Lighting conditions in hospital medication rooms and nurses appraisal

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1 Introduction
In hospitals medication follows a long route before it reaches the targeted patient. In this process (e.g. procurement, prescribing, transcribing, order entry, preparation, dispensing, administration, and monitoring of medications), human mistakes are easily made. Missed doses, missed medications or wrong medication are the primary errors (Mahmood et al. 2012). These can result into a life threatening situation for patients. Human mistakes might for example originate from a too high workload, or from distractions such as noise disturbance or interruptions by colleagues. Another cause could be the lighting conditions. Although nurses associations have regulations for medication safety and to minimize disturbance and distractions. The most important purpose of applying the right lighting is to be able to perform certain visual tasks. Mistakes in medication are more pronounced during night shifts, when there is not enough lighting, not the right spectral distribution or distracting lighting. Since the main focus in a hospital lies with the patients, keeping dim lighting during night check-ups enhances the patients sleep but turn out to be too low for the nurses to read the dose, to tell apart different pills and to check whether the infusion is still working properly. This effect becomes even worth for nurses whose sight is deteriorated due to presbyopia and eye fatigue due to biological ageing. Therefore it is crucial to have a lighting situation that enhances the visual performance of nurses managing medication (Graves et al. 2015; Graves et al. 2014). In this research, especially the preparation and dispensing of medication are of interest. Therefore the lighting situation is measured in different wards and hospitals as well as a survey on their personal experience with the lighting condition was conducted among the nurses.

2 Materials/Methods
In order to assess the lighting condition in the medication room, the lighting was measured in five different wards of two hospitals in the Netherlands. Hospital 1 (H1) is designed according to the healing environments concept, completed in 2013 (H1) and hospital 2 (H2) is an older hospital completed in 1973. The medication rooms in H1 have all similar size and lay-out. The medication room of the medium and intensive care has a deviating size and set-up. In H2, three different medication rooms are measured. In this hospital a long-term renovation process is going-on. The medication rooms are not similar. Therefore two old medication rooms (H2 A and H2 B) and one renovated ward (H2 C) are measured. The illuminance levels (E) and correlated color temperature (CCT) are measured horizontally at the desk(s), on the floor and
horizontally and vertically close to the medication closets. (Ill. spectrometer Konica Minolta CL-500A). If possible, the exact lamp- and luminaire type is determined. Luminance pictures are made to determine the light contrast and to assess glare (UGR).

One of the questions of the survey was how the nurses (N=32) experienced the lighting in the medication room.

3 Results and Discussion
The average lighting conditions are given in Table 1. According to the recommended values (NEN-EN, 2011) the CCT and UGR are in all medication rooms according to the standards. The desk illuminance in the new hospital is a bit too low, as well as in the old, not renovated medication room.

Table 1 Lighting conditions for different medication rooms

<table>
<thead>
<tr>
<th></th>
<th>E_avg [lx]</th>
<th>CCT_avg [K]</th>
<th>UGR [-]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1 standard</td>
<td>397</td>
<td>325</td>
<td>2823</td>
</tr>
<tr>
<td>H1 IC</td>
<td>293</td>
<td>356</td>
<td>2967</td>
</tr>
<tr>
<td>H2 A</td>
<td>195</td>
<td>315</td>
<td>2784</td>
</tr>
<tr>
<td>H2 B</td>
<td>521</td>
<td>773</td>
<td>3039</td>
</tr>
<tr>
<td>H2 C</td>
<td>839</td>
<td>483</td>
<td>3092</td>
</tr>
<tr>
<td>Floor</td>
<td>500</td>
<td>100</td>
<td>&lt;19</td>
</tr>
</tbody>
</table>

When comparing these values to the experience of the nurses (Figure 2) we can see that most are quite satisfied with the amount of light, although the nurses at H2 A tend to be less satisfied than at the other wards.

4 Conclusions
Not all lighting conditions in the different medication rooms follow the current recommended value for hospitals. Although nurses are in general quite satisfied with the lighting condition, this does not necessarily mean that there is no room for improvement. Especially the combination between small printed labels and dim light conditions might lead to fatigue and possibly errors.

5 Acknowledgement
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6 References

