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**An ergonomics evaluation of the manual  
handling operations of UK ambulance staff, with  
particular emphasis on the risks associated with  
the use of carry chairs**

**ERG/03/24**

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## **BACKGROUND**

A recent survey of accident and incident data collated from six UK ambulance service Trusts has shown that between 30 and 51% of all recorded incidents involved the moving/handling of loads and resulted in some form of musculoskeletal injury (Boocock et al., 2002). With a mean incidence rate of 178 per 1000 employed, ambulance personnel were considered to have an 18% risk of sustaining a musculoskeletal injury due to the moving/handling of loads. Furthermore, sickness absence due to musculoskeletal injury was suggested to result in an absence rate of 8.25 days per employee, per year. It is for these reasons that the ambulance profession is viewed as a high risk occupation for which the Health and Safety Executive are seeking ways of promoting and improving safer working practices.

The emergency carry chair is one of the principal handling aids used by the UK ambulance service for transporting patients to and from public/domestic dwellings. A recent analysis of 1039 incidents identified the use of the carry chair as one of the three main tasks linked to accident/injury causation (Boocock et al., 2002). However, knowledge and experience of handling practices associated with the use of this equipment is limited, and organisations such as HSE are often restricted in the provision of information and advice that they can offer to employers/users. There is, therefore, a need to provide objective, independent evaluation of current handling practices involving the use of carry chairs so that employers and users can be better informed about the risks.

Whilst over many years the basic design of the carry chair has remained unchanged, recent innovations, such as specially designed wheeled-based systems for manoeuvring up/down stairs, are now available to users. These new handling aids claim to offer significant benefits over the traditional methods of lifting and carrying a seated patient, by reducing the risk of injury to operators.

## **AIMS AND METHODOLOGY**

The overall aim of this study was to determine the risks associated with patient transfers of seated patients using emergency carry chairs by UK A&E ambulance personnel. More specifically, the study sought to:

- (1) Identify risk factors associated with the use of the emergency 'carry' chair during 'normal' day-to-day operations of A&E personnel;
- (2) Evaluate the extent to which 'carry' chair design, patient behaviour/condition and workplace factors impact on the risk of injury to A&E personnel; and
- (3) Determine the level of exposure to manual handling operations arising from the normal daily activities of A&E ambulance staff.

To achieve these aims, the study adopted the following methods:

- (1) A questionnaire survey of A&E personnel to elicit opinions as to the risk factors arising from the use of emergency 'carry' chairs;
- (2) Semi-structured interviews with ambulance personnel to identify design issues, working practices and work organisation impacting on the safe use of 'carry' chairs;
- (3) Observation of patient handling tasks performed by A&E staff as part of their normal working practices; and
- (4) Documentation of patient handling tasks in order to determine the exposure to manual handling operations and, in particular, risks encountered during patient transfers involving the 'carry' chair.

To ensure a focused approach this study was restricted to the working practices and handling procedures adopted by A&E ambulance personnel. Whilst acknowledging that PTS staff are faced with similar handling problems, accident information would suggest that A&E staff are at an increased risk of injury (Boocock et al., 2002).

### **BACKGROUND TO THE THREE PARTICIPATING TRUSTS**

All three trusts covered large geographical areas, both urban and rural. Trust C was the largest employer of A&E personnel with approximately 925 staff compared to approximately 536 and 527 at trusts A and B, respectively.

Initial enquiries regarding the principal make and model of carry chair in regular service at each trust suggested the following distribution of carry chairs:

- Trust A: Ferno Compact 3 (Ferno UK Ltd) and Ferno Mobylye (Ferno UK Ltd);
- Trust B: Ferno Compact 2 (Ferno UK Ltd); and
- Trust C: IBEX Transeat (21<sup>st</sup> Medical Ltd)

At the time of the study, these were considered to represent the primary makes and models used throughout the UK ambulance service.

Only following visits to each trust was it possible to identify the actual types of carry chairs in use by A&E staff, which often revealed a variety of chairs (e.g. retrofit or slightly modified versions) other than those listed above. In the case of Trusts A and C, some frontline vehicles carried more than one type of carry chair, thereby allowing staff the option to select between which chair they used. The 3 main carry chairs used in the study are shown in the following photographs along with the distribution of chair types most frequently used across each of the trusts expressed as a percentage of total respondents.



Ferno Mobyler (Ferno UK Ltd)

Ferno Compact 2 (Ferno UK Ltd)

IBEX Transeat

Figure 1. The makes and models of the three main carry chair designs used within the three ambulance trusts

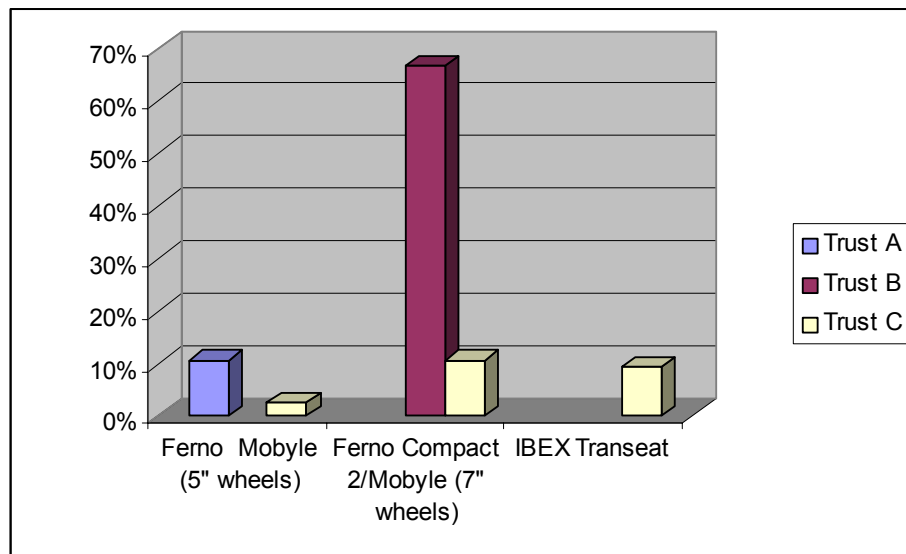


Figure 2. Distribution of chair types most frequently used across each of the trusts expressed as a percentage of total respondents.

## SUMMARY OF FINDINGS

This summary of the findings combined:

- 114 questionnaire responses;
- 210 incident forms completed by A&E personnel immediately after an incident involving patient transportations; and
- approximately 10 visits conducted by ergonomists of the Health and Safety Laboratory which included riding with and observing the working practises of the ambulance crews.

Despite this number of questionnaires and incident forms return, this reflects a 5% response rate which is considered low. Possible reasons for this are explored in the full report.

The results look at 'carry' chair usage, 'carry' chair usability, 'carry' chair design and organisational issues.

### 1. 'Carry' chair usage

Results showed that carry chairs were used in 38% of incidences involving patient transportation which was greater than other methods such as walking the patient (35%) or using a stretcher (17%). 70% of transfers of patients to the ambulance were from residential properties. Patient transportation *from* the ambulance was most commonly performed using a stretcher (60%). Figure 3 illustrates both the observed and reported frequencies for each handling environment encountered by carry chair users.

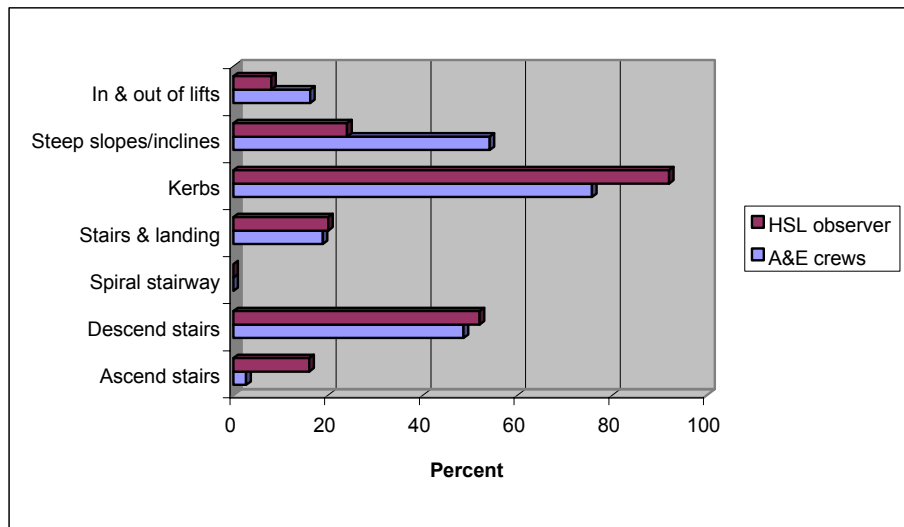


Figure 3. Handling environment faced by users of the carry chair

The most common handling environments encountered by the A&E crews involved:

- movement up/down kerb stones (approx. 80% of incidences);
- descent of stairs (approx. 50% of incidences) and;
- movement on steep slopes (approx. 50% of *reported* incidences).

***Surfaces over which carry chairs were pushed/pulled***

The floor surfaces over which carry chairs were most often pushed or pulled included carpets and smooth surfaces, which were identified in approximately 68% and 52% of incidents, as illustrated in Figure 4.

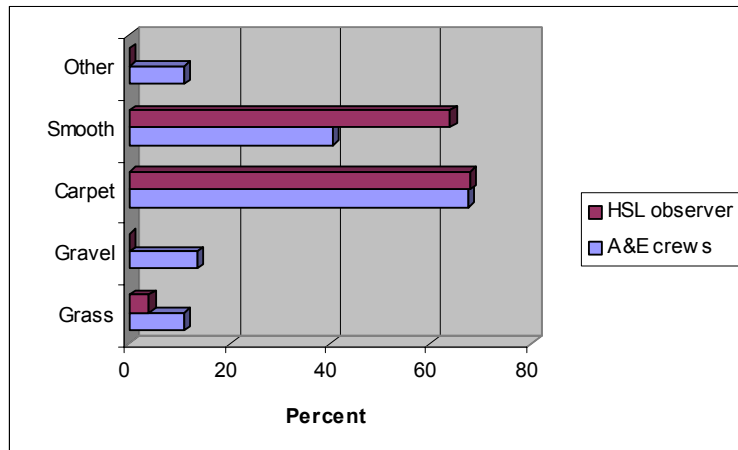


Figure 4. Surfaces over which carry chairs were pushed/pulled

**2. Carry chair usability**

***Lifting from the foot and head-end of the chair***

A&E staff rated the ease of lifting the chair from a horizontal surface while standing at both the Head-End (HE) and Foot-End (FE) of the chair, taking into consideration a patient of average and heavy weight. As Figure 5 shows, A&E staff generally considered that there was no significant difference in the degree of difficulty when lifting from either the HE or FE. Overall, approximately one-third of A&E staff rated the lifting of a patient of average weight (av) as either difficult or very difficult, which increased to approximately two-thirds for patients regarded as heavy (hv).

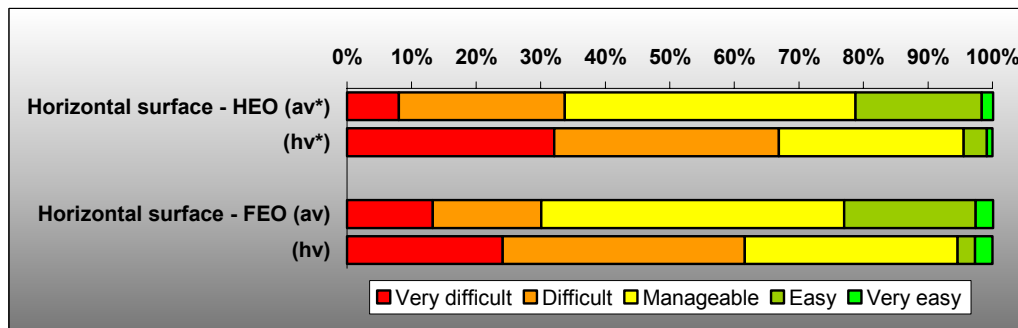


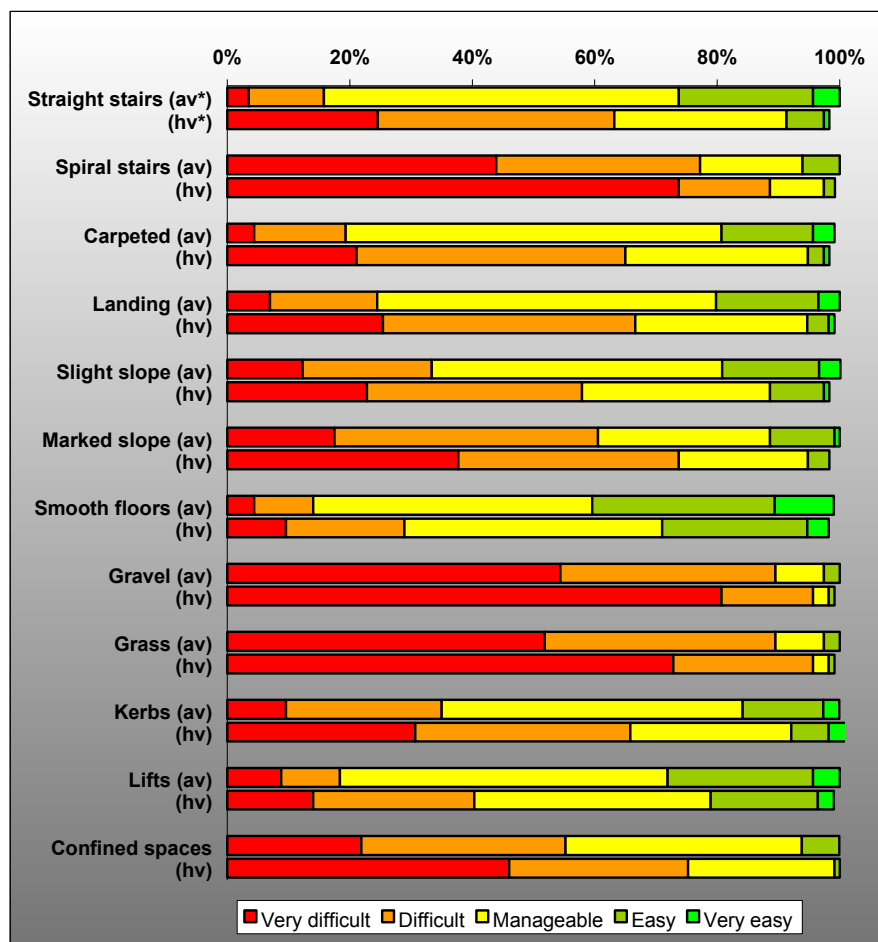
Figure 5. A&E staff responses about the ease of lifting the chair (with average or heavy patients) from a horizontal surface while at both the HE and FE

### ***Transporting the chair to the patient***

When asked to indicate how they transported the chair to the patient, nearly all A&E staff (95%) indicated that they transported the chair in a folded position, with only approximately 4% indicating that they would first assemble the chair prior to taking it to the patient. This suggests that A&E staff normally elect to carry the chair, as opposed to assembling it and wheeling it to the patient. This may be due to a perception that such a method is quicker and easier to adopt, with the majority of chairs not representing a difficult or heavy object to carry.

### ***Ease of use of occupied carry chair in various environments***

The ease of use of the 'carry' chairs depended greatly on the environment in which they were used. Figure 6 illustrates the perceived ease of use in a variety of environments with both an average sized patient (av) and a heavy patient (hv):



\*av – patient of average weight; hv patient of heavy weight

Figure 6. A&E staff responses to the question 'Rate the ease of use of the chair in each of the following environments when carrying an average and heavy patient'

From this graph it can be seen that using the carry chairs was considered most difficult when:

- ascending/descending spiral staircases;
- pushing on grass or gravel surfaces;



- manoeuvring in confined spaces; and
- manoeuvring along a marked slope.

### ***Patient transfer during incidences***

As part of each incident report, both A&E staff and HSL observers identified the handling tasks performed during each patient transfer. As Figure 7 illustrates, the 3 most commonly performed patient transfers involved:

- 1) carry chair to stretcher (27%);
- 2) stretcher to bed or trolley (20%); and
- 3) chair to carry chair (16%).

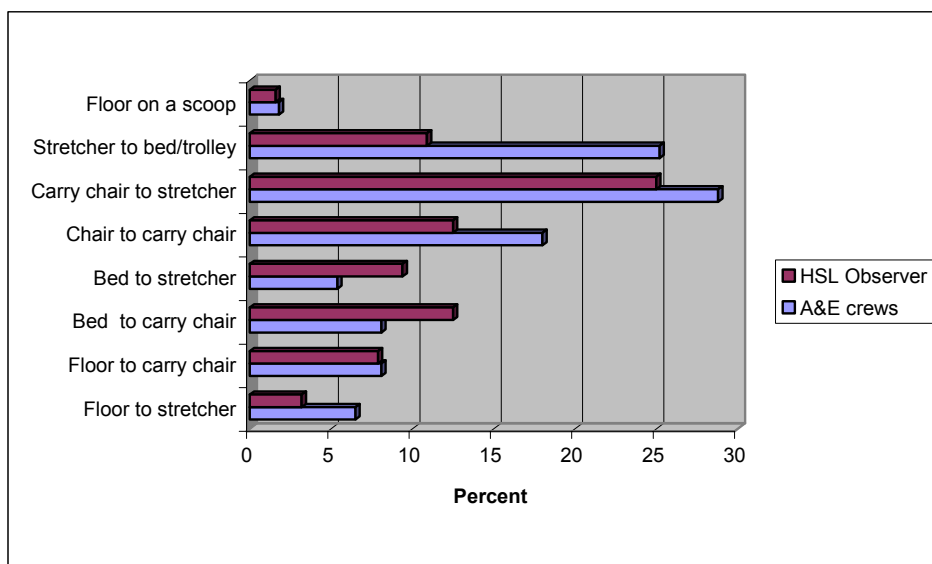


Figure 7. Patient transfers occurring during assessed incidents

When asked to comment about features of the chair that can affect the ease of patient transfer during common handling tasks (e.g. bed-to-carry chair, carry chair to stretcher), the majority of respondents (approximately 75%) did not consider any particular feature of the chair to hinder these tasks. Of the remaining 25% of respondents who did identify problems, three common themes emerged from the responses given by A&E staff:

1. stability of the chair during the patient transfers;
2. mismatch in height between the chair and other equipment; and
3. effects of backrest height on the position and posture of the attendant.

### 3. Carry Chair Design

#### *Handle and wheel design*

When asked to rate the suitability of handle and wheel positions on the carry chair approximately 40% of users rated the HE handle and as being either very poor or poor, as did 35% for the FE handle positions. Wheel position was regarded favourably by 40% of A&E staff, although slightly more felt unable to express an opinion as to an appropriate wheel position and 29% regarded the wheel position as poor.

#### *Size and shape of handles and wheels*

When asked to comment on the thickness of the handles a majority of A&E staff (approximately 62%) regarded them as being of a suitable size. Whilst very few regarded the handles as being oversized, some (approximately 37%) considered them to be too thin.

Wheel sizes and thickness of tread were viewed by many (approximately 80%) as being either too small or too narrow. These results are shown on the following graph (Figure 8).

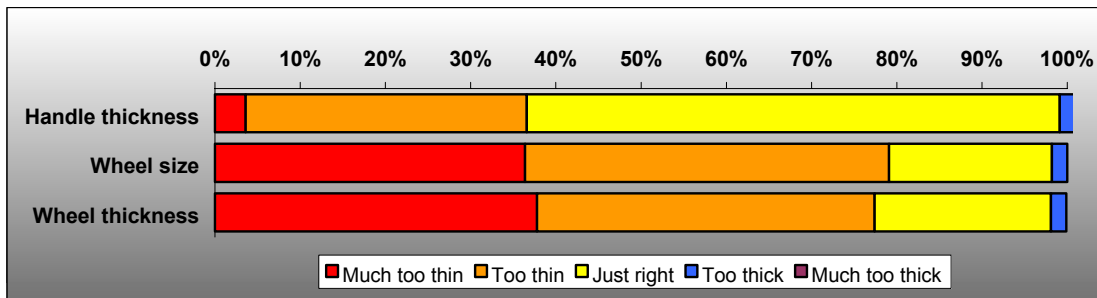


Figure 8. A&E staff responses concerning handle thickness and wheel sizes.

#### *Footrest*

The usability of the footrest was seen by a majority (approximately 60%) as being 'poor' or 'very poor'. No significant difference was identified amongst the users of the different carry chairs.

#### *Chair robustness*

The robustness of the chair was not considered to be an issue with most A&E staff, as a large percentage of respondents (approximately 87%) rated it as being adequate or better than adequate

Other design issues identified by A&E staff during interviews included the following:

- Small wheel size was a factor contributing to difficulties on certain surfaces such as gravel, grass and flag-stone paving.;
- Patient restraint strapping was considered poor on certain carry chairs where there was an absence of lower leg straps, foot straps and upper limb straps (or containment).

- Footrest designs were often considered poor, with inadequate surface area for feet to remain supported once placed on the foot rest.
- Head end handles were often considered to be inappropriately positioned (most commonly too low) and a common desire for adjustability was expressed throughout the A&E staff.
- The poor balance or stability of the occupied chair was a common complaint amongst A&E staff and was often attributed to the lack of upper limb security.
- The 'carry' chairs' compatibilities with other equipment was also a cause for complaint, especially in relation to transporting other equipment along with the chair (such as gas bottles).

#### **4. Organisational Issues**

##### ***Information transfer / training in carry chair use***

General feedback on training suggests that the majority of the crews interviewed received adequate initial training on carry chair use when either beginning ambulance work or receiving a new carry chair model, with a few exceptions.

##### ***Risk assessment and control***

Training in risk assessment and awareness in risk assessment was concluded to be poor throughout the trusts, with few ambulance crew members being involved in or aware of risk assessments made.

## **CONCLUSIONS**

The report concludes that many of the primary functional requirements of A&E work do not appear to be met by many of the carry chairs in regular service; and measures should be taken to increase the awareness amongst manufacturers of these primary functional requirements and limitations in present designs. Consequently, greater consideration should be given towards 'special' situations and dedicated equipment to assist the ambulance crews in certain 'high risk' environments.

As part of stage 2 of this study ergonomists from the Health and Safety Laboratories are conducting laboratory based research to determine the musculoskeletal loads placed on ambulance staff during common carry chair related tasks. Stage 2 of the study intends to:

- 1) To determine musculoskeletal loads imposed on ambulance staff when performing handling tasks involving the use of carry chair equipment;
- 2) To determine the influence of workplace factors and carry chair design characteristics on handling capabilities;
- 3) To provide recommendations and advice on the safe use of carry chairs within the work environment.