Using an ergonomics approach for sustainable improvements in safe patient handling

Erasmus + Conference, Kortrijk
Dr Mike Fray

Personal History

• 1997 Postgraduate programme for patient handling
• 2012 MSc Ergonomics in Health and Community Care
• The Guide to the Handling of People 7th Edition Sept 2019
• Education and research portfolio, equipment solutions, technique evaluations and SPHM interventions.
Ergonomics and Human Factors (EHF)

- EHF is concerned with the understanding of interactions among humans and other elements of a system. It’s the profession that applies theory, principles, data and methods to design to optimise human wellbeing and overall system performance.
- (IEA 2000)
EHF –
A THOUGHT ON LANGUAGE

An ergonomic solution
Vs
An ergonomics solution

Patient Handling Ergonomics

Studies, Solutions, Error and Compliance
What is the main concern for health/care workers in 2019?

Walk into any care facility and what do you see?
Patient Handling Ergonomic(s) Solutions

• Simple
• Intuitive
• Error Free
• Easy to learn
• Even easier to remember

• ‘People should deliver the right solution the first time’
• (Murray et al 2017, You Tube)

Redefining Slide Sheet use in a Healthcare Organisation

Project with GBUK and Darlington and Durham NHS Trust
(Fray, Daniel et al 2017)
82% of respondents gave a wrong selection
<table>
<thead>
<tr>
<th></th>
<th>Equipment</th>
<th>Size cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Single layer Theatre Sheet A</td>
<td>70x190</td>
</tr>
<tr>
<td>2</td>
<td>Single layer Theatre Sheet B</td>
<td>70x190</td>
</tr>
<tr>
<td>3</td>
<td>Pair of Flat Sheets (Coated Polyester, no handles)</td>
<td>70x200</td>
</tr>
<tr>
<td>4</td>
<td>Pair of Flat Sheets (Green Plastic)</td>
<td>70x200</td>
</tr>
<tr>
<td>5</td>
<td>Pair of Flat Sheets (Coated paper)</td>
<td>70x200</td>
</tr>
<tr>
<td>6</td>
<td>Tubular Double bed size (Coated Polyester)</td>
<td>140x200</td>
</tr>
<tr>
<td>7</td>
<td>Tubular Slide Sheets (Coated Polyester, 3 of, full body length)</td>
<td>70x145</td>
</tr>
<tr>
<td>8</td>
<td>Pair of Flat Sheets (Coated Polyester Handles)</td>
<td>70x200</td>
</tr>
<tr>
<td>9</td>
<td>Redi Slide (Coated Polyester, Novel design)</td>
<td>90x220</td>
</tr>
<tr>
<td>10</td>
<td>Tubular Slide Sheets (Polyester 2, Shoulder &amp; hips/calf)</td>
<td>70x145</td>
</tr>
<tr>
<td>11</td>
<td>Tubular Slide Sheets (Polyester 1 of, Shoulder to hips)</td>
<td>70x145</td>
</tr>
<tr>
<td>12</td>
<td>Pair of Flat Sheets Double bed size (Polyester Handles)</td>
<td>140x200</td>
</tr>
</tbody>
</table>

### Single vs Double Layer

![Graph comparing single and double layer equipment](graph.png)
**Surface Area Effect**

- **Trunk Only**
- **Shoulders and legs**
- **Full length**

**Move Up the Bed Errors**

- **Tubular Full sheet**
- **Tubular Head Trunk Sacrum**
- **Tubular Heels to shoulders**
- **Versal Full sheet**
### Worst Force Errors

<table>
<thead>
<tr>
<th>Activity</th>
<th>Best Force</th>
<th>Worst Error Force</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up bed</td>
<td>90.8</td>
<td>175.1</td>
<td>92.8</td>
</tr>
<tr>
<td>Turning</td>
<td>61.9</td>
<td>174.8</td>
<td>182.4</td>
</tr>
<tr>
<td>Lat On Bed</td>
<td>63.5</td>
<td>167</td>
<td>163.0</td>
</tr>
<tr>
<td>Single vs Double</td>
<td>104.7</td>
<td>214.7</td>
<td>105.1</td>
</tr>
<tr>
<td>Surface Area</td>
<td>62.5</td>
<td>132.8</td>
<td>112.5</td>
</tr>
</tbody>
</table>

### Pre-Trial
- 78.8% Always, Mostly, Occasionally confused.

### Post-Trial
- 90.3% stated less confusion

Confusing?

Yes | No | No Answer
--- | --- | ---
100 | 50  | 0
Positional effect on the loads for horizontal transfers
Fray, Holgate 2018 IEA Congress

Aim / Overview

• To quantify the amount of force required in each condition of transfer for both novice and expert users.
• To compare and rank the different conditions from best to worst in terms of force needed.
• Conditions
  1. Parallel Stepping - up the bed (2Px)
  2. Rotation - feet fixed (2Px)
  3. Two person oblique from top of bed (2Px)
  4. Single person pull up the bed
Methods

• Subjects informed of actions.
• Time to familiarise
• Inline electronic force meters were used with flexible hand grips
• Repeated measures for each action x 3
• Variations >5% on the maximum removed
• Subjective data recorded, effort, security, safety, likelihood of use (Expert only)
• (n=10 Novices, 11 Experts)

Total Force per Transfer. R & L Hand n=21

- Single person
- 2 Person Oblique
- Rotation
- Parallel Stepping
Total Force per Transfer. Expert vs Novice

- Single person
- 2 Person Oblique
- Rotation
- Parallel Stepping

Force per person. All subjects.

- Peak
- Average
Single Hand Loads. Left vs Right

- Condition 1: Parallel Stepping
- Condition 2: Rotation
- Condition 4: Single person

Single Hand Loads. Up vs Down

- Condition 1: Parallel Stepping
- Condition 2: Rotation
Subjective Data

- Comfort and safety directly correlated
- Perceived force showed Rotation disliked more than other conditions (p<0.05)
- Perceived force indicated 2 Person Oblique easiest NS.
- Top of the bed positions both (1 and 2 Px) scored best for:
  - Comfort
  - Safety
  - Individual Acceptance

Conclusions.

- Novices > Experts
- Left hand > Right hand
- Significant differences between the conditions
- Oblique 2 person is preferred
- Palms up, flexed elbow = lifting
  - Kemp (2018) 4 different conditions
  - Flexed elbow is key factor on load
- Individual loads did not exceed the recommended loads
- Side stepping and rotation equated to single person top of the bed.
Best hoist format

Get it right from the start.

Fray, Curren, Guldmann ab (in Press)

Aim / Overview

• Repeated measures (n=15 trained carers)
• Quantify and compare the time taken to use 3 hoist types for a range of transfers
• Hoists:
  • Floor Standing Mobile hoist, Single Track Gantry, H-Frame Gantry
• Transfers:
  • Bed to bed-side chair, Bed-side chair to wheel chair, Wheel chair to bed
Methods:

• Single participants, all tasks, squared order
• Manakin Load, Sling in place.
• Video recorded.
• Hierarchical Task Analysis – Task Lists
• Accuracy of placement
• All phases timed and reviewed
• Subjective feedback from participants after all tasks and debrief

Task Comparison:
### Task and Hoist Comparison:

![Graph showing comparison between mobile hoist, ceiling track (fixed), and ceiling track (HFrame)]

### Subjective Comparison:

<table>
<thead>
<tr>
<th>Hoist - Task</th>
<th>Very easy</th>
<th>Easy</th>
<th>Neutral</th>
<th>Hard</th>
<th>Very hard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile – Bed to chair</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Mobile - Chair to wheelchair</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Mobile - Wheelchair to bed</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Fixed- Bed to chair</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Fixed- Chair to wheelchair</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Fixed - Wheelchair to bed</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>H-frame - Bed to chair</td>
<td>8</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>H-frame - Chair to wheelchair</td>
<td>7</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>H-frame - Wheelchair to bed</td>
<td>6</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
Participant feedback

- Mobile Hoist
  - Space was an issue
  - Time consuming with a single carer, and was seen as a 2-person transfer
  - Postural comprise
  - Thought needed to complete the activities
- The Ceiling Track (Fixed)
  - Difficulty in positioning the hoist and extra manoeuvring of equipment was needed
  - More steps required than the H-frame
  - Very Easy to operate and move the hoist
  - Less effort required to hoist the patient
- The Ceiling Track (H-frame)
  - Easy to position the hoist as there was minimal preparation
  - There was no restriction to the access of the hoist
  - Positioning the patient was hard on the bed, due to the moving hoist.

Using Ergonomics to support Single Handed Care

Fray, & Thornton (Applied Ergonomics in Review)
In a Social Care Setting

• Compared Two Person with Mobile Hoist Versus
• Single Person with Ceiling Track Hoist

• Laboratory study
• Field Trials
• Objective and Subjective

Results

• Risks to staff equal or better for SHC with Ceiling track
• Time to deliver equal or better for SHC with Ceiling track
• Feedback from person
  • Better engagement with carer
  • Better security
  • Better comfort ratings
  • Some negative comments from carer groups

• Risk Assessment process to support rollout
What have I learned from these studies?

Work as imagined is usually not work as done.

K.I.S.S.

What have I learned from these studies?

Utilise single equipment and technique solutions
Make the solution easy to learn & remember
Standard and correct responses
Ergonomic(s) solutions can enhance performance?

• To gain support from management
• Collect evidence to support the purchasers goals
• Explore the relationship between interventions and outcomes (TROPHI)

Thank you!

Dr Mike Fray

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References

- Holgate G., and Fray M., (2018) Does carer position around a bed change the force applied when moving a person up a bed. *Column 30.2, NBE UK*
- Fray M., Daniel D., Hindson D., Pattinson L., Metcalfe D. (2017). Does the use of friction reducing devices actually reduce the exposure to high force horizontal transfers. *Column 29.2, NBE UK*