co-workers' as an influencing factor. The two variables are in fact interrelated and interlocked conceptually. This may be a matter of chain of event. The factor 'challenge from co-workers' itself can be a source of stress, which in turn makes the nurse think that triage work is 'difficult'. The perceived 'difficulty' would be a result of 'challenges from co-workers'.

Conclusion

From the findings of the present study, it can be concluded that the subjects considered triage as a difficult duty in the AED, especially the junior nurses. The findings also evidenced those environmental factors, interpersonal factors, and administrative factors, which would influence the triage process. All these make triage work a very difficult and complex task.

The findings also revealed that the traditional decision pattern in the local AED persisted. The triage decision was generally led by objective data such as blood pressure reading and extra subjective information on top of the chief complaint (the presenting health problem). The triage nurses believe that objective data is essential and important to support their triage decisions. They understand that substantial information like blood pressure readings can justify their views upon challenges, if any.

The demographic findings showed that nurses of the older age group, and higher rank could perform triage more independently. They would not be influenced by the working environment and co-workers' challenges on their triage decisions. They would exercise discretion based on clinical experience and knowledge in decision making. They would be able to handle the decision making process confidently, independently, and decisively. The physical environment and challenges from colleagues would not cause undue stress for them. In view of triage accuracy, nurses of the older age group, and longer total nursing experience tended to achieve a higher accuracy rate. Senior and experienced nurses may be able to triage patients in a more accurate, confident and comfortable way than younger nurses.

Contribution to the study of clinical decision making

This study has not only provided answers to the research questions, but also contributed to the research methodology and learning of clinical decisions making in nursing.

The researcher has constructed a set of computer-assisted patient scenario simulations using a programming software called 'Authorware'. The construction of these simulations can act as a blueprint, under the multimedia interactive features of the Authorware, to develop other patient scenarios to suit the context of research on decision making in other fields of nursing.

There are two major issues that researchers have to consider vigorously for using simulations in the decision study. The first issue relates to the sense of reality of the simulations. Many critics argue that as the simulations are not real, many extraneous variables cannot be 'installed' to the simulation. The second issue relates to the reliability of the procedures that are employed to record the process of decision making. It has been argued that some of these procedures would interrupt the subjects during the decision making process such as the 'thinking aloud' technique. Cioffi (1998) reported that the mean percentage of perceived comfort in using thinking aloud technique in a decision study was 67.5%, with discomfort raging from 28-35%. Those data recorded are subjected to challenge on their reliabilities. To address the issues, the researcher of the present study constructed a set of Computer-assisted Simulated Patient Scenarios (CSPS) in the Authorware environment. The contents of the CSPS were derived from real medical records from a local AED. The time taken to finish each scenario and the process of decision making could be recorded automatically and instantly with a special feature of the Authorware. Thus the sense of urgency has been 'installed' with an aim to enhance the sense of reality. With the recording function of Authorware, the subjects' decision process can be recorded and reviewed after accomplishment of all the scenarios without interrupting the subject. The researcher was able to view the track record of individual's decision process by the end of the simulation. The subjects were enabled to make decisions in an undisturbed environment.

Computer-assisted simulated scenarios, apart from applying to decision research, can also be used as a means for learning decision making. Thiele, Holloway, Murphy, Pendarvis and Stucky (1991) maintained that decision making was a learnable skill that should be deliberately and systematically taught using a variety of approaches. A local university used computer-drive manikins (some may call this a 'robot') to teach nurse learners in decision making in the care of the critically ill patient. Such a sophisticated approach was considered ethically sound. The critical conditions could be made reproducible as much as desired without harming a patient. However, the robot approach was expensive, space consuming and labour intensive in terms of technical support. The approach adopted by the present researcher was relatively simple and is affordable for most learning institutes. By using a notebook or desktop computer in addition to the software, one may design any sort of medical condition with multimedia presentation. Cost-effective learning could be assumed.

The present study established a new approach to determine the accuracy rate of triage decision. Traditionally, the assessment of accuracy was a benchmarking procedure comparing the triage category assigned by the triage nurse with the physician's diagnosis or category. There were critiques against such a comparison procedure because the two parties (the triage nurse and the physician) might be processing inconsistent information to justify their decisions. The triage decision was usually made shortly after, or even immediately, when the patient arrived at the AED. The physician category or diagnosis was made after completing physical examinations and laboratory studies if necessary.

Considering the potential validity dispute against the nurse-to-physician approach, the researcher of the present study introduced a new approach. A panel of three expert AED nurses was invited to achieve the gold standard for individual scenarios. They were required to triage the scenarios in the same way the subjects did. Thus the nurse panel and the subjects were exposed to identical information for decision making. The present study identified a comparable under triage rate in comparing with the other study using the classical nurse-to-physician approach. Thus the nurse-to-nurse approach was equally sensitive in detecting inaccurate triage decisions. The researcher contributed to the body of knowledge on triage decision a new and valid approach in determining the accuracy rate of triage decisions.

Recommendations for future research directions

Further study of clinical decision making by triage nurses will be extremely important in justifying the 'expanded roles' which nursing will fill in the future.

Further research in identifying relationships between the reasoning methods and the time spent in triaging a patient may enable the development of training aiming at enhancing the capability of the clinician to think in an effective way. The accuracy rate of triage should also be studied in assessing reasoning methods. Research addressing to these two elements (time and accuracy) may provide valuable information in formulating a cost-effective triage model.

To assess 'time spent', randomized sequence of occurrence of individual scenarios is recommended. It is believed that the subjects would be more familiar with the scenario after finishing the first one or two cases. Randomized occurrence of scenarios may help balance such a 'maturation factor' that would probably become a potential bias.

Future study on triage process should also address other variables such as use of past triage experience, recency of exposure to similar scenarios and reasoning methods.

The newly introduced nurse-directed approach in determining the accuracy rate of triage decisions should be applied in future studies in either the local context or overseas entity to check its validity and legitimacy.

Further study to investigate both the magnitude and the contributing factors of under triage is deemed necessary. A 10% under triage rate indicates 10% of patients will not benefit from the triage system. It is an alarming figure for the management as well as for the profession of emergency nursing.

As 'under triage' may become a source of potential threat to patients, it is necessary for the emergency medical services to determine an acceptable rate of under triage. A collaborative multidisciplinary study comprising emergency nurses, doctors and advocators for patients' right would be the method of choice. Only a standard and acceptable rate could be applied to objectively measure the effectiveness of a triage system.

Based on the findings of the present study, the researcher would like to recommend the following strategies to improve the emergency nursing services with particular attention to triage:

1. To assign senior nurses to perform triage duty;
2. To establish a triage review committee involving nurses from all grades;
3. To conduct continuous monitoring and auditing on the performance of triage by that committee;
4. To include elements of clinical decision making, critical thinking and reasoning methods in triage training; and
5. To formulate a standard curriculum for all the AEDs on triage training. Nurses should not practice triage before successful completion of that particular training course.

The decision making process can also be applied in other teaching-learning nursing situation in acute care settings such as intensive care, coronary care, and sorting of victims in mass casualty incidents.

In summary, this study has not only illustrated the decision process of triage nurses but also addressed some hidden issues in the actual practice. These issues require further investigation to establish building blocks for constructing possible solutions. The ultimate aim would be to enable emergency nurses in the local context to provide effective and efficient care to their patients and to enhance professional value in emergency nursing services.

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Appendix 1

Hong Kong Polytechnic University
Department of Nursing and Health Sciences

Dr. x
Hospital Chief Executive
xxx Hospital

Date:

Dear Dr. x

Re: Request for Permission to Conduct Research

My name is Ping Fat LAU. I am a Master of Philosophy student under the supervision of Prof. Ida Martinson and Dr. Thomas KS WONG in the Hong Kong Polytechnic University. I am planning a research work entitled '*Decision Making of Triage Nurses in Determination of Patients' Level of Urgency in Accident & Emergency Departments in Hong Kong*'. The Ethical Committee of the University had approved this study.

As your hospital is one of the major treatment centre in Hong Kong, I would like to conduct the research in your hospital. Not more than ten nurses will be selected to participate a simulated triage scenario and answer a questionnaire either in the University or venues convenient to the subjects. The primary purpose of this study is to investigate the process and pattern of clinical decision making of emergency nurses upon triaging patients. Findings will provide valuable information to develop a standard model for triage nurses which in turn enhancing quality of triage work.

A copy of the summary of research protocol and the consent forms for this study are enclosed for your reference. Should I be able to provide additional information, please do not hesitate to contact me by any means convenient to you.

Thank you very much and looking forward to hearing from you.

Yours sincerely

Ping Fat LAU, RN BSN
Nursing and Health Sciences Department
The Hong Kong Polytechnic University, Hong Kong

Phone: 2595 Fax: 28984941 e-mail:pflau@

Appendix/accessletter

Appendix 2

The Hong Kong Polytechnic University
Department of Nursing and Health Sciences

INFORMED CONSENT

I am a candidate of Master of Philosophy at the Hong Kong Polytechnic University, Department of Nursing and Health Sciences. This study is my master dissertation.

This is a study on clinical decision making of triage nurses working in the Accident and Emergency Departments. Your participation in this study will contribute to the understanding of this vital process underpinning the delivery of emergency nursing care.

Your participation is completely voluntary. Your decision to participate or not to participate will not prejudice your future relation with your employer in any way. If you decide to participate, you are free to discontinue participation at any time without prejudice. Any information obtained in connection with this study that can be identified with you will remain confidential and will be disclosed only with your permission. In order to facilitate data analysis, a personal code which is only known to the researcher will be assigned to you during the study. In any written reports or publications, only aggregate data will be presented. No one will be identified or identifiable. Your performance in this study will not be reported to your supervisor.

You will be asked to perform triage work independently (using a set of personal computer) which may last not more than 30 minutes, by following the instructions outlined in the Instruction Sheet. Then you will be asked to respond to a questionnaire, which is, designed to obtain your personal particulars and the influencing factors which affect triage decision. It takes about 15 minutes to complete this questionnaire. Triage performance and all responses will remain absolutely confidential; no harm will occur to you as a result of participation to this study.

By signing below, you show your voluntary participation in this study. Your signature also indicates that you have read the information provided above and have decided to participate. You may withdraw at any time without prejudice after signing this form. A copy of this form will be offered to you.

If you have questions about the study, I shall be happy to answer them and if you wish to discuss any aspect of the study, or see a summary of the results, please feel free to reach me at phone no. 2814 or by electronic mail (pflau@).

Signature of Researcher Ping-Fat LAU, RN BSc(Hons)Nursing	Signature of Participant
Date	Name of Participant

Appendix/consent

Appendix 3

The Hong Kong Polytechnic University
Department of Nursing and Health Sciences

AGREEMENT

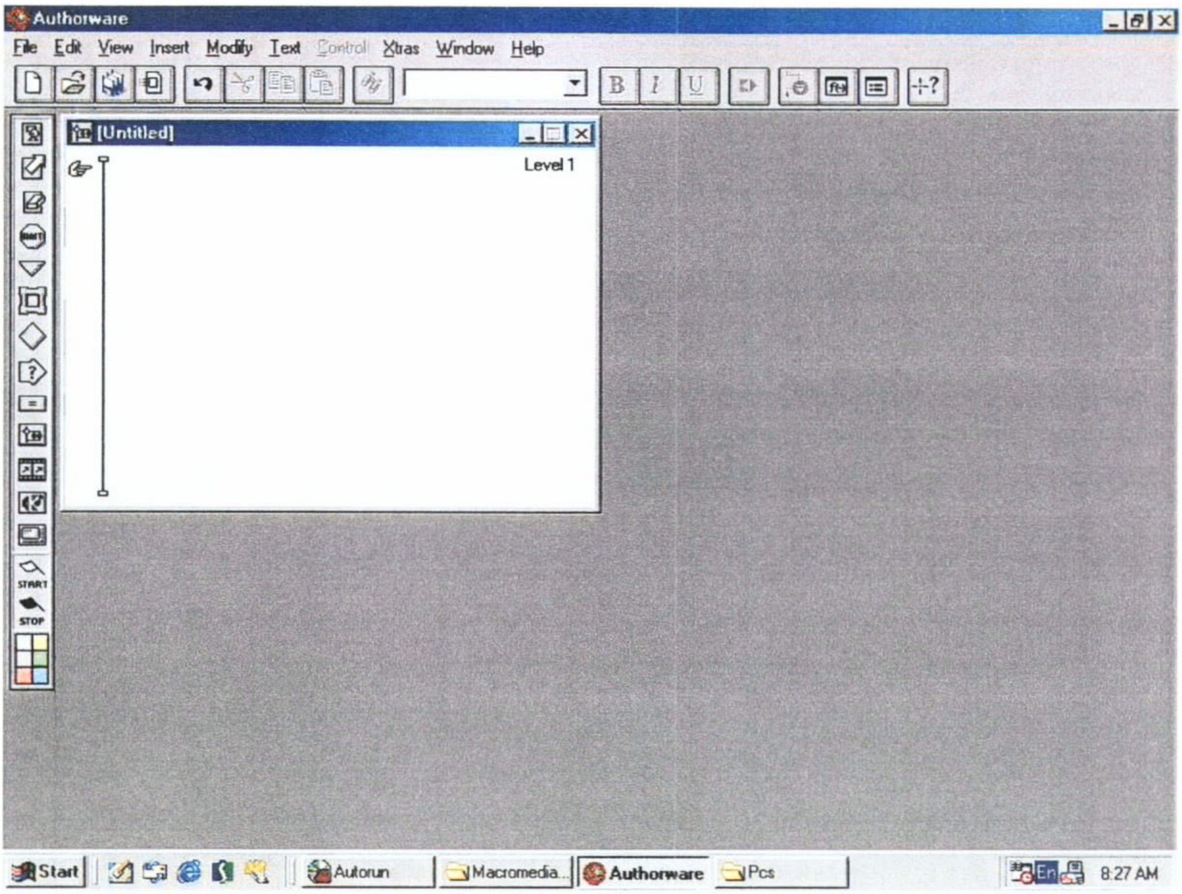
I understand that it is in the best interest of scientific inquiry not to discuss with my fellow colleagues any aspect of the experiment in which I am participating. I fully realize that such discussion may lead to possible distortions of the data and may in effect cause the entire experiment to be abandoned. I agree to keep the experiment confidential.

________________________ ____________________
Signature Date

____
Name

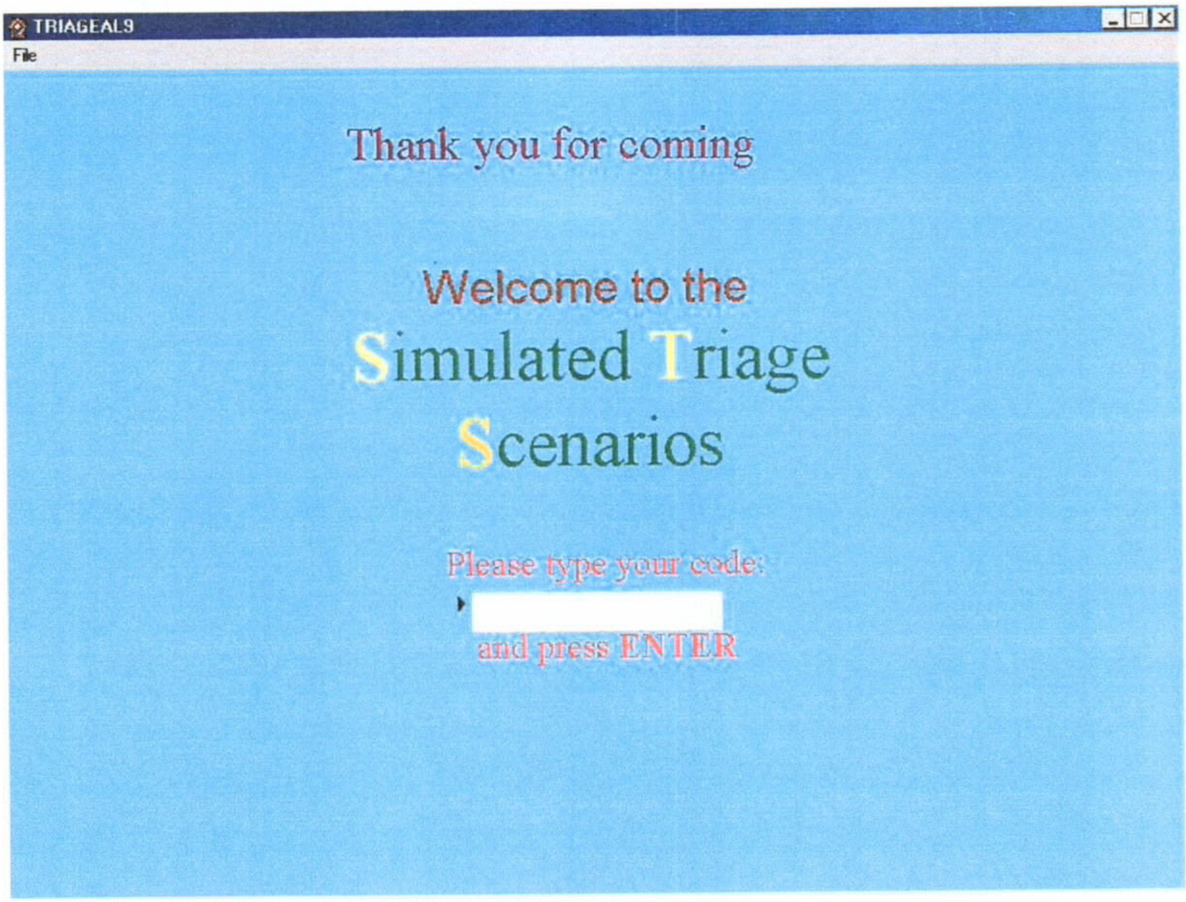
Appendix 4

Design window of the Authorware



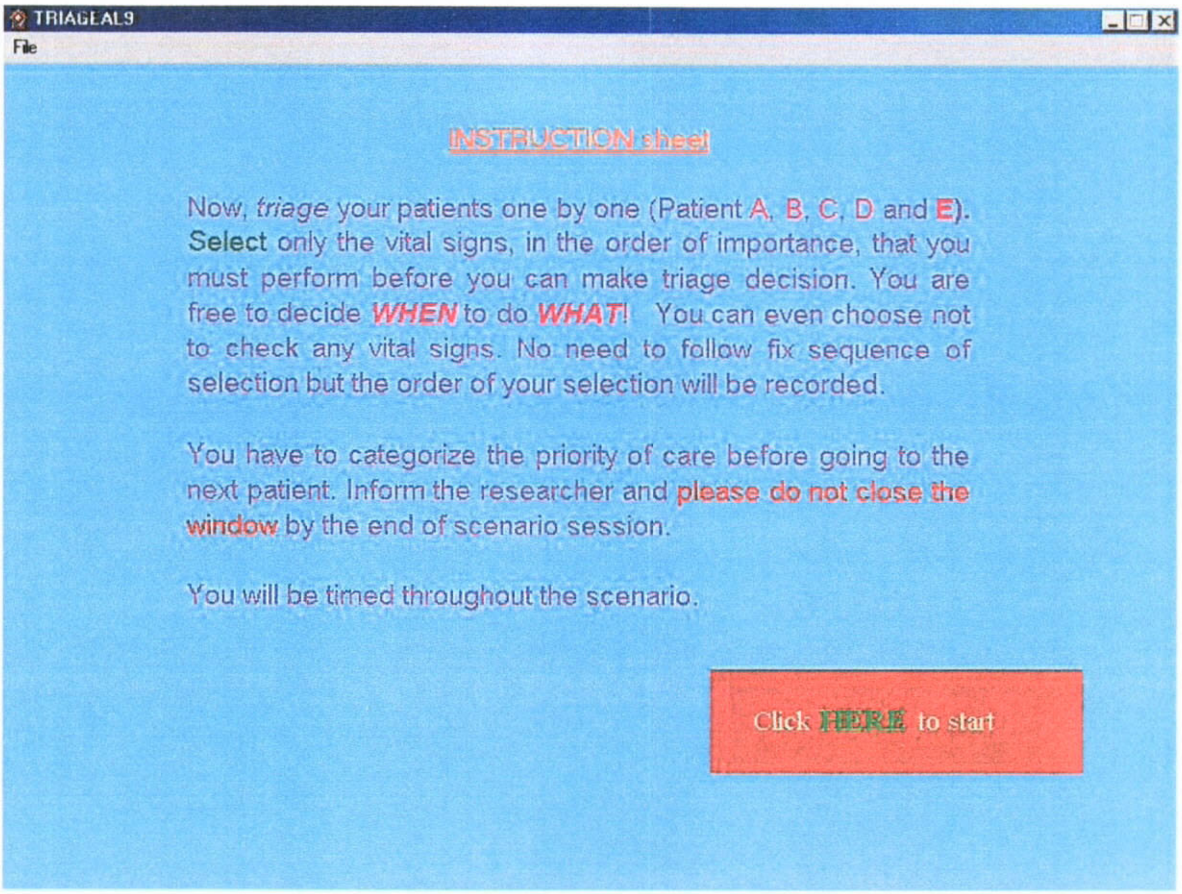
Appendix 5

Scenario screen display (the login page)



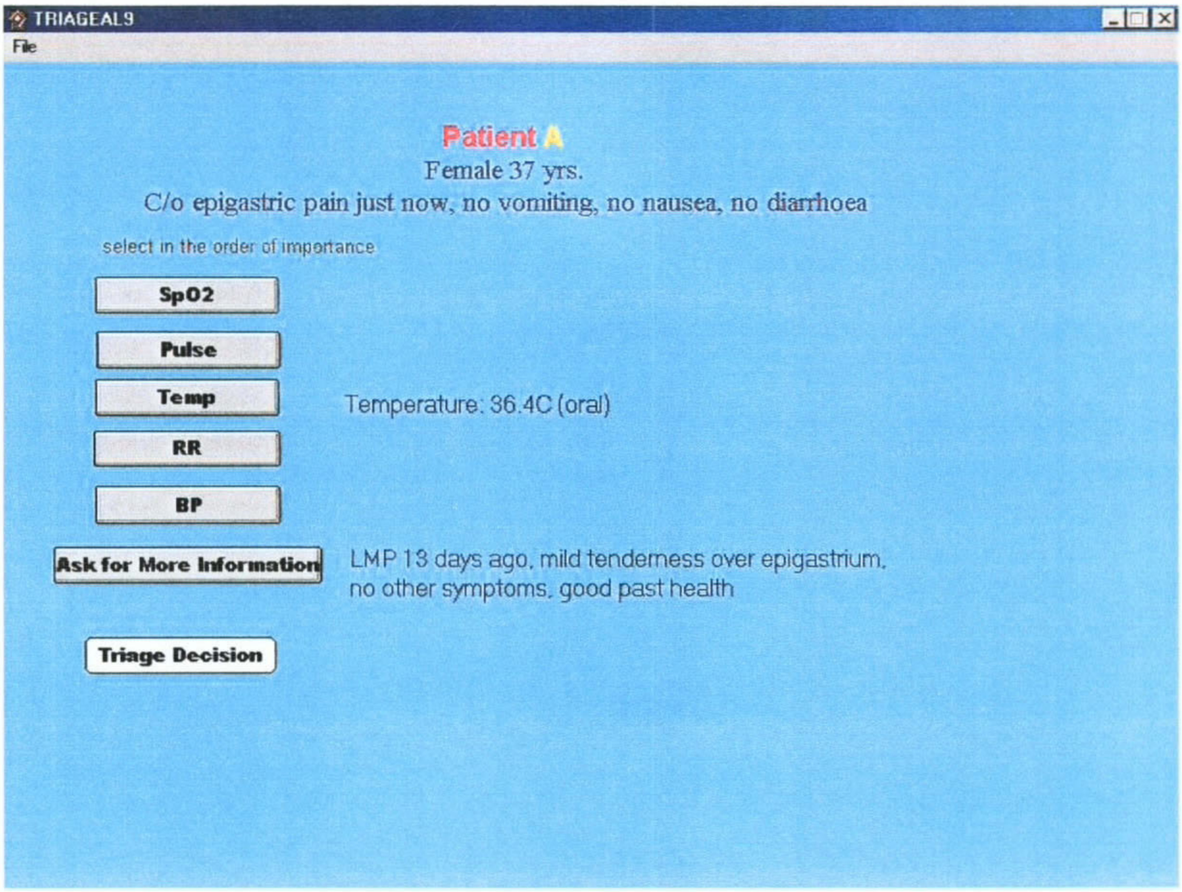
Appendix 6

Scenario screen display (the introduction page)



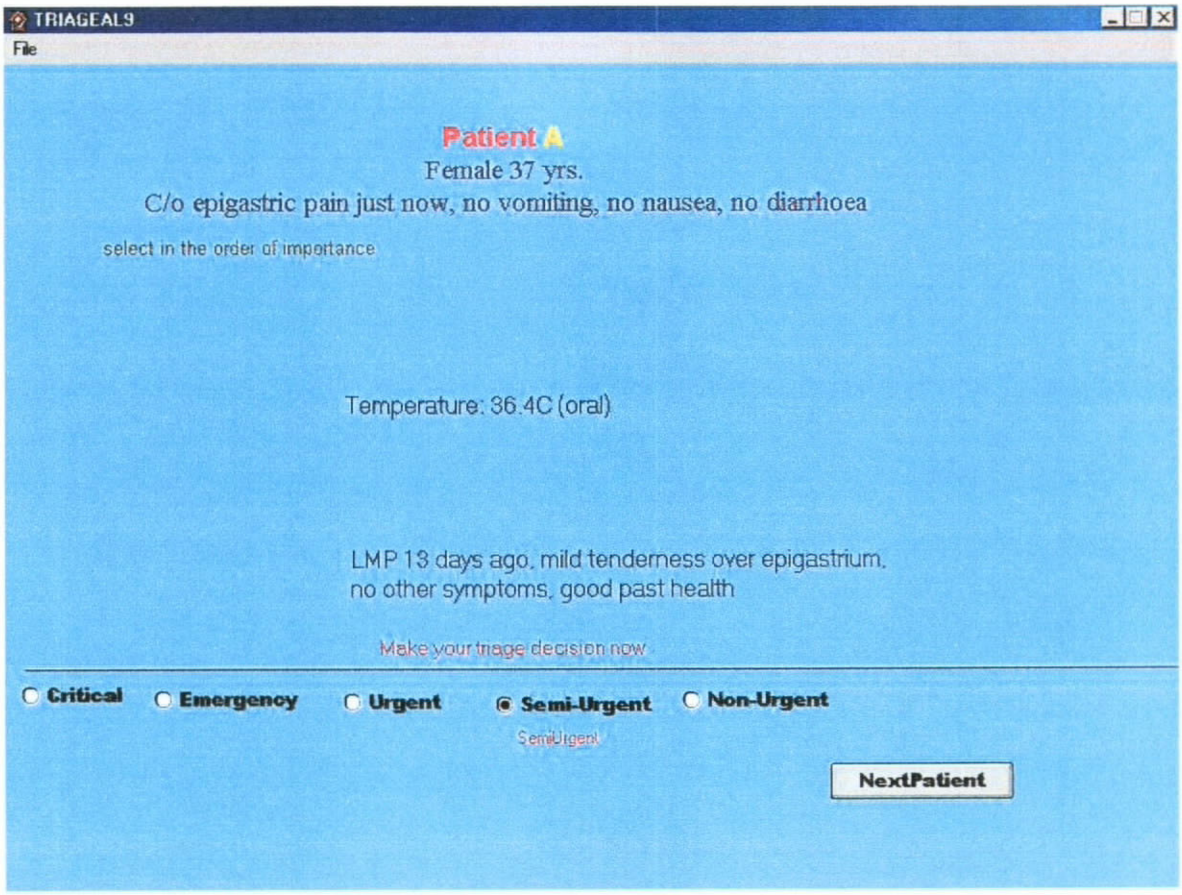
Appendix 7

Scenario screen display (the triage process page)

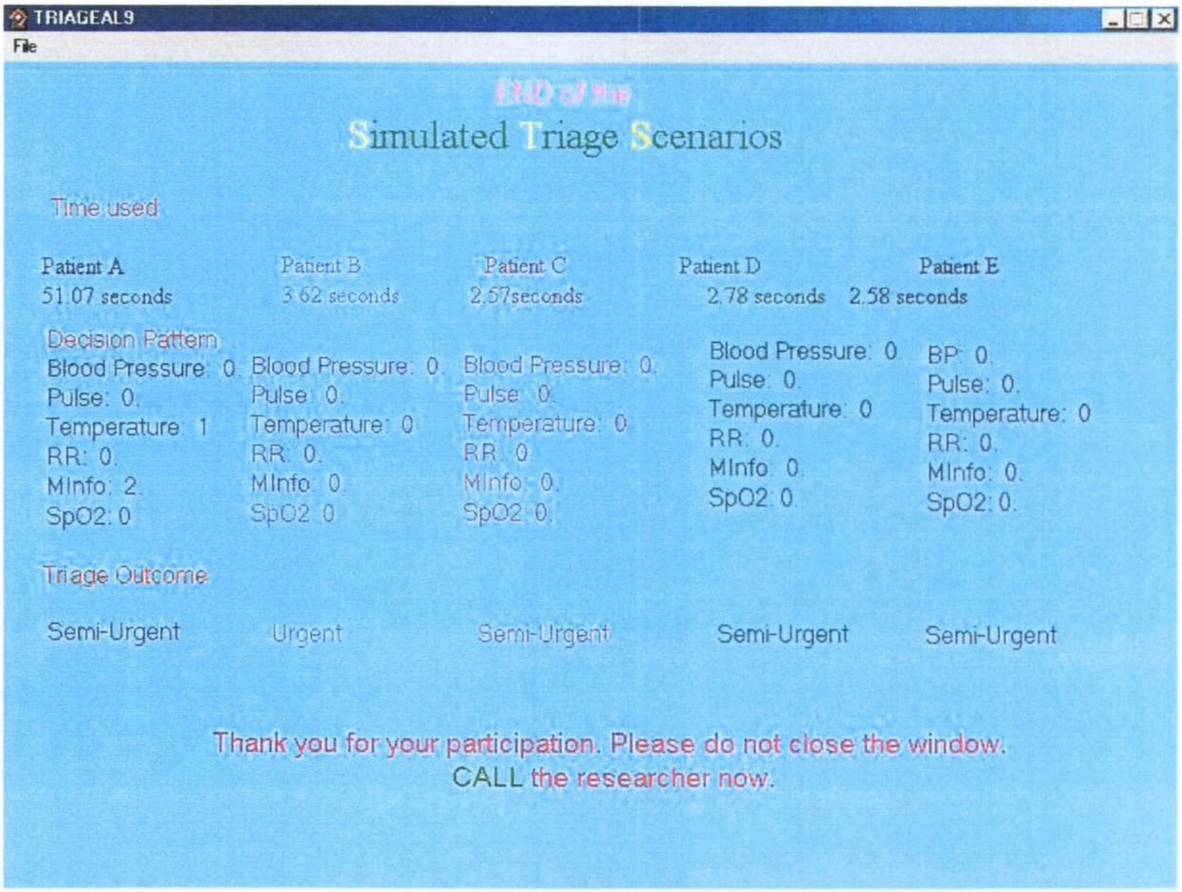


Appendix 8

Scenario screen display (the triage decision page)



Scenario screen display (the performance track record page)



QUESTIONNAIRE

DECISION MAKING IN TRIAGE AT A&E DEPARTMENTS

This questionnaire aims to obtain your opinion regarding the influencing factors on the process of decision making during triage process at A&E departments. Please consider factors which may influence what you *do* and how you *think* before determining patient priority during triage. **NOT** the triage *outcome* (categorisation).

Part I Influencing Factors

Read each statement carefully, then indicate one of the five (unless specially indicated) responses which best describes your opinion against each statement in the appropriate answer column. Please attempt all questions.

SA = Strongly Agree   A = Agree   NS = Not Sure   D = Disagree   SD = Strongly Disagree

1	Factors related to patients	SA	A	NS	D	SD
1.1	Complexity of illness/injury of the patient					
1.2	Level of discomfort of the patient					
1.3	Communication ability of the patient					
1.4	Behaviour of the patient					
1.5	Amount of information available					
1.6	Absence of significant others					
1.7	Altered mental status					
1.8	Motive of the patient attending A&E e.g., extend sick leave period etc.					

2	Factors related to the physical structure of triage stations	SA	A	NS	D	SD
2.1	Location of the triage station - able to view the main entrance of the A&E department					
2.2	Convenient placement of various utilities in triage station e.g., strapping, bandages					
2.3	Sufficient working space at triage station					
2.4	Types of equipment available e.g. BP machines, electronic thermometers					
2.5	Physical layout of the station that can provide privacy to patients					

3	**Factors related to Triage Nurses**	**SA**	**A**	**NS**	**D**	**SD**
3.1	Clinical experience					
3.2	Knowledge of disease, conditions, syndromes					
3.3	Documentation/writing technique					
3.4	Communication skill/ability					
3.5	Physical well-being					
3.6	Emotional/Psychological well-being					
3.7	Past experience in handling patients with similar problem					
3.8	Confidence					
3.9	Knowledge and skills in performing health assessment					

4	**Factors related to management/administrative aspect**					
4.1	Availability of extra man power at triage station when in need					
4.2	Availability of senior/experienced colleagues for secondary opinion					
4.3	Departmental protocols/guidelines/policy					

5	**Other factors**					
5.1	Information available before arrival of patients					
5.2	Many patients queue up waiting for triage					
5.3	Behaviour/attitude of accompany persons/friends/relatives etc.					
5.4	Presence of other patients nearby					
5.5	Presence of other accompany personnel e.g., police, reporters, journalists.					
5.6	Physical comfort of the environment e.g., lighting, ventilation, noisy control					
5.7	Challenges from co-workers (doctors/nurses) on your triage decision					
		SA	**A**	**NS**	**D**	**SD**

6. Do you want to add some more factors? If YES, please specify below:

____

____

____

Part II Demographic Data

Please tick the appropriate box (if applicable) or write down the appropriate information in the space provided (if applicable) and do **NOT** omit any one item.

1. Gender: [] Male [] Female

2. Age group:
   [] 21-25 [] 26-30 [] 31-35 [] 36-40
   [] 41-45 [] 46-50 [] 51-55 [] >55

3. Rank:
   [] Registered Nurse [] Nursing Officer

4. Years of clinical practice in total since initial registration/enrolment:
   [] <1 year [] 1-2 years [] 3-5 years
   [] 6-10 years [] >10 years

5. Years of experience in A&E:
   [] <1 year [] 1-2 years [] 3-5 years
   [] 6-10 years [] >10 years

6. Have you attended any in-service or self-arranged courses related to Nursing triage in A&E (seminars introducing triage guidelines or field triage should ***NOT*** be considered)?

   [] No [] Yes, specify ______________________

7. Highest educational qualification attained:
   [] Diploma, nursing [] Bachelor, nursing [] Masters
   [] PhD [] Others, specify ______________________

8. Triage is the most difficult job in comparison with other nursing duties in the A&E
   []Strongly Agree []Agree []Not Sure []Disagree []Strongly Disagree

~ End of questionnaire - Thank you ~

Work Instruction for the Main Study

Before commencement of the research procedure:

1. To check the environment: quiet, well lighted and ventilated room isolated from the main area of the A&E; proper power supply to the notebook computer; sufficient working space for completing the CSPS and the questionnaire
2. To give a self-introduction and short briefing of the outline of the study
3. To acknowledge the participants verbally
4. To emphasize voluntary participation, the participant may opt to withdraw from the study anytime
5. To make sure inclusion criteria met for all the participants
6. To offer personal identification code for individual participants
7. To sign consent forms and agreement forms by both the participant and the researcher
8. To introduce the rules of playing CSPS
9. To introduce steps in playing the CSPS-
    - Enter personal code to start the game
    - Read the on-screen instruction carefully
    - Start triaging the scenarios, no fixed sequence or types of triage actions expected, even no vital signs accepted
    - The CSPS would be timed
    - Call the researcher if assistance required and when completed
10. To highlight the points to note in completing the questionnaire-
    - Put down the personal identification code on the first page of the questionnaire
    - Answer all questions
    - Return the questionnaire to the researcher
    - Call the researcher if assistance required and when completed

Commencement of the research procedure:

1. Make sure the participants complete the research procedure independently, no intra-particpant discussion allowed
2. Encourage the participant to call the researcher anytime during the research procedure if required

After completion of the research procedure:

1. Ensure all the relevant documents were received
2. END of data collection

Checklist of the research kit

No.	Item	Qty.	Remarks
1.	Notebook computer with CSPS installed	1	
2.	Floppy disc with CSPS installed	2	backup
3.	Participant name list	1	
4.	Consent forms	multiple	
5.	Agreement forms	multiple	
6.	Pencil with rubber eraser	10	
7.	Questionnaire	Multiple	
8.	Work instruction sheet for the main study	1	
9.	Checklist of the research kit	1	