Interhospital transfers: Decision-making in critical care areas

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Objectives: To evaluate the training of clinical staff in the use of interhospital transfer guidelines and to examine the underlying decision-making behavior in organizing patient transfers between hospitals.

Design: Prospective assessment of clinical scenarios, given before (time 1), immediately after (time 2), and 3 months after (time 3) a program informing clinical staff about the use of interhospital transfer guidelines.

Setting: Three emergency departments and one intensive care unit at three hospitals and a medical retrieval service in Sydney, Australia.

Subjects: Physicians, nurses, and a paramedic working in critical care areas and at a medical retrieval service.

Interventions: Fifteen minutes of training in the use of interhospital transfer guidelines, conducted by a trained nurse.

Measurements and Main results: A questionnaire containing clinical scenarios was administered to clinical staff. There was a significant difference in mean scores for selecting the appropriate escort levels across time ($F_{2,78} = 24.2$; $p < .01$) and for participant's experience with interhospital transfer ($F_{2,39} = 4.63$; $p = .02$). Significant improvement in mean scores occurred between time 1 (7.55 ± 1.84) and time 2 (9.48 ± 1.47) ($t_{41} = -6.21$; $p < .01$). The improvement in selecting appropriate escorts was maintained at time 3 (mean score 9.86 ± 2.01). The error rate for inappropriate assignment of low levels of escorts decreased from 35% (time 1) to 10% (time 2) and 14% (time 3). Using conjoint analysis, there were large variations in the decision-making behavior between each time period. The relative importance of each factor in influencing the decision to organize an escort at time 3 were as follows: treatment (43%); physiology (29%); patient age (24%); and diagnosis (4%). The decision-making model observed at time 3 had a high predictive value (87%) as compared with the model at time 1 (48%).

Conclusion: Clinical staff can make informed and appropriate decisions by using standardized guidelines when organizing interhospital transfers. (Crit Care Med 1996; 24:618–622)

KEY WORDS: patient transfer; transportation of patients; decision-making; health education; health planning guidelines; standards; healthcare team; emergency medical services; hospitals; critical care

Patient transfers between hospitals should be for appropriate indications, properly timed, and safely undertaken. The decision to transport must be based on an assessment of the potential benefits of transport weighed against the potential risks (1). Patients are currently transferred between a network of hospitals within Sydney to access a full range of clinical services. The South Western Sydney Area Health Service covers an area of 6512 km^2, with a resident population of 651,018 (2) and is serviced by Liverpool Hospital, a 450-bed university teaching hospital, and five district hospitals with limited or no intensive care facilities or specialized radiologic services.

There is a limited amount of literature that addresses the need for different levels of care in transferring patients between hospitals. Much of the literature has focused on aeromedical transport of critically ill patients by specialized medical retrieval teams (3–5). Guidelines (6–8) have been developed to enumerate the clinical conditions where aeromedical transport is required. However, these guidelines do not address the issue of matching levels of escorts to patient needs if specialized retrieval teams are not required (6–8).

After initial consultation with the New South Wales Ambulance Medical Retrieval Subcommittee, Australian and New Zealand Intensive Care Society representatives, and members of the Critical Care Committee of South Western Sydney Area Health Service, a set of guidelines (Appendix 1) were established to aid the "nonexpert" clinician to organize the appropriate levels of escort for particular clinical conditions. The basis for the formation of these guidelines was to standardize decisions made by physicians and registered nurses with different levels of experience in transporting patients between hospitals, and to ensure a minimum standard of care.

This article reports on our analysis of a training program for clinical staff to use interhospital transfer guidelines. It also examines the underlying decision-making behavior in organizing patient transfers between hospitals.

MATERIALS AND METHODS

The study was carried out in an intensive care unit and emergency

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department at a 450-bed university teaching hospital, emergency departments at two referring hospitals, and National Roads and Motorists' Association CareFlight (a medical retrieval service) in Sydney, Australia. Institutional Review Board approval was obtained. Physicians, nurses, and paramedics working in intensive care, anesthesiology, emergency medicine, or aeromedical transportation were enrolled in the study.

Survey. The aim of the education program was to standardize the decision-making process of clinical staff when they organize patient transfers between hospitals. Explanation of the interhospital transfer guidelines (Appendix 1) took ~15 mins and was given by a trained nurse. The content of the training session consisted of how to utilize the guidelines and what procedures were to be followed when arranging the appropriate level of patient escort.

In the *first* instance, clinical staff were instructed to match the patient's condition with items listed on the guidelines and to note the color coding. *Second*, depending on the color coding, the escort level was determined. A red coding suggested that the patient may require a retrieval team, no matter what other codings were present. Blue codings required escorts with advanced airway management skills and cardiac skills, and corresponded to specifically trained paramedics, nurses, or doctors. Green codings were nurse or doctor escorts who had basic skills and were familiar with hospital treatments and equipment required for transfer. *Third*, staff organized the appropriate level of transfer by referring to the phone numbers of the service required listed below the guidelines.

A clinical scenario is shown in Table 1. In this example, the patient's diagnosis matches a blue coding. His treatment and physiology do not match any of the items listed in the guidelines. Thus, a blue coding indicates that an escort with advanced airway management skills and cardiac skills would be required. In the clinical setting, the participant would then organize the transfer with consideration to the resources available within the hospital or contact the state ambulance service with a skilled escort.

Table 1. Example of a clinical scenario

The patient is a 54-yr-old male with chest pain of 45 mins duration. He has a past history of angina, but no previous myocardial infarction.
He is receiving oxygen (4 L/min) via mask, and has been given 7.5 mg of morphine with some relief of chest pain.
He appears anxious and sweaty. His vital signs are: blood pressure of 110/80 mm Hg; heart rate of 85 beats/min; oxygen saturation of 98%.

Participant's responses to the level of interhospital transfer required were compared against a panel of three experts (M.L., S.B., and K.H.). A pilot study was undertaken to assess the validity of the clinical scenarios and there was substantial agreement between the experts ($\kappa = 0.64$) (9).

Each participant was presented with a set of 12 scenarios before (time 1), immediately after (time 2), and 3 months after (time 3) the education program. Correct participant's responses were totaled, and a score for the 12 scenarios was calculated for each time period. At 3 months after the education program, participants had access to the guidelines as simulated in the workplace environment (guidelines were not necessarily given to them unless specifically requested). An assessment of the guidelines at 3 months after the education program was made by measuring the level of utilization, participant's perceptions of the usefulness of the guidelines, problems encountered, and the role of the guidelines in interhospital transfers.

Scenarios. Conjoint analysis was used to identify and characterize underlying decision-making patterns of clinical staff involved with interhospital transportation of patients. Conjoint analysis has been used in medicine to evaluate how physicians weigh clinical information in decision-making. The method allows multiple factors to be included in an analysis without requiring large numbers of hypothetical cases (10).

One of the investigators (M.L.) devised each clinical scenario based on a structure generated by a conjoint technique, using a fractional factorial design. The advantage of this design was that it avoided the evaluation of all 24 possible combinations of four factors and levels included in the scenarios and assumed no interactions between these factors. Two sets of scenarios were generated (A and B) and were equivalent to each other in statistical design. Set A was given before the education program (time 1). Set B was given immediately after the education program (time 2). Set A was repeated 3 months after the education program (time 3).

Each of the 12 scenarios from each set were presented separately to participants and randomly ordered to minimize the error associated with evaluation fatigue. For each scenario, the participant was asked to give the following responses: a) choose the most appropriate level of patient escort; b) rate how likely an urgent new intervention was needed, using a Likert Scale (0 to 10); and c) rate how likely it was that intensive care-level therapy and monitoring were required. A Retrieval Index (0 to 20) was defined by the addition of the ratings and was used in the conjoint analysis. The internal consistency of the two items, as measured by Cronbach's α, was 0.72, suggesting that the Retrieval Index was a reliable measure (11). A low Retrieval Index suggested a high likelihood of choosing a basic skills escort, while a high Retrieval Index suggested a high likelihood of organizing a medical retrieval team.

The four factors chosen from the interhospital transfer guidelines to create the clinical scenarios included: a) age, which was categorized as either adult or child (defined as <15 yrs); b) diagnosis, which was divided into two levels (any airway/breathing/circulation diagnosis and disability/other diagnosis); c) physiology, which was classified as abnormal or normal; and d) level (the nature of the treatment was divided into three levels—specialist, advanced support, basic support).

Data Analysis. Mean scores, with 95% confidence intervals, were calculated for each time period. Repeated-measures analysis of variance was used to detect any differences in scores between the time periods and the participant's previous experience with interhospital transfers. Independent and paired *t*-tests were used to examine significant differences between groups and time periods, respectively.

Utilities (weighted scores) were estimated for each factor at each level by conjoint analysis. The units for

utilities are arbitrarily defined and are relative only to the factors tested in the scenarios used in this study. The "relative importance" was calculated by taking the utility range for a particular factor and dividing it by the sum of all of the utility ranges. The sum of the relative importance for the four factors is 100%. The r^2 statistic was used to indicate the variance accounted for between the observed and estimated models. Of the 12 scenarios created, nine were used for modeling and three were used as validation scenarios to examine the consistency of participant's organization of interhospital transfer behavior at each time period (predictive accuracy of the model).

Statistical analysis was performed by using SPSS software (12). Values are expressed as mean ± SD. The level of significance was set at $p < .05$.

RESULTS

Forty-three participants (24 physicians, 18 nurses, and one paramedic) were successfully recruited and followed up until 3 months after the education program, representing a response rate of 88% (43 of 49). The majority (72%) of participants surveyed were from a teaching hospital, while the remainder of participants were from referring hospitals (16%) and National Roads and Motorists' Association CareFlight (12%). Specialist areas represented in the study included anesthesia (n = 9), intensive care (n = 14), and emergency medicine (n = 17 plus three junior staff on general rotation). Most participants (n = 42) already had experience with the transfer of patients between hospitals, either in the role of referring patients (26%), transporting them (24%), or receiving patients (50%).

Figure 1 shows a significant difference in the mean scores for selecting appropriate escort levels across time ($F_{2,78} = 24.2$; $p < .01$) and for respondent's experience with interhospital transfers ($F_{2,39} = 4.63$, $p = .02$). Respondents with transporting experience had a significantly higher baseline score than respondents with referring experience ($t_{19} = -3.01$; $p < .01$). Overall, there was a significant improvement in scores between time 1 (mean score 7.55 ± 1.84) and time 2 (mean score 9.48 ± 1.47) ($t_{41} = -6.12$; $p < .01$).

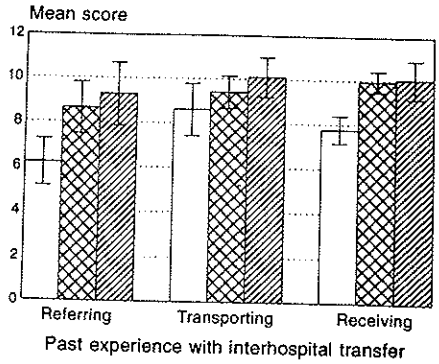

Figure 1. Mean scores across time for participants with past experience of interhospital transfers. *Open bars*, time 1; *crosshatched bars*, time 2; *diagonal bars*, time 3.

After 3 months, the improvements in selecting appropriate escorts was maintained (mean score 9.86 ± 2.01). The error rate for inappropriate assignment of low levels of escort before the educational inservice training program was 35%. This error rate decreased to 10% at time 2, and to 14% at time 3.

In the month immediately before completion of the last set of scenarios, 29 (67%) of the 43 participants had been involved with interhospital transfers in their clinical work. Eighty-nine percent reported that they had used the guidelines to assist them in their decision-making but 11% found the guidelines difficult to use. All except one participant thought that the guidelines were useful.

There were large variations in the decision-making behavior over the three time periods. In examining which factors were important in making the choice of escort, most participants focused on the patient's treatment during all three time periods (Fig. 2). After the education program, a more balanced consideration was given to all four factors. There was a marked emphasis placed on patient's diagnosis (26%) at time 2 compared with time 1 (6%). At time 3, the underlying decision-making behavior returned to a similar pattern observed at time 1 but with more consideration placed on physiologic signs. The rankings of the four factors were similar between times 1 and 3.

The overall variance accounted for by the four factors used in estimating the escort levels from the scenarios by all participants was 92% (times 1 and 2) and 97% (time 3). In the model

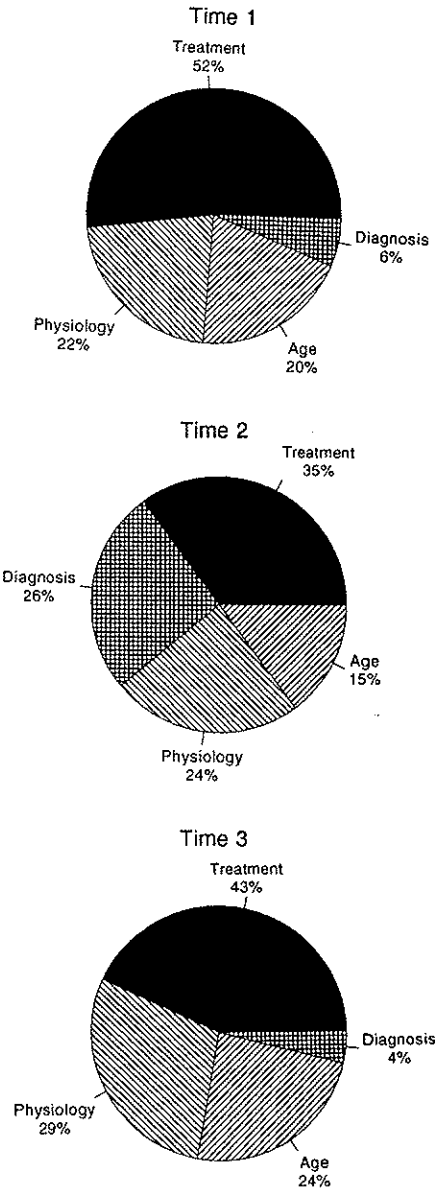

Figure 2. Relative importance of various factors for choice of escort levels across time.

validation process, three of 12 scenarios were used. The predictive accuracy of the model decreased substantially from 48% (time 1) to 5% (time 2). This finding shows that before the education program, the decision-making pattern was found to be consistent under half of the time. In comparison, immediately after the education program, the decision-making pattern was highly inconsistent and may reflect the presence of other factors associated with learning new tasks. After 3 months of familiarization and use of the guidelines, the predictive accuracy of the model was very high (87%). This finding suggests that the guidelines successfully standardized the decision-making process.

DISCUSSION

Effective utilization of medical retrieval teams and ambulance and hospital transporting personnel depends on appropriate organization of escort levels by clinical staff. A wide range of specialties and experience are represented by the clinical staff who are involved in organizing interhospital transfer. However, little is known about how these health professionals make such decisions and the factors underlying them. In this study, appropriate use of the guidelines was enhanced by conducting a short but structured education program.

The guidelines were well received, with a number of participants commenting that the guidelines should have been more visible in the clinical environment. Two thirds of the cohort had organized an interhospital transfer in the month before the follow-up survey, many of whom referred to the guidelines to assist them in making the appropriate decision. Hospital-based clinical staff involved in referring or receiving patients showed significant improvements in their ability select the appropriate level of escort. This situation was due to a successful education program. However, significant improvements in scores were not found for participants who were experienced in transporting patients. It is possible that this group of participants was already highly experienced, as demonstrated by a high baseline score.

There was no deterioration in the ability to select the appropriate level of escorts 3 months after the education program. However, whether this ability is maintained over time requires further research. In one study (13), no significant deterioration of the didactic knowledge base of advanced cardiac life support was detected 1 to 2 yrs after the completion of an advanced cardiac life support course.

In this present study, the reduction in the error rate of inappropriate assignment of low escort levels between the three time periods suggests that our unified approach to transport needs is feasible. Although clinical outcomes and cost implications of training improvements were not examined in this study, we observed a reduction of inappropriate interhospital transfers requiring retrieval management. Incorrect discrimination between the red level (retrieval team) and the blue level (advanced airway management and cardiac skills) occurred in 38 (36%) of 105 calls over a 3-month period before implementation of the guidelines. In contrast, over a 3-month period after implementing the guidelines, there were 24 (15%) of 156 calls that did not require the expertise of a retrieval team (unpublished observations).

Conjoint analysis was useful in observing the various underlying decision-making behavior throughout the evaluation and has been used in several studies (14–16) in the biomedical field. Analysis of the relative importance of various factors showed that treatment was weighted most heavily throughout the three time periods. Also, more consideration was given to physiologic state over time, ranging from 22% to 29% of the overall decision. Better recognition of abnormal physiologic parameters may account for this finding, as shown by the increase in the number of correct responses when "problem" scenarios were compared between times 1 and 3. Previous studies (17, 18) of inhospital cardiac arrests suggested that clinical personnel often do not respond adequately to patients with abnormal physiology, such as respiratory or mental deterioration, and recommend greater training in evaluating the patient's condition.

One of the limitations in using conjoint analysis is that the scenarios are hypothetical. The validity of the scenarios depends on the choice of factors and levels chosen. Other factors that could influence the interhospital transfer decisions, such as distance, would need to be tested in another analysis with a larger set of scenarios.

For effective health management planning, clinicians using a transport network must provide consistent and predictable responses. The high degree (87%) of consistency provided by these guidelines meets such a criterion. Matching to appropriate levels of escort and mode of transportation with patients' needs is important for individual patient care, as well as for areas such as efficiency and cost. Thus, these interhospital transfer guidelines could function as an objective resource allocation tool.

Clinical outcomes and cost analysis following implementation of the guidelines were not examined in this study. Future studies are required to evaluate the impact of our guidelines on patient outcomes. Indicators—such as rate of complications during transportation, cost of personnel and equipment, and ongoing cost of regular staff education programs—should be measured.

We believe the guidelines will assist in establishing further clinical standards in patients requiring interhospital transport. The education program provides a rapidly assimilated means of educating a large group of "nonexpert" clinical staff to make informed decisions, ensuring that patients receive appropriate care during transportation. Part of the success of the education program could be attributed to training sessions being conducted on site in departments where the participant worked. A previous study suggested that onsite training is more beneficial than offsite training because participants develop a different rapport with their fellow professionals, identify facility shortcomings, and find sufficient strength to change their attitudes and performance (13).

In conclusion, this study showed that clinical staff can make informed and appropriate decisions by using standardized guidelines when organizing interhospital transfers. The guidelines have been well accepted in our clinical practice and ensure a minimum standard of care during the transfer phase.

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SWSAHS INTERHOSPITAL TRANSFER ESCORT GUIDELINES

Some patients have special needs when being transported. Use these guidelines to establish an appropriate level of escort for patients being transferred between hospitals ***NOTE If the patient has no special needs during transfer then organise a transfer in the usual way.***

STEP ONE

CHECK EACH ITEM LISTED ON THE CHART BELOW AGAINST YOUR PATIENTS CONDITION AND NOTE THE COLOUR CODING

CHECK ALL THREE COLUMNS SYSTEMS SHOULD BE ASSESSED *AFTER INITIAL* TREATMENT	PHYSIOLOGY	TREATMENT	DIAGNOSIS
AIRWAY	Threatened	**Endotracheal Tube** Recent Tracheostomy	Epiglottitis/Croup Upper Airway Obstruction Facial or Airway Burns or Trauma
Acute changes in BREATHING (with patient on oxygen)	RR < 10 or > 30 $Sa0_2$ < 92% Abnormal Breathing in a Child	**O_2 rebreather mask (> 50%)** **IPPV with Bag** Needing specialised support such as a ventilator especially with Airways pressure >35cmH_2O or CPAP/PEEP or ventilated with FiO_2 > 50% or Muscle relaxants	**Simple Pneumothorax after tube in place** Tension or Haemopneumothorax Severe Asthma Severe Chest Trauma
Acute changes in CIRCULATION (after respiratory status)	SBP < 90 mmHg PR > 140b/m Abnormal Circulation in a Child	Complex monitoring (other than ECG) trans venous pacing Any inotropic drugs required to keep the patient stable *Other drug infusions required* *Blood products required* *Nursing Specialist treatments in place*	Burns with unstable circulation Burns > 20% or Burns > 10% children Severe Sepsis & multi organ failure Repeated Cardiac Arrest **Stable post arrest or ARF patient** **Acute third degree heart block**
DISABILITY	GCS<12 or falling 2 points Any Deterioration in a Child		Acute Coma with treatable cause Acute Meningitis with sepsis/seizure Continuous/repeated seizure **Acute Spinal Injury**
	ANY DETERIORATING OR UNSTABLE PATIENT	*Diagnostic transfer only with no definitive treatment intended*	Serious Diving accidents SEVERE TRAUMA including Trauma involving two or more long bones Poisoning/Anaphylaxis/Envenomation

Appendix 1. The South Western Sydney Area Health Service (SWSAHS) interhospital transfer guidelines. Italicized items represent green conditions; white bolded items represent blue conditions; all other items represent red conditions. *RR*, respiratory rate; Sa_{O_2}, arterial oxygen saturation; *SBP*, systolic blood pressure; *PR*, pulse rate; *GCS*, Glasgow Coma Scale score; *IPPV*, intermittent positive pressure ventilation; *CPAP/PEEP*, continuous positive airway pressure/positive end-expiratory pressure; *ECG*, electrocardiogram.