Peer reviewed article

Impact of an intervention to control risk associated with patient transfer

Jean-Blaise Wasserfallen[a], *Nicolas Meylan*[b], *Marie-Denise Schaller*[c], *René Chioléro*[c], *Daniel Fishman*[d]

[a] Medical Directorate
[b] Nursing Directorate
[c] Adult Intensive Care Unit
[d] Interdisciplinary Emergency Centre
University Hospital, Lausanne (Switzerland)

Summary

Question under study: Hospitals transferring patients retain responsibility until admission to the new health care facility. We define safe transfer conditions, based on appropriate risk assessment, and evaluate the impact of this strategy as implemented at our institution.

Methods: An algorithm defining transfer categories according to destination, equipment monitoring, and medication was developed and tested prospectively over 6 months. Conformity with algorithm criteria was assessed for every transfer and transfer category. After introduction of a transfer coordination centre with transfer nurses, the algorithm was implemented and the same survey was carried out over 1 year.

Results: Over the whole study period, the number of transfers increased by 40%, chiefly by ambulance from the emergency department to other hospitals and private clinics. Transfers to rehabilitation centres and nursing homes were reassigned to conventional vehicles. The percentage of patients requiring equipment during transfer, such as an intravenous line, decreased from 34% to 15%, while oxygen or i.v. drug requirement remained stable. The percentage of transfers considered below theoretical safety decreased from 6% to 4%, while 20% of transfers were considered safer than necessary. A substantial number of planned transfers could be "downgraded" by mutual agreement to a lower degree of supervision, and the system was stable on a short-term basis.

Conclusion: A coordinated transfer system based on an algorithm determining transfer categories, developed on the basis of simple but valid medical and nursing criteria, reduced unnecessary ambulance transfers and treatment during transfer, and increased adequate supervision.

Key words: patient transfer; risk assessment; hospital care

Introduction

Hospitals are becoming increasingly interconnected with other health care providers in an overcrowded health care system. As a result, they can no longer admit all patients or afford to keep them until they can go home. In Switzerland, legal and insurance considerations mandate that patients be treated at their local hospital as soon as they no longer need the technical facilities of larger hospitals [1]. Finally, a prospective payment system tends to shorten hospital stays further [2]. Hence patients increasingly need to be transferred from hospitals to rehabilitation centres or nursing homes in the course of the same condition.

In Switzerland the dispatching hospital is responsible by law for these transfers, and responsibility extends until the patient is admitted to the new health care facility [3]. This fact is often unknown to hospital managers and physicians, and the organisation of such transfers is assigned to an external ambulance company without the dispatching hospital being able to control the quality of the service provided. Depending on the type of disease, haemodynamic stability, type of care, and equipment of the patient, transfer may constitute a risk to his health, or even life, and requires adequate supervision [4].

With specially trained personnel, accidents secondary to patient transportation are rare [5–9] and these specialised teams are cost-effective [10]. Transporting patients between hospitals was shown to be safe, even in the early hours after life-threatening events such as myocardial infarction [11], acute severe unstable respiratory and circula-

Financial support: none.
Competing interests: none.
Funding: none.

tory failure [12] or use of high-technology devices such as intra-aortic balloon pumps [13] or extracorporeal membrane oxygenation [14]. Published guidelines exist for air and ground transportation of paediatric patients [15] and for inter- and intrahospital transport of critically ill patients [16].

Transfer organisation is therefore an important step in ensuring patient safety. When transfers are organised by different wards in the same hospital, different options and types of supervision may be selected without hospital management having an opportunity to oversee actual practice, assess the concrete risk and improve practice.

Our aim was to define safe transfer conditions based on adequate risk assessment, coordinate transport organisation and prospectively assess the impact of this intervention on our hospital's transfer practice.

Patients and methods

Definition of transfer categories

A working team involving a registered nurse and paramedic (NM), two physician heads of intensive care units (MDS, RC), and a physician involved in the Emergency Department (DF) developed a simple, unambiguous algorithm to define transfer categories based on patient destination, type of treatment, and supervision needed to limit risk during transfer. This algorithm was based on existing guidelines [15, 16], adapted to local conditions and implemented in all wards in the hospital. It is shown in the Appendices.

Prospective testing of the algorithm over 6 months

The utility of this algorithm was tested in a prospective survey of all transfers carried out from our hospital to other health care facilities over a 6-month period. Conformity with the algorithm criteria was assessed by NM for every transfer, and percentages of nonconformity were computed for each of them, allowing assessment of the potential for improvement and appropriateness of transfer categories.

Implementation of transfer coordination centre and algorithm

After this first phase, a transfer coordination centre was set up to guarantee application of the algorithm. For any transfer to another facility, the hospital ward contacts the centre by computer as soon as possible to book the appropriate transport vehicle according to the patient data entered in the algorithm. A part-time transfer coordinator and 2 transfer nurses were hired to run the system (check the request, assist the wards if needed and carry out some of the transfers). Negotiations were carried out with the ambulance companies to select one willing to accept the conditions linked to the project: provision of a conventional vehicle for low-risk transfers, and acceptance of hospital nurses and physicians for staffing of intermediate- and high-risk transfers respectively. The whole process took over 1 year to complete.

Prospective impact assessment of transfer coordination over 1 year

After transfer coordination had been implemented, the same survey as described above was carried over a whole year. Detailed data on transfer characteristics were available for all patients, but data on compliance with the algorithm were available only for 74% of the transfers, the others being carried out by different ambulance companies on behalf of our main partner but complying with safety requirements. Patients with incomplete data were included only to describe the trend in the number of transfers over time, but were excluded from the rest of the analysis.

The analysis compared the distribution of the different variables before and after the intervention. The initial period of 6 months served as baseline, and 2 consecutive periods of 6 months each after the intervention were used to test the stability of the new system. Conformity with the algorithm criteria was assessed in 3 categories: safer than necessary, as safe as required, and below theoretical safety.

As this study only observed current practice and did not involve patients directly, no ethics committee approval or patient consent was needed.

Results

Patient origins and destinations

Over the 3 periods of observation, an increasing number of patients were transferred to other health care settings (1467, 1964 [+34%] and 2063 [+40%] patients in the initial, first and second evaluation periods respectively). Most of this increase concerned the emergency department, as a result of the overstretched health care system in the Canton of Vaud. As a result, most private patients were transferred to private clinics directly from the emergency room if they did not specifically need the university hospital's equipment. Because of incomplete data, 503 and 727 patients were then excluded from the first and second evaluation period respectively. For the remaining patients, the distribution of services requesting transfers and the distribution of destinations are shown in tables 1 and 2.

Characteristics of the transfers

The characteristics of the transfers are shown in Table 3. While the number of transfers carried out by the ambulances run by our transfer centre remained stable, there was an increase in the number of transfers to nursing homes or rehabilitation centres by conventional vehicles instead of ambulances.

There was a slight drop in the number of patients with no equipment. The transfer coordina-

Table 1
Distribution of the departments requesting patient transfers.

Type of ward	Initial period (6 months) Number (n = 1467)	%	First evaluation period (6 months) Number (n = 1461)	%	Second evaluation period (6 months) Number (n = 1535)	%
Emergency Department	406	28	579	40	585	38
Cardiology	154	11	109	7	113	8
Internal Medicine	144	10	141	10	173	11
Neurology	101	7	97	7	113	8
Neurosurgery	96	6	81	5	81	5
Intensive Care Units	81	5	82	6	84	5
Orthopaedics/Traumatology	77	5	78	5	74	5
General Surgery	76	5	95	7	95	6
Cardiovascular Surgery	70	5	23	1	17	1
Miscellaneous	262	18	176	12	200	13

Table 2
Distribution of destinations by type during the 3 study periods

Type of destination	Initial period (6 months) Number (n = 1467)	%	First evaluation period (6 months) Number (n = 1461)	%	Second evaluation period (6 months) Number (n = 1535)	%
Hospital+rehabilitation	1102	76	1001	68	1063	69
Private clinic	149	10	232	16	238	16
Nursing home	106	7	143	10	147	9
Home	33	2	31	2	29	2
Other destination	77	5	54	4	58	4

tion centre had a major impact by reducing the number of intravenous lines left in place for "safety" reasons from 34% to 15%, but no impact on the number of drugs infused during transfer. However, the percentage of lines used during transfer increased from 29% to 88% and 75% during the first and second evaluation periods respectively. The 2 most frequently infused drugs were heparin (3.3%, 4.6%, and 5.4% in the three periods respectively), and potassium chloride (1.7%, 2.6%, and 1.7% in the three periods respectively).

While the number and percentage of transfers requiring an accompanying emergency medical technician according to the algorithm slightly decreased, those requiring an accompanying nurse, and particularly a physician, increased.

Transfer organisation

During the initial period the hospital transportation service carried out a large number of these transfers (72%). As compared with the algorithm, the more complex the situation, the more often the transfer was organised by the personnel of the ward in which the patient was hospitalised: 80% (16 out of 25 cases) when an accompanying physician was required, 33% (40 out of 118), when an accompanying nurse was required, 25% (310 out of 1143) when an ambulance assistant was needed and 10% (15 out of 157) when no accompanying person was required. During the 2 evaluation periods all transfers were organised by the transfer centre.

Compliance with the algorithm

In the initial period, of the 118 transfers requiring an accompanying nurse according to the algorithm, only 36 (31%) were accompanied by a nurse. Similarly, of the 25 transfers requiring an accompanying physician according to the algorithm, only 14 (56%) were accompanied by a physician.

In the 2 evaluation periods, of the 92 and 87 transfers requiring an accompanying physician according to the algorithm, 35 (38%) and 30 (35%) were accompanied by a physician. All other transfers were "downgraded" to an accompanying nurse, and the level of safety judged adequate, though below the theoretical level, by the transfer coordinator and the requesting ward. Of the 157 and 164 transfers requiring an accompanying nurse according to the algorithm, 157 (100%) and 153 (93%) were accompanied by a nurse. In addition, 7 of the remaining transfers (4%) were covered by a physician (ie, were safer than necessary), while only 4 (2%) were considered below theoretical safety. Finally, an accompanying nurse carried out 324 of the 1212 (27%), and 312 of the 1284 (24%) transfers requesting an emergency medical technician, providing a service safer than necessary. Global distribution of safety levels across all accompanying personnel categories is shown in Table 4. No incident was recorded in all 3 periods, including during transfers of patients with incomplete data.

Table 3
Characteristics of the transfers.

Characteristics of transfers	Initial period (6 months) Number (n = 1467)	%	First evaluation period (6 months) Number (n = 1461)	%	Second evaluation period (6 months) Number (n = 1535)	%
Type of transport						
Helicopter	23	1	57	4	42	3
Ambulance	1263	86	1127	77	1181	76
Conventional vehicle	157	11	264	18	301	20
Patient association	24	1	13	1	11	1
Medical equipment						
None	812	56	794	54	799	52
Oxygen	245	17	291	20	322	21
Intravenous line	506	34	200	14	236	15
Intravenous drug	149	10	176	12	178	12
Accompanying person required						
Emergency medical technician	1324	90	1212	83	1284	84
Nurse/paramedic	118	8	157	11	164	10
Physician	25	2	92	6	87	6

Table 4
Distribution of safety levels of transfers for all accompanying personnel categories.

Safety level	Initial period (6 months) Number (n = 1467)	%	First evaluation period (6 months) Number (n = 1461)	%	Second evaluation period (6 months) Number (n = 1535)	%
Safer than necessary	0	0	324	22	319	21
As safe as necessary	1374	94	1080	74	1155	75
Below theoretical safety	93	6	57	4	61	4

Discussion

An algorithm determining safe patient transfer categories was developed in a tertiary university hospital, based on very simple but valid medical and nursing criteria. When applied in practice, it showed that some transfers did not meet these defined safety criteria before implementation of a transfer coordination centre, while the situation improved after this intervention. Even if no serious incident occurred, risk management mandates that specific steps be taken by hospitals to prevent incidents or accidents during patient transfer, as this activity is the dispatching hospital's responsibility [17]. As overcrowding of hospitals is a growing feature necessitating increased transfers of patients at an earlier stage after stabilisation of their condition, this risk is growing accordingly and demands serious consideration.

Between the 2 study periods the number of patients transferred increased by 40%, mainly to private clinics and rehabilitation centres, as public hospitals were no longer able to accommodate all patients presenting at the emergency department without increasing the number of patients transferred to other facilities both for acute and chronic care. This change in policy was a direct consequence of budget restrictions and hence bed closures. The main impact of setting up a transport coordination centre was to provide transport nurses when needed, to restrict drugs used during transfers and to downgrade supervision needs in a substantial number of cases, thereby facilitating transfer implementation and reducing risks and costs.

Compliance with the algorithm increased but remained below 100%, available resources being inadequate to cover for weekends, especially in the case of transfers requiring an accompanying physician. On the other hand, the system allowed safer transfers than necessary in some 20% of cases. Even if the number of transfers considered below theoretical safety decreased, it chiefly involved transfers requiring an accompanying physician according to the algorithm, hence high-risk patients. Some of the difference can be regarded as "overcoding" by the algorithm, as transfers to intensive care units of smaller hospitals would be directed to intermediate care units in tertiary hospitals and would be "downgraded" to an accompanying nurse. In future, however, nursing and medical shortages are likely to affect these results in all hospitals. An additional effort is currently under way to further decrease the number of potentially dangerous drugs infused during transfers.

This kind of risk management approach is conditional on several things: 1) that hospital managements understand their responsibilities, 2) that ambulance companies agree to provide a limousine for transfer of low-risk patients and agree to the hospital providing the assistance of trained personnel for these transfers [6, 8, 9], and 3) that both types of health care professionals change their practices [4], negotiate agreements and organise a centralised transport system. These steps take time to implement. Once the new management system is working, however, [18] the risk can be considered negligible as the central organisation is responsible for carrying out algorithm-based patient classification and transport organisation, as was demonstrated in the prospective impact assessment. Computerisation of the transfer order form further ensures that all patients receive similar quality of care.

Quality of care has a cost, and adoption of this kind of standard may have different financial implications depending on the health care system [19]. On the other hand, injury due to negligence may prove very costly [20]. The cost-effectiveness of different transport models has only been studied in paediatrics, where it was shown that in most conditions accompanying registered nurses are less costly than emergency medical technicians or combined teams of registered nurses and respiratory therapists [21]. In our study we did not focus on this issue but the increased cost linked to adoption of the new system was limited by tariff negotiations, and was deemed worth paying.

Surprisingly, data on safety of transfer between hospitals are scarce in the literature. They chiefly involve single centre or country experience of a limited number of patients, and particularly severe conditions such as myocardial infarction [11], acute severe unstable respiratory and circulatory failure [12] or use of high-technology equipment such as intra-aortic balloon counterpulsation [13] or extracorporeal membrane oxygenation [14]. The outcome of transferring patients with less severe conditions is largely unknown. This does not imply, however, that it is absolutely safe.

The main limitation of our study is the low return rate of data in the post-intervention period (74%), due to subcontracting of transfers to other ambulance companies. However, our staff was also responsible for checking the equipment of these ambulances. The only exceptions were transfers carried out by an ambulance from another hospital or hired by an insurance company. Our results can therefore be considered reasonably reliable.

Second, it involved only one hospital, and thus its conclusions cannot be extended to other hospitals without taking into account the different characteristics of the health care system. Third, the study did not cover the reasons for noncompliance with the algorithm, an issue that must be addressed in order to correct the system. Finally, patient long-term outcome after transfer was not recorded, thus overlooking any deterioration possibly linked to premature hospital discharge. However, this study did serve to identify a risk, assess it, and take preventive measures before an incident or accident occurred, thus providing at least preliminary data on safety of transfers in frequently encountered conditions.

Furthermore, it showed that it was possible to draw the attention of hospital management to an activity which is at the hospital's interface with other health care providers but still part of its responsibility. This kind of project may have a positive impact on the external image of the hospital, even if the relevance of this indicator is very difficult to evaluate.

The authors thank all collaborators in the different wards who allowed data collection and assessment.

Correspondence:
J.-B. Wasserfallen, MD MPP
Medical Direction
University Hospital (CHUV)
CH-1011 Lausanne
E-Mail: jbw@chuv.ch

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Appendix 1

Definition of transfer categories

The algorithm for classification of patients into different transfer categories was defined and involved three steps.

Step 1: Assess patient's destination. Transfers to nursing homes, rehabilitation centres or normal wards in hospitals can be carried out with a trained emergency medical technician (EMT). Transfer to an intermediate care unit should be carried out with a nurse trained in intensive care, anaesthesiology, intermediate care or emergency care. Transfer to intensive care units should be carried out with accompanying physicians trained in emergency or intensive medicine.

Step 2: Assess patient's equipment. According to the kind of respiratory assistance, infusion, drainage, pacing and fixation systems, the accompanying person should be an EMT, a nurse or a physician. The choice is left to the ward's discretion, as the patient's underlying characteristics could play a role and mandate either an increased or decreased level of monitoring. Detailed distribution of criteria for each category is shown in Appendix 2.

Step 3: Assess medication need. Only drugs which cannot be discontinued for the duration of the transfer are considered. Again, depending on the type of drug and supervision needed, an ambulance assistant, a nurse or a physician should be selected. Detailed distribution of drugs for each category is shown in Appendix 3.

The accompanying person eventually carrying out the transfer is the most qualified person requested in Step 1, 2 or 3.

Finally, if the accompanying person is an EMT, the type of vehicle chosen depends on whether the patient can move, requires a wheelchair or must lie down. In the first case, a conventional car is used, driven by an EMT. In the second case, a society specialised in transporting the handicapped is called and asked to carry out the transfer. The third case requires a conventional ambulance with an EMT crew.

Appendix 2

Algorithm for assessment of patient's required assistance by type of equipment

STEP 2. EQUIPMENT	Minimally required assistance		
	Ambulance assistant	Nurse	Physician
RESPIRATOR			
Respirator			√
Naso/orotracheal tube			√
Cannulated tracheotomy		√	
Non-cannulated tracheotomy	√		
Ventimask $Fi0_2$ <0.35	√		
Ventimask $Fi0_2$ >0.35		√	
Nasal prongs	√		
Mucus aspirator		√	
CATHETERS			
Peripheral catheter	√		
Central catheter	√		
Swan Ganz catheter			√
Arterial catheter		√	
Peridural catheter		√	
Port-a-cath	√		
TUBES			
Gastric and/or jejunal tube	√		
Percutaneous feeding tube	√		
Bladder suprapubic drain	√		
Bladder drain	√		
Continuous bladder/irrigation		√	
DRAINS			
External ventricular drain		√	√
Thoracic drain		√	
Pericardial drain		√	
Retrosternal drain		√	
Aspiration drain	√		
Penrose	√		
PACING			
Internal pacemaker		√Implant <24h	
External pacemaker			√
Epicardial pacemaker		√	√
MISCELLANEOUS			
External fixator	√		
Traction	√		
Extension	√		
Braun splint	√		
Arterial compression dressing	√		

√ : Required
☑ : Optional
Depending on patient state and/or drug dosage

Appendix 3

Algorithm for assessment of patient's required assistance by medication need

STEP 2. EQUIPMENT	Minimally required assistance		
	Ambulance assistant	**Nurse**	**Physician**
Adrenalin			√
Amiodarone		√	
Amoxicillin + clavulanic acid	√		
Atropine		√	
Blood transfusion		√	
Butylscopolamine	√		
Chemotherapy		√	
Clonazepam		☑	√
Dexamethasone		√	
Diazepam		√	
Dobutamine		☑	√
Dopamine		☑	√
Fentanyl			√
Furosemide		√	
Haloperidol		√	
Heparin <10000 Ul/24 h	√		
Heparin >10000 Ul/24 h		√	
Hexoprenaline		√	
Insulin		√	
Isosorbide dinitrate		√	
Labetalol		☑	√
Lidocaine		√	
Magnesium	√		
Midazolam		√	
Morphine		√	
Neo-synephrine			√
Nitroprussic acid			√
Noradrenaline			√
Octreotide		√	
Paracetamol	√		
Phenytoin		☑	√
Potassium chloride		☑	√
Propofol			√
Tirofiban		☑	√

√ : Required
☑ : Optional
Depending on patient state and/or drug dosage

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