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Knowledge of inter-facility transport among emergency nurses in Hong Kong: A questionnaire survey

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Abstract

Introduction: Inter-facility transport (IFT) is a dynamic process and its quality largely depends on pre-transport preparation, emergency equipment support and recognition of possible en route adverse events. This study aims to evaluate knowledge of IFT among emergency nurses of three Accident and Emergency Departments in Hong Kong.

Methods: Questionnaires were distributed to registered nurses of the three departments. Data was sought on participants’ characteristics, knowledge on equipment preparation and management of en route adverse events. Four clinical IFT scenarios were set for participants and answers were scored. Measured outcomes were defined as (1) relationships between clinical experience and relevant training in
IFT with questionnaire results, (2) staff knowledge of the equipment carried routinely in ambulances and (3) the en route adverse events encountered according to the participants’ past experience.

Results: Participants’ test scores ranged from 24 to 37 (out of 40) with a mean of 30.6 (95% confidence interval 29.7–31.5). Participants with more clinical experience demonstrated significantly better test scores ($p < 0.05$). Most participants were familiar with the monitoring devices carried in ambulances but were less familiar with the pharmacologic agents and airway devices available routinely in Hong Kong ambulances. Thirty participants (59%) had encountered en route adverse events in the past.

Conclusion: Nurses in emergency departments in Hong Kong have good knowledge of IFT. Extensive clinical experience is related to better IFT knowledge. IFT training for nurses should emphasize available ambulance service resources and capabilities.

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Introduction

The role of inter-facility patient transport (IFT) is constantly being extended and expanded especially in smaller scale local hospitals in Hong Kong. This trend can be explained by three reasons. Firstly, there is ongoing centralization of specialist services to tertiary centers and this reorganization of services increases demand for IFT. Secondly, the difficult first hand experience of the severe acute respiratory syndrome (SARS) crisis sensitized all healthcare staff to the importance of maintaining strict infection control measures. Strict infection control policies have led to declines in both patient turnover and the capacities of the wards. This clinical framework further aggravated existing bed constraints and a high quality IFT service became a must. In addition, IFT also plays a role in supplementing the primary trauma diversion program as trauma patients who have airway or breathing compromise that cannot be overcome at the scene or in transit require stabilization in the nearest hospital (Cheung et al., 2006).

IFT is a dynamic process which should occur when the benefits to the patient exceed the risks of transport. The decision for transport is inherently risky and it means that accompanying personnel have a responsibility to handle any complications in transit on their own (Lee et al., 1996; Warren et al., 2004). In Hong Kong, ambulances are the main choice of transport medium, with only exceptional cases being transported by helicopter or police launch when handling cases from outlying islands or rural hiking spots during adverse weather when air transport not possible (College Organizing Committee of Intensive Care, 2004).

It is unknown what the general level of IFT knowledge among registered nurses in Hong Kong is at present. Nurses from the accident and emergency department (AED) are usually assigned the task of escorting seriously ill patients to other hospitals when the need arises, either in conjunction with a paramedic or with a doctor.

The aim of this study is to evaluate knowledge levels of inter-facility transport among registered nurses of the AEDs in the eastern New Territories of Hong Kong, with special emphasis on equipment preparation and management of en route adverse events.

Methods

This descriptive questionnaire study took place in three hospitals located in the eastern New Territories of Hong Kong, namely Alice Ho Miu Ling Nethersole Hospital (AHNH), North District Hospital (NDH) and Prince of Wales Hospital (PWH).

The questionnaire was designed in four parts with questions relating to (1) participant characteristics, (2) general information about IFT, (3) equipment preparation and (4) management of adverse events en route. Draft questionnaires were distributed to three local experts for content validity. A pilot study was performed in the AED of another local hospital, the Pamela Youde Nethersole Eastern Hospital (PYNEH), to elicit feedback on the clarity and readability of the questionnaire. Amendments were made accordingly following the feedback received.

Ethic approval was granted by the Joint Chinese University of Hong Kong – New Territories East Cluster Clinical Research Ethics Committee (CRE-2006.247) prior to the commencement of this study. Participation was voluntary and the questionnaires were distributed to all registered nursing staff working in the AED of the three participating hospitals. Participants were expected to complete and return the questionnaires on their own during the calendar month of September 2006. All data
was anonymized for further analysis. Participant characteristics as well as general information about IFT were illustrated with descriptive statistics. Participants’ performance on the questions about equipment support and management of adverse events were scored (out of a maximum possible score of 40).

The Mann–Whitney test was used to compare participants’ test scores with their clinical experience and details of any relevant courses taken. All data was entered on to an Excel spreadsheet and transferred to SPSS for further statistical analysis.

Results

A total of 123 questionnaires were distributed and 56 responses were received, giving a response rate of 46%. Five responses had to be excluded due to lack of data leaving 51 questionnaires eligible for analysis.

Nine participants were senior nursing staff (nursing officer or above). Twenty-six participants (more than half) had more than 10 years clinical experience and the majority of them (45) had received relevant training in IFT. Thirty-three participants had experience of using their escort kits in the past but 19 participants indicated that the escort kit had too much equipment.

Thirty nurses had encountered en route adverse events during IFT and the most common physiologic deterioration was systolic hypotension ($n=14$), followed by oxygen desaturation ($n=10$) and neurological deterioration ($n=9$). Thirty-one participants had encountered equipment mishaps during transport (Fig. 1).

Most participants were familiar with the monitoring devices available in ambulances but they were less familiar with the availability of the various airway devices. There was poor knowledge of the availability of resuscitation agents in the ambulance, specifically the drug adrenaline. A summary of participants’ knowledge of items available on ambulances is shown in Tables 1 and 2.

Overall, participants’ total scores ranged from 24 to 37 (out of 40) with a mean of 30.6 (95% confidence interval 29.7–31.5). Neither higher job ranking nor relevant training were associated with better participant scores. The only factor that gave rise to a statistically significant difference (median difference = 1.98; 95% confidence interval 0.33–3.62) in scores was clinical experience of more than ten years ($p<0.05$, Mann–Whitney test, Fig. 2).

Discussion

High quality IFT is largely dependent on several factors: (1) Pre-transport preparation, (2) equipment support, (3) appropriateness of the transport configuration and (4) anticipation and management of en route adverse events.

Figure 1  Types of en route adverse events encountered by participants in percentages.
Pre-transport preparation comprises patient stabilization (wherever possible), communication and documentation. This study showed that 65% (n = 33) of the participants had experienced physiological deteriorations during transport and referring facility therefore should attempt to stabilize the patient prior to dispatch as the presence of physiological instability is associated with greater risks of en route deterioration (Tan, 1997; Oakley, 1999; Uusaro et al., 2002). However, the benefits of transport may outweigh the risks in some circumstances (for example, transfer to a vascular unit for surgery for ruptured aortic aneurysm) and this principle was essentially revealed by the guidelines written by American College of Critical Care Medicine Task Force (1993). A reliable communication system including physician-to-physician and/or nurse-to-nurse communication regarding patient’s condition is also a fundamental principle of IFT (Tan, 1997; Warren et al., 2004). Documentation is vital in IFT not only for the quality of the transport, but also to minimize potential medico-legal issues including informed consent, a written plan from attending doctors and an en route observation record (Maxwell and Miller, 1988).

In order to supplement the role of nurses during preparatory phase of IFT, pre-transport preparation should consist also of pre-transport assessment and preparation of necessary pharmacological agents for management of en route physiological deterioration (Maxwell and Miller, 1988; Tan, 1997). Pre-transport assessment implies ensuring all equipments, intravenous lines, tubes and drains are secured and function properly as well as recording vital signs before dispatch. A multitude of equipment mishaps such as dislodged cannulae or loss of tubes can occur during IFT that is also demonstrated in this survey.

Equipment support is a major component regarding preparatory work accountable by emergency nurses (Maxwell and Miller, 1988; Tan, 1997; Oakley, 1999; Barbara, 2003). It can be classified into two parts – escort kits and on board equipments. Escort kits are usually pre-packed with minimum recommended devices (airway, monitoring and intravenous) and pharmacological

| Table 1 | Items routinely available in ambulances with individual accuracies in percentages |
|---------|-------------------------------------------------------------------|
| Airway management devices | Drugs or fluids |
| Bag valve mask resuscitator | 100% | Normal saline |
| Oxygen mask | 100% | Dextrose 10% |
| Oropharyngeal airway | 96.0% | Nitroglycerin |
| Suction device | 94.1% | Salbutamol |
| Combitube | 78.4% | Thiamine |
| Laryngeal mask airway | 76.5% | Naloxone hydrochloride |

**Monitoring devices and others**

| Defibrillator | 96.0% |
| Pulse oximetry | 96.0% |
| Intravenous catheter | 94.1% |
| NIBP | 88.2% |

| Table 2 | Items not routinely available in ambulances with individual accuracies in percentages |
|---------|----------------------------------------------------------------------------------|
| Airway management devices | Drugs or fluids |
| Mechanical ventilator | 88.2% | Vasopressin |
| Nasopharyngeal airway | 54.9% | Amiodarone |
| Endotracheal tube | 68.6% | Midazolam* |
| Monitoring devices and others | Ipratropium bromide* |
| Capnometer | 88.2% | Atropine |
| Syringe pump | 88.2% | Haemaccel |

**Monitoring devices and others**

| Defibrillator | 96.0% |
| Pulse oximetry | 96.0% |
| Intravenous catheter | 94.1% |
| NIBP | 88.2% |

**Midazolam and Ipratropium bromide have been available in ambulances since October 2006.**
agents (intravenous fluid and medication) (Warren et al., 2004). As in this survey, the majority of participants felt that escort kits were over-equipped. The content of escort kits commonly overlap with ambulance equipment and a crowded kit may hinder personnel from accessing necessary equipment in a timely manner.

The performance of the survey participants was suboptimal with respect to knowledge of drug availability on ambulances — only 33% of participants could state that adrenaline was routinely stocked in ambulances. A standardized "vehicle equipment checklist" and "trauma kit equipment checklist" prepared by Ambulance Command, Hong Kong Fire Service Department (1998) documents the equipment and drugs stored in each ambulance. Future training efforts for IFT in Hong Kong could include distributing these checklists to AED staff to improve awareness.

Britto et al. (1995), Etxebarria et al. (1998) and Blackwell (2002) identified equipment that is often brought on board after including devices for monitoring cardiac rhythm, blood pressure and oxygen saturation; ventilatory support (ventilator and capnometry); and cardiac support (defibrillator, pacing). They should be compact, robust, vibration-resistant, clearly visible and illuminated and have adequate battery power (Oakley, 1999). Nearly two-thirds of participants reported equipment mishaps in this survey. Over a third of nurses experienced monitoring device failures and a fifth experienced venous access and endotracheal tube dislodgements during transport. Equipment checks and trouble-shooting should form part of the IFT curriculum for nurses in Hong Kong.

Paramedics remain the commonest provider for IFT and are responsible for around 95% of all transports according to data from quarterly audits on IFT of AHNH 2007. It remains unclear as to whether a physician or nurse should be present during IFT. Configurations can be nurse—paramedic or physician—nurse combination (Oakley, 1999; Blackwell, 2002; Barbara, 2003). Alternative personnel or specialized transport teams may be necessary depending on specific patient conditions (McGinn et al., 1996; Vos et al., 2004). There is still no worldwide accepted standard for assigning accompanying personnel for IFT (Markakis et al., 2006). In Hong Kong, training for IFT is not mandatory. This study did not show the significant relationship with training which is different from other studies (Tan, 1997; Blackwell, 2002; Uusaro et al., 2002). Nevertheless, training is still to be recommended for frontline staff in order to enhance and enforce their skills in an unfamiliar prehospital environment — the noisy, vibrating and bumpy ambulance (American College of Emergency Physicians, 1990; Australasian College for Emergency Medicine, 2003).

Adverse events can occur anytime during transport and may affect a variety of organ systems (Etxebarria et al., 1998; Uusaro et al., 2002; Markakis et al., 2006). We found that thirty nurses had encountered en route adverse events during IFT. The management of these adverse events can influence the quality and thus the outcome of transport. Physiological deteriorations should be anticipated and managed appropriately if they do occur. An inter-facility transport triage guideline can practically, effectively and objectively stratify risk before actual transport thus anticipating deterioration en route (Lee et al., 1996).

**Conclusion**

Familiarity with monitoring devices and pharmacological agents are essential in IFT preparedness due to their frequent use. AED staff need to be familiar with the available resources in ambulances. Both well established hardware (clinical guidelines and appropriate escort kits) and competent staff with relevant training are required to minimize risks and maximize outcomes and patient safety.

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**Figure 2** Box plot of total score against clinical experience.
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