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Potentially Severe Incidents During Interhospital Transport of Critically Ill Patients, Frequently Occurring But Rarely Reported: A Prospective Study

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Objectives: The out-of-hospital environment can pose significant challenges to the quality and safety of interhospital transport of critically ill patients. Because we lack knowledge of the occurrence of incidents, their potential consequences, and whether they are actually reported, this study was initiated.

Methods: Two different services in Norway were asked to self-report incidents after every interhospital transport of critically ill patients. Sampling lasted for 12 and 8 months, respectively. An expert group evaluated each incident for severity and demand for reporting into the hospital's electronic incident reporting system. One year later, the hospital's reporting system was scrutinized to determine the number of incidents actually reported.

Results: A total of 455 transports of critically ill patients were performed, resulting in 294 unique incidents reported: medical (15%), technical (25%), missing equipment (17%), and personal failures and communication difficulties (42%). Only 3 (1%) of the 294 unique incidents were actually reported in the hospital's electronic incident reporting system. The experts were inconsistent in which incidents should have been reported and to what degree checklists, standard operating procedures, simulation, and training could have prevented the incidents.

Conclusions: This study of interhospital transports of critically ill patients reveals a very high number of incidents. Despite this fact, these incidents are severely underreported in the hospital's electronic incident reporting system. This suggests that learning is lost and errors with predominant probability are repeated. These results emphasize the existing challenges in regard to the quality and safety of interhospital transport of critically ill patients.

Key Words: interhospital, interfacility, incidents, adverse events, critically ill, transport, reporting systems, patient safety, ambulance transport, intensive care, standard care

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The need for interhospital transport of critically ill patients is increasing as a consequence of specialization and regionalization designed to improve intensive care outcomes.^{1,2} The critically ill patients are either transported to receive a higher level of treatment or transported back to a lower level of treatment, but are still in need of critical care.

Safe interhospital transport of critically ill patients can be challenging given the characteristics of the out-of-hospital environment. These transports are performed under different routines, using different equipment, with few (if any) checklists and by different professionals.³ Transports have been described as logistically challenging and potentially unsafe for both patients and personnel.⁴ However, out-of-hospital treatment for critically ill patients should be of the same levels of quality and safety as in-hospital treatment.⁵

The quality of medical services is partially evaluated based on the number and severity of reported incidents. It is therefore imperative that these reports be as complete as possible—not only to describe the risks but also to help prevent future incidents—in pursuit of the goal of continuing improvements in patient safety.⁶

The international literature on prehospital and interhospital services concerning adverse event reporting is sparse. However, in an article analyzing extracorporeal membrane oxygenation patients' medical transport records, the authors identified adverse events during 31.7% of transports. In 34 of 514 transports, 2 or more adverse events occurred during the same trip.⁷ In another article, incidents were reported in 16.7% of interhospital transports, but this included nurse-led transports as well, indicating a lower portion of critically ill patients.⁸

Within prehospital services in Norway, information on the prevalence of incidents and compliance regarding their reporting is lacking. Based on our clinical experiences and compared with other services, we expected that such incidents both occur⁹ and may be underreported.

The primary aim of this study therefore was to investigate the number and type of self-reported incidents during interhospital transport of critically ill patients between geographically separated hospitals, and the proportion of these that were reported in the hospital's electronic incident reporting system. Second, we wanted to evaluate the registered incidents in regard to potential severity and suggest possible interventions in general to avoid the incidents in the future.

METHODS

Incident Self-Reporting and Hospital System Reporting

Part 1 of this study was to collect prospectively self-reported incidents that occurred during interhospital transport of critically ill patients by either of 2 designated services: service A or service B. An interhospital transport of a critically ill patient was defined as a

transport between 2 geographically separated hospitals with the required assistance of an anesthesiologist during transport.

Service A is a prehospital physician-staffed service at Oslo University Hospital performing interhospital transport of critically ill patients in addition to primary emergency missions. When a critically ill patient is transported, this service staff includes either an emergency medical technician (EMT) or paramedic in addition to the anesthesiologist. The unit is available on a short-notice, emergency basis at any time of day to supplement the usual ambulance staff for transport of critically ill patients. The service is operating in a dedicated emergency vehicle with no room for a stretcher, and the personnel must therefore enter a regular ambulance or an intensive care ambulance to complete a patient transport. Most of these transports are performed among the 4 hospitals making up Oslo University Hospital. Service A started to transport critically ill patients September 2013, thus being novel to these transports.

The personnel manning the service were asked to complete a study incident form after every interhospital transport of a critically ill patient from September 2013 to August 2014.

Service B is a well-established interhospital transport service at Oslo University Hospital that is staffed with an intensive care or anesthetic nurse and an anesthesiologist. These transports are also performed at any time of day via airplane and/or a dedicated intensive care ambulance. This service performs a large number of interhospital transports and retrievals every year covering the entire country. To limit data collection to true intensive care transports, study forms were only collected when an anesthesiologist attended the transport.

To collect an equivalent number of transport forms from service B to compare with service A, the service B survey lasted 8 months, from March 2016 to October 2016. We performed no collection of transport forms from service A during this latter period.

Occasionally, if time is critical or there is a concurrency conflict, the transports primarily dedicated to either service A or B can be transferred to the local helicopter emergency medical service, representing a close cooperation between these prehospital services.

The participants were asked to report all incidents, independent of their opinion of the potential significance of the incident. It was emphasized that the survey was in addition to the mandatory electronic incident reporting system and that every incident had to be reported as usual, independent of the survey.

With the aim of obtaining a high response rate from personnel who work in a demanding service, the study data collection form was designed to require minimal effort. This very simple, single-page, semiopen template had space on the reverse side for more information, as needed (Appendices 1, 2, <http://links.lww.com/JPS/A354>; <http://links.lww.com/JPS/A355>). If no incidents occurred, the only effort required was to check 4 boxes. Service personnel were instructed (verbally and in writing) to complete and deliver the form after each transport, including those without any incidents. Forms were delivered anonymously to a locked box adjacent to the local work desk. To maintain participant anonymity, increase response rates, and allow us to calculate the response rate, only the transport number was recorded. Reminders were sent to staff at both services via mail and delivered verbally at both staff meetings and services throughout the study period.

Maintaining an electronic incident reporting system is required within all prehospital and in-hospital services at Oslo University Hospital; using this system to report incidents with potentially moderately serious, serious or catastrophic consequences is mandatory. All personnel working at Oslo University Hospital, both inside and outside hospital, are able and obliged to file incidents in this system.

One year after the data collection was complete, the hospital's electronic incident reporting system was scrutinized to determine

the proportion of incidents that had been reported. Both services and all incidents reported to all the different unit leaders were searched and then double-checked in case any reports had been inaccurately addressed. Only incidents reported from interhospital transport of critically ill patients during the sampling periods were investigated.

Expert Group Evaluation

Part 2 of the study was an evaluation of the self-reported incidents. To assess the potential severity of each incident, we established a group of senior prehospital physician experts to evaluate the materials. We also asked this group to consider which incidents should have been reported in the hospital's electronic incident reporting system and suggest an intervention to avoid the incident in the future. Each expert uniquely evaluated and scored all forms blinded to each other's results.

The expert group consisted of 3 anesthesiologists, each represented 1 of the 3 other health regions in Norway, all with more than 10 years of clinical and administrative prehospital health care experience, including interhospital transport of critically ill patients. All experts had at least 4 years of experience in developing standard operating procedures (SOPs) for these transports and responsibility for follow-up on reported incidents within their local prehospital service. The experts were blinded to one another's identities.

Data forms were manually entered into statistical software for analysis (SPSS Statistics for Windows, version 21.0; IBM Corp., Armonk, New York); these encrypted files were sent to the expert group members for evaluation, along with scans of the forms themselves, so they could consider the written descriptions. To guide their evaluations and reduce personal bias, the expert group members were also sent instructions for the Oslo University Hospital electronic incident reporting system. They were asked to evaluate the potential consequences of each incident and whether it should have been reported in the hospital's mandatory reporting system. To maintain full anonymity for the patients in this study, there were no options to evaluate the true impact of the incidents from the patients' records. Finally, they were asked to suggest whether each incident could be avoided in the future by the use of checklists, SOPs, or education, and whether they considered the incident unavoidable.

Data Analysis

Only descriptive analyses were performed, using SPSS (IBM Corp.).

RESULTS

Self-Reported Incidents

The 2 services performed a combined 455 interhospital transports of critically ill patients during the study period. At least one of the participating personnel completed the data sheet for 336 of these transports, representing a 74% response rate. Service A performed 156 transports from September 2013 to August 2014, whereas service B performed 299 transports from March 2016 to October 2016.

For services A and B, at least one participating professional reported on 84% of 156 and 69% of 299 total transports, respectively. The anesthesiologists reported on 69% and 54% and the EMTs on 66% and 64% of total transports in services A and B, respectively. In service B, the specialized nurses reported on 64% of transports. There were an additional 21 transports included in service B transports for which data were reported by the rescue personnel at the local helicopter emergency medical service. These

latter transports were performed in the same manner as the other service B transports and thus included in the results.

Service A reported incidents during 48% of their transports, with up to 7 unique incidents reported during a single transport. Service B reported incidents during 49% of their transports, with up to 4 unique incidents during a single transport. If the same incident during one transport was reported by both doctor and paramedic/specialized nurse, it was merged into one incident to avoid double registration of the same incident. A total of 634 registered incidents, consisting of 294 unique incidents, were reported, representing an average of 0.65 unique incidents per transport.

The registrations were evenly distributed between “during loading” (30%), “during transport” (35%), and “during handover” (35%), with some of the incidents occurring in more than one phase of the transport. The category for “unnecessary time use” was rarely completed, usually with just a repetition of already registered incident and with no estimated time loss.

The self-reported incidents were a mixture of medical (15%), technical (25%), missing equipment (17%), and administrative and personal failures and communication difficulties (42%; Table 1). One example of missing equipment is forgotten capnometer/capnograph occurring in 6 different transports. A capnograph/capnometer is mandatory for intubated patients according to the Norwegian standard of anesthesia.¹⁰

Incidents Reported in the Hospital’s Electronic Incident Reporting System

Surprisingly, few incidents were reported in the hospital’s electronic incident reporting system. Although 455 interhospital transports of critically ill patients were performed between the 2 services during the study periods, only 3 incidents were reported in the system, indicating a missing rate of 99% of the incidents.

Expert Group Evaluations

The expert group varied in their evaluations of the potential harm from the self-reported incidents; 21% to 90% were considered insignificant or less serious, 5% to 49% were characterized as moderately serious, and 3% to 29% were categorized as serious or catastrophic (Table 2).

Incidents classified by the expert group as potentially serious or catastrophic included dislocation of oral or tracheal tube, ventilator malfunction, and pauses in inotropic infusions due to pump failure.

The expert group advised that 28 (10%), 33 (11%), and 250 (85%) of the registered incidents should have been reported in the hospital’s electronic incident reporting system (Table 2).

The expert group’s suggestions for how to avoid these incidents in the future were distributed among “checklists,” “SOPs,” “simulation,” and “training,” but there was discrepancy in the importance of the suggested solutions. Checklists, SOPs, and training were quite evenly distributed, but simulation was rarely considered relevant in avoiding incidents in the future (Table 3).

TABLE 1. Incidents for Service A (Anesthesiologist and Paramedic/EMT by Car or Ambulance) and Service B (Anesthesiologist and Specialized Nurse by Plane or Ambulance) Categorized by Most Common Events

Service	Medical	Technical Failure	Equipment Not Available	Administrative
A	19 (13%)	33 (23%)	19 (13%)	72 (50%)
B	25 (17%)	41 (28%)	30 (20%)	51 (35%)
Total	44 (15%)	74 (25%)	49 (17%)	123 (42%)

TABLE 2. Expert Group’s Evaluation of Incidents’ Potential Consequences and Number That Should Have Been Reported in the Hospital’s Electronic Incident Reporting System

Expert No.	Potential Consequence of Incidents			No. Incidents That Should Have Been Reported
	Insignificant or Less Serious	Moderately Serious	Serious or Catastrophic	
1	211 (72%)	47 (16%)	33 (11%)	28 (10%)
2	62 (21%)	143 (49%)	86 (29%)	250 (85%)
3	266 (90%)	14 (5%)	9 (3%)	33 (11%)

One-third of the incidents were classified as “unavoidable” by the expert group members, varying from 6% (expert 2) to 72% (expert 3).

DISCUSSIONS

The 2 participating services self-reported 294 unique incidents; surprisingly, only 3 were reported in the hospital’s electronic incident reporting system during this period. The expert group diverged in their evaluation of the potential consequences of these incidents, but nevertheless, the experts suggested that 10% (expert 1) to 85% (expert 2) of the incidents should have been reported, implicating a major underreporting of potentially moderately serious, serious, or catastrophic incidents.

Even minor errors can be leading of more significant ones, and by recognizing that untoward events occur, learning from them, and working toward preventing them, patient safety can be improved.¹¹ This is, however, dependent on the incidents to be reported; therefore, system safety depends on feedback for optimal functioning. When incidents are underreported, important incentives for improvement are lost, and safety procedures remain static or worsen.

International consensus regarding the importance of reporting incidents exists.¹² Such procedures have been regulated under Norwegian law since 2001, and the reporting of serious or catastrophic events to the National Board of Health Supervision is mandatory.¹³ When considered necessary, these events are then investigated by the National Board of Health Supervision, which determines whether the incident requires sanctioning. The Health Service as a system, as well as the individual health personnel, may be sanctioned. However, the main objective is to learn from such incidents to improve quality and patient safety. All hospitals in Norway are obliged to have an incident reporting system, although their usefulness is questionable because of known underreporting.^{14,15}

The present study was initially conducted for 1 year, after which, an additional 8 months was added. During the sampling period, personnel may have focused more on these incidents, potentially even introducing actions to minimize them, which would cause the Hawthorne effect¹⁶ and result in fewer actual incidents. An example of this is that the capnograph/capnometer was added to the equipment bag in service A during the study period, possibly leading to a lack of forgotten capnograph/meter incidents during the latter study period.

Service A was the first and, originally, only group to participate. After discovering a large volume of self-reported incidents, we added service B. Thus, service B personnel who were aware that service A was previously enrolled may have understood that there were reasons to expand the study to a second service. This may

TABLE 3. Experts' Suggestions for Avoiding Future Incidents

Expert No.	Suggested Solution				
	Checklists	SOP	Simulation	Training	Unavoidable
1	19% (55)	39% (114)	6% (17)	18% (51)	18% (53)
2	34% (99)	16% (47)	10% (29)	34% (97)	6% (17)
3	6% (18)	8% (24)	0% (0)	14% (41)	71% (206)
Combined from all experts	20% (172)	21% (185)	5% (46)	22% (189)	32% (276)

have influenced the responses in service B, potentially resulting in underreporting to make their service appear safer.

The study may also have served as an immediate posttransport debriefing, satisfying participants that the incidents were resolved, after which, they forgot about them, leading to underreporting in the hospital's system. Alternatively, the medical and technical challenges during transport may have been so impactful that incidents were overlooked. Although this issue could theoretically be resolved by including dedicated study observers on each transport, this was considered too excessive. Regardless, according to Oslo University Hospital's SOPs, reporting these incidents is mandatory.

Incident underreporting may also be due to a local or general culture in emergency medicine in which personnel expect incidents to occur and are therefore prepared for them. When an expected incident occurs, personnel may not consider it to be an incident at all because it was easily handled (i.e., as a result of competence) and therefore not report it.

A person-centered reason for underreporting incidents may be the sense that one is accusing one's colleagues, and thus, they could avoid reporting even serious incidents. Another reason could be a culture of not reporting incidents, either because of a perception that service leaders do not have incidents or because personnel avoid admitting reporting that would make them or their colleagues vulnerable. We tried to avoid similar resistance to self-reporting by ensuring the participants' anonymity.

There may be other reasons why incidents are not reported in the electronic incident reporting system.¹⁷ One such reason might be the electronic incident reporting system itself, which is time-consuming and cumbersome, as it requires logging in, registering the patient's 11-digit identification number, describing the incident, suggesting potential consequences, grading severity, and suggesting solutions. This reporting system may also be more difficult to access for prehospital personnel than it is for hospital staff. In the study, we avoided this by using a low-effort self-report data form; to some extent, this may also explain the large discrepancy between self-reported incidents and those reported in the hospital's system. Nevertheless, when incidents go unreported in the electronic incident report system, there is no other system available, and thus, it is left to individual staff to share their experiences with colleagues or use other means of changing procedures, if possible.

Lessons can be learned from other safety-focused professions, such as aviation, which use amnesty-based and/or low-effort systems for their personnel to report incidents. Our expert group's suggested solutions for avoiding future incidents correspond with some of these (e.g., checklists, SOPs, and training).¹⁸ This, however, requires that incidents be reported so that the organization can learn from them. Incident reporting should be a blameless system, focused on systems rather than individuals, to facilitate patient safety.^{19,20}

The large proportion of unavoidable incidents implicates not only the need to prevent the incidents but also the importance of knowledge in how to deal with them. This calls for targeted training and simulation of the personnel before their participation in these transports. In that way, the personnel will be prepared to handle the unavoidable incidents.

The study results are based on 2 services, one (service A) initiated concurrent with the study and the (service B) previously well established. Nevertheless, they both experienced many incidents, surprisingly, few of which were reported in the electronic incident reporting system, suggesting an overall culture of underreporting. There is no change in the degree of reporting, demonstrating that no improvement in culture was seen over the years between the study periods. The high degree of underreporting is unfortunately described for other services as well.²¹ This may give a false impression of a safe system and veil potentials of improvement.

Our expert group diverged in their evaluations of the potential harm from the self-reported incidents, which incidents should be reported and how they might be prevented, particularly in regard to the number of unavoidable incidents. This surprising discrepancy is difficult to explain completely but is previously described for other experienced reviewers.²² Although these experts had similar professional backgrounds, diverse personal experiences may play a part. Different local cultures regarding incident reporting may also have been a factor.

Limitations

Our study depended on voluntarily self-reporting of incidents; thus, one of its limitations was likely to have been underreporting.¹⁴ The percentage of missing forms (26%) may have been due to a concurrency conflict; both services receive emergency assignments and are quite busy with multiple daily assignments. On-call services are vulnerable to time conflicts, resulting in down-prioritizing participation in a research project. Other reasons of nonparticipation may have been lack of information or disagreement with the study itself. We tried to avoid this by thorough information of the study and guarantees of anonymity and acceptance among local representatives and leaders at the participating organizations.

Incidents might also have been either overreported or underreported with a personal agenda to show that transports are either more or less safe than reality. Both services had 2 participants in each transport who were eligible to fill out a self-report form. The forms were posted anonymously so that the participants were blinded to the reports of others. This may have reduced individual agendas to either overreport or underreport incidents.

None of the experts had any particular background in patient safety research. Because we chose to use the experts' individual review as evaluation methodology, they primarily had to have experience from the service. A better alternative might have been a multidisciplinary panel of our experts together with experts in patient safety work gathered to discuss each form aiming for a consensus decision on each incident. This methodology, which was considered, was, however, too expensive to arrange within the resources of the project.

CONCLUSIONS

A large number of incidents do occur during interhospital transport of critically ill patients in Norway. Many of these incidents are potentially dangerous or catastrophic, and reporting them in the hospitals electronic incident system is therefore mandatory. Despite this, hardly any incidents from 2 different services were reported in the hospital's electronic incident reporting system.

This large degree of underreporting implicates that important lessons may be missed, system errors with predominant probability are repeated, and service quality may be overrated; hence, transports seem to be safer than they actually are.

The interhospital transport of critically ill patients is a well-established procedure and should be subjected to the same level of inquiry as the in-hospital treatment for these patients to secure quality and patient safety. This includes an improved failure culture instead of a “failures happen” culture. It is imperative to learn from reported incidents to obtain a systematic improvement of these transports.

These results emphasize some of the existing challenges in regard to the quality and safety of the interhospital transport of critically ill patients.

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