Overloaded?

Dispensing errors in community pharmacy

Dr Hannah Family & Mr Steve Churton FRPharmS

RPS Conference 2014 ~ ICC Birmingham ~ Monday 8th September 2014
What is Mental Workload?

- A multidimensional construct that describes the demands made of an individual’s **limited information processing capacity**.
- The level of demand made is the product of the interplay between an **individual’s characteristics**, the **environment** in which the task is carried out and the **task characteristics**.

When Mental Workload is high or low, it can affect the way our brain processes information and the way we carry out tasks.

This usually happens without conscious awareness that it has changed.
What does your mental workload look like?

Fill in the spaces in the brain either with pictures or words.

Inspiration Points!
Think of...
• what makes your workload feel heavy / high
• what makes tasks feel effortful / stressful
• the tasks you feel need a lot of concentration / attention
• the tasks you are happy to be distracted from
• the things that are on your mind when you are at work (doesn’t have to be work related)
The Cognitive Systems Model (Grasha 2001)

- Task Demands
  - Sensory Register
  - Working Memory
  - Long Term Memory

Influences:
- Interpersonal influences
- Personal influences
- Extra-organisational influences
- Organisational influences
- Environmental influences

Correct and incorrect responses/decisions
Beliefs, attitudes, values and emotional responses
Accuracy Checking Task Characteristics

Target Frequency & Accuracy Checking

- Rare targets are often missed
- Dispensing errors made in up to 3% of dispensed items (Franklin & O’Grady, 2007)

Fig 1 (from Wolfe, Horowitz & Kenner, 2005) The effects of target prevalence on search performance. a. Error rates for rare targets (blue bars, 1% prevalence), less rare targets (yellow bars, 10% prevalence) and common targets (red bars, 50% prevalence).
Try rating your mental workload now

Mental Workload Rating 1

1. Please rate the MENTAL DEMAND of the task: How much mental and perceptual activity was required?
   Low 0 1 2 3 4 5 6 7 8 9 10 High

2. Please rate the PHYSICAL DEMAND of the task: How much physical activity was required?
   Low 0 1 2 3 4 5 6 7 8 9 10 High

3. Please rate the TEMPORAL DEMAND of the task: How much time pressure did you feel due to the pace at which the task elements occurred?
   Low 0 1 2 3 4 5 6 7 8 9 10 High

4. Please rate your PERFORMANCE: How successful do you think you were in accomplishing the goals of the task?
   Low 0 1 2 3 4 5 6 7 8 9 10 High

5. Please rate your EFFORT: How hard did you have to work (mentally and physically) to accomplish your level of performance?
   Low 0 1 2 3 4 5 6 7 8 9 10 High

6. Please rate your FRUSTRATION: How discouraged, irritated, stressed and annoyed did you feel during the task?
   Low 0 1 2 3 4 5 6 7 8 9 10 High

N.B. Please rate your mental workload in relation to the task of listening to me (don’t worry – I won’t look at these – they are just for you)!
Community pharmacists’ descriptions of mental workload

“Really there’s so much going on in your mind that you’re perhaps trying to follow a conversation that’s going on elsewhere in the shop, that’s really important that you make sure that staff are doing it as properly. So I do feel that as I’m talking to a customer I’m never giving them a 100% of my mental attention which sounds awful ‘cause there are always other things that you’re thinking about. So actually your conversation to the customer can be hard work and that’s sort of mental and physical really”. Pharmacist 9

“But I guess for instance I come in and there is a whole stack of stuff then that is actually a workload sort of thing, so that is when the cogs sort of break up, they just it sort of goes to pot, that is when it is so called harder to concentrate on what you are doing at that point in time without thinking about everything else, that is when it becomes harder.” Pharmacist 67
Mental Workload in Community Pharmacy

Mental Workload during the day (averaged across 41 participants)
Table 15: Mean mental workload scores reported by participants in experiments 1 and 2 and the subset of participants who completed the mental workload diaries

<table>
<thead>
<tr>
<th>Description</th>
<th>Where the mental workload ratings were made</th>
<th>Mean</th>
<th>Range of scores</th>
<th>Std. Error</th>
<th>Std. Deviation</th>
<th>t (df)</th>
<th>P</th>
<th>Effect size (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The mental demand of the task</td>
<td>Diary</td>
<td>6.28</td>
<td>0-10</td>
<td>.18</td>
<td>2.50</td>
<td>-6.25</td>
<td>&lt;.001</td>
<td>.33</td>
</tr>
<tr>
<td></td>
<td>Experiment</td>
<td>7.64</td>
<td>1-10</td>
<td>.15</td>
<td>1.66</td>
<td>7.17</td>
<td>&lt;.001</td>
<td>.36</td>
</tr>
<tr>
<td>The physical demand of the task</td>
<td>Diary</td>
<td>4.23</td>
<td>0-10</td>
<td>.19</td>
<td>2.60</td>
<td>7.17</td>
<td>&lt;.001</td>
<td>.36</td>
</tr>
<tr>
<td></td>
<td>Experiment</td>
<td>2.52</td>
<td>0-8</td>
<td>.19</td>
<td>2.05</td>
<td>1.66</td>
<td>&gt;.05</td>
<td>.12</td>
</tr>
<tr>
<td>The temporal demand of the task</td>
<td>Diary</td>
<td>5.88</td>
<td>0-10</td>
<td>.21</td>
<td>2.88</td>
<td>-7.11</td>
<td>&gt;.05</td>
<td>.36</td>
</tr>
<tr>
<td></td>
<td>Experiment</td>
<td>6.08</td>
<td>0-10</td>
<td>.22</td>
<td>2.57</td>
<td>.95</td>
<td>&gt;.05</td>
<td>.27</td>
</tr>
<tr>
<td>Your Performance on the task</td>
<td>Diary</td>
<td>2.23</td>
<td>0-10</td>
<td>.14</td>
<td>1.88</td>
<td>1.14</td>
<td>&gt;.05</td>
<td>.27</td>
</tr>
<tr>
<td></td>
<td>Experiment</td>
<td>2.07</td>
<td>0-8</td>
<td>.14</td>
<td>1.51</td>
<td>1.14</td>
<td>&gt;.05</td>
<td>.27</td>
</tr>
<tr>
<td>The effort you put into the task</td>
<td>Diary</td>
<td>6.53</td>
<td>0-10</td>
<td>.17</td>
<td>2.32</td>
<td>-2.32</td>
<td>&gt;.05</td>
<td>.27</td>
</tr>
<tr>
<td></td>
<td>Experiment</td>
<td>7.02</td>
<td>1-10</td>
<td>.16</td>
<td>1.77</td>
<td>.95</td>
<td>&gt;.05</td>
<td>.27</td>
</tr>
<tr>
<td>Your Frustration with the task</td>
<td>Diary</td>
<td>4.51</td>
<td>0-10</td>
<td>.23</td>
<td>3.19</td>
<td>5.38</td>
<td>&lt;.05</td>
<td>.27</td>
</tr>
<tr>
<td></td>
<td>Experiment</td>
<td>2.93</td>
<td>0-10</td>
<td>.22</td>
<td>2.57</td>
<td>5.38</td>
<td>&lt;.05</td>
<td>.27</td>
</tr>
<tr>
<td>Overall mental workload score</td>
<td>Diary</td>
<td>4.94</td>
<td>.67-.93</td>
<td>.14</td>
<td>1.98</td>
<td>1.14</td>
<td>&gt;.05</td>
<td>.27</td>
</tr>
<tr>
<td></td>
<td>Experiment</td>
<td>4.71</td>
<td>.67-8.17</td>
<td>.11</td>
<td>1.26</td>
<td>1.14</td>
<td>&gt;.05</td>
<td>.27</td>
</tr>
</tbody>
</table>
Accuracy checking Task

N.B. This and all other prescriptions and medicines in this task were made up and are not real!
### Mental Workload Rating 2

1. Please rate the MENTAL DEMAND of the task: How much mental and perceptual activity was required?
   - Low: 0 1 2 3 4 5 6 7 8 9 10
   - High

2. Please rate the PHYSICAL DEMAND of the task: How much physical activity was required?
   - Low: 0 1 2 3 4 5 6 7 8 9 10
   - High

3. Please rate the TEMPORAL DEMAND of the task: How much time pressure did you feel due to the pace at which the task elements occurred?
   - Low: 0 1 2 3 4 5 6 7 8 9 10
   - High

4. Please rate your PERFORMANCE: How successful do you think you were in accomplishing the goals of the task?
   - Low: 0 1 2 3 4 5 6 7 8 9 10
   - High

5. Please rate your EFFORT: How hard did you have to work (mentally and physically) to accomplish your level of performance?
   - Low: 0 1 2 3 4 5 6 7 8 9 10
   - High

6. Please rate your FRUSTRATION: How discouraged, irritated, stressed and annoyed did you feel during the task?
   - Low: 0 1 2 3 4 5 6 7 8 9 10
   - High

---

**N.B. Please rate your mental workload in relation to the accuracy checking task**
65% of our community pharmacist sample failed to detect all the dispensing errors.

Figure 6: Rates of dispensing error detection
Labelling errors harder to detect

Table 2: The dispensing errors, how often they were missed and the types of errors missed

<table>
<thead>
<tr>
<th>Item no</th>
<th>Type of error (Content/Label)</th>
<th>What the error actually was</th>
<th>Missed (%)</th>
<th>Number of times checked</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>Label</td>
<td>Wrong drug name on label</td>
<td>50</td>
<td>42</td>
</tr>
<tr>
<td>9</td>
<td>Label</td>
<td>Wrong quantity on label</td>
<td>47</td>
<td>38</td>
</tr>
<tr>
<td>54</td>
<td>Label</td>
<td>Wrong drug name on label</td>
<td>44</td>
<td>43</td>
</tr>
<tr>
<td>55</td>
<td>Label</td>
<td>Wrong patient name on label</td>
<td>36</td>
<td>14</td>
</tr>
<tr>
<td>35</td>
<td>Label</td>
<td>Wrong directions on label</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>41</td>
<td>Label</td>
<td>Wrong strength on label</td>
<td>18</td>
<td>50</td>
</tr>
<tr>
<td>34</td>
<td>Content</td>
<td>Wrong formulation dispensed</td>
<td>7</td>
<td>44</td>
</tr>
<tr>
<td>2</td>
<td>Content</td>
<td>Wrong quantity dispensed</td>
<td>7</td>
<td>42</td>
</tr>
<tr>
<td>22</td>
<td>Content</td>
<td>Wrong quantity dispensed</td>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>10</td>
<td>Content</td>
<td>Wrong drug dispensed</td>
<td>3</td>
<td>59</td>
</tr>
<tr>
<td>48</td>
<td>Content</td>
<td>Wrong drug dispensed</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>11</td>
<td>Content</td>
<td>Wrong strength dispensed</td>
<td>0</td>
<td>53</td>
</tr>
</tbody>
</table>
### Table 4: The percentage of correctly identified errors (hit rates) made by the two groups of participants

<table>
<thead>
<tr>
<th>Experimental condition</th>
<th>Hit rates task 1</th>
<th>Hit rates task 2</th>
<th>Overall Hit rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Deviation</td>
<td>Std. Error Mean</td>
</tr>
<tr>
<td>No Distraction</td>
<td>80.13</td>
<td>21.61</td>
<td>4.24</td>
</tr>
<tr>
<td>Distraction</td>
<td>89.74</td>
<td>17.69</td>
<td>3.47</td>
</tr>
</tbody>
</table>

Significant difference in hit rates in the second task: \( t(50) = 2.59, p < .05, r = .34 \).

But no significant difference in overall hit rates in the...
Dispensaries aren’t like cockpits!
Recommendation 1

Reduce unnecessary distractions and interruptions in the dispensary

- Communication is essential in healthcare – so we don’t want to reduce all interruptions and distractions
- The type and frequency of distractions will vary between pharmacies, and different community pharmacy organisations.
- Individuals will always distract themselves and allow others to distract them – but will and are able to restrict this on direction.
- Individuals may sometimes lack awareness of the impact of interruptions and distractions on the safety of their work
Ways we could reduce interruptions and distractions in dispensaries

This could be done by

- Moving the safety critical work to a specific area – away from distractions (patients, telephones, etc)
- Asking pharmacy staff to avoid interrupting colleagues until they have finished checking / dispensing a prescription (or on completion of a sub-task)
- Creating visible barriers around areas where safety critical work is being carried out, but that don’t reduce critical lines of sight for staff (e.g. Colligan et al 2012)
- Move the telephone to an area (or another room)
- Create a sterile dispensary (like sterile cockpits) (e.g. Leporte, Ventresca, & Crumb, 2009)
If you can’t remove the distractions...

Improve lines of defence

- **Standardised checking procedures** *(e.g. James et al, 2010)*

- **Techniques to recover situation awareness on returning to the task**
  - marking the point at which a task is disengaged *(Boehm-Davis & Remington, 2009)*
  - Questions to find your place:
    - Identify (what was I doing?),
    - Ask (where was I interrupted?)
    - Decide/act (what do I need to do to get back on track?) *(Airbus, 2004; Boehm-Davis & Remington, 2009)*

- **Regular breaks**
  - so that concentration can be maintained
  - and to reduce internal interruptions (e.g. hunger, need for toilet breaks)
Human observers are not necessarily aware of all the factors which may lead to an error being made because

- It happened through an unconscious cognitive process
- Their actions were part of a chain of events in a system

**To identify the cognitive processes involved in pharmacy tasks we can use the following methods**

- Hierarchical Task Analysis
- Verbal Protocols and/or Think Aloud studies
- Route Cause Analysis (already done in practice)
- Focus groups and interviews

**Other issues to consider when planning pharmacy workload and workforce**

- Time needed to complete each task
- Can some steps be automated?
- Skill mix
- Multi-tasking / competing tasks

Multi-tasking is particularly bad when they use the same response modes (e.g. if both tasks require motor responses) – see excellent paper by Wickens (2008)
Recommendation 3

Provide more support for pharmacists and their teams in managing their workload and mental workload

Strategies for managing mental workload

- **Autonomy and control over workload**
  - Having control over one’s workload helps sustain mental resources and optimal mental workload *(Hockey & Earle, 2006)*

- **Breaks**
  - Emphasise the importance of breaks and the need to mentally “switch off”

- **Planning safety critical or demanding tasks to avoid times when mental resources may be lower**
  - The first 15 minutes after a break
  - First thing in the morning / in the evening
  - Help pharmacists identifying factors which affect their mental workload so that they can individually plan around this
Sharing knowledge on factors that increase mental workload, increase errors, and what errors are occurring

- **Within organisations**, or through informal networks pharmacy teams could **share strategies** for dealing with sub-optimal mental workload and high objective workload.

- **Newsletters of anonymous reports** of workload issues or errors made/experienced e.g. Chirp ([www.chirp.co.uk](http://www.chirp.co.uk)) or ISMP ([www.ismp.org](http://www.ismp.org)) to improve awareness of the factors that cause errors, and the errors that can happen.

  - Could the GPhC share this info in their updates? Or at least disseminate it if another organisation collected and published this information?
Pharmacy consultation video

Pharmacy Research UK
My Acknowledgement and Thanks to...

You all for coming today!

- The study participants
- The pharmacy organisations who supported the research
- Our Project Management Team
- Our actors from the video: Jilly Breeze, Jasmine Darke and Jack Llewellyn

For funding the project, to Steve Churton for his support today. And a big thank you to Charlotte Coates, Beth Allen and Duncan Walsh for all their support for this talk and throughout the project.

Elizabeth Gorrie and Melissa Dear for their excellent filming and video work

The University of Bath for funding my PhD which this research formed part of and a big thanks to Dr Jane Sutton, Prof Marjorie Weiss, Dr Lynette James, Mr Chris Coy, Dr Philip Rogers for their support of the project.


