

A comparison of upper limb disorder risks between manual and automated cytotoxic compounding

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Focal points

- Our objectives were to compare the upper limb disorder (ULD) risk of manual and automated cytotoxic compounding and comment on the suitability of the UK Health and Safety Executive Assessment of Repetitive Tasks (ART) tool¹ for this purpose.
- Manual compounding was associated with a much greater ULD risk than automation. The ART tool was useful for assessing ULD risk of cytotoxic compounding.
- Automation is an alternative to manual compounding that does not compromise operator safety from ULD risks.

Background

In the UK, approximately one in five work-related injuries are attributed to ULDs². Manual cytotoxic compounding is a highly skilled task that can cause ULDs such as stiffness and pain in the upper limbs, back or neck. In contrast, use of automation requires fewer manipulations and potentially a lower ULD risk.

Objectives

To compare the ULD risk associated with manual and automated cytotoxic compounding, and comment on the suitability of using the UK Health and Safety Executive ART tool for this purpose.

Methods

We used the ART tool to assess the ULD risk of cytotoxic compounding in a single UK hospital pharmacy aseptic unit. The tool comprised 12 domains, each scored on an ordinal scale. An overall ULD risk score was calculated and categorised using the tool as low-, medium- or high-risk. We compared the (1) overall ULD risk scores, (2) overall ULD risk categories and (3) risk scores for each of the 12 domains. Practicalities of using the ART tool were documented. The type of grip used for syringe manipulations was not included in the tool, we therefore included this 'syringe-grip' as part of the hand grip domain.

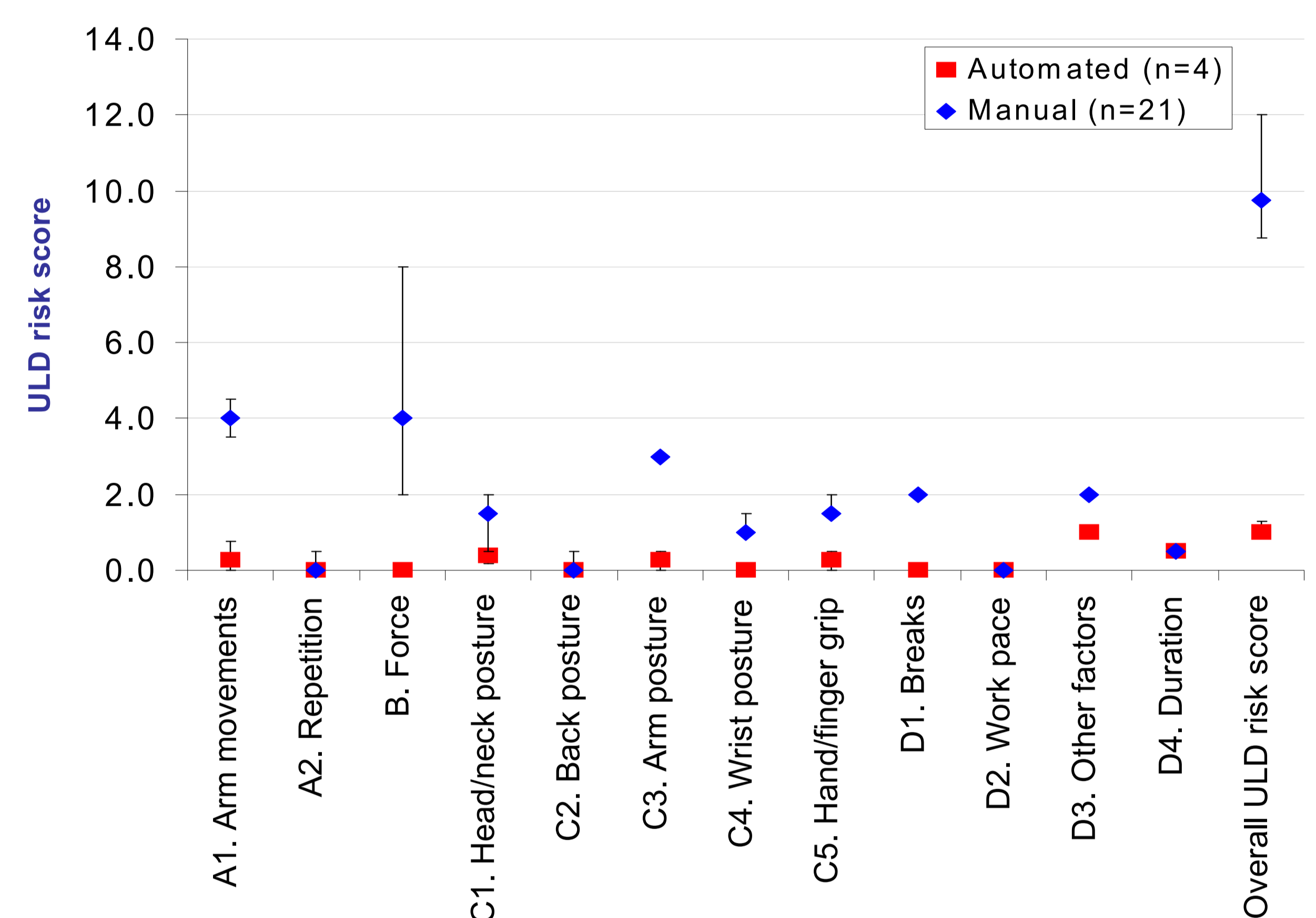
Results

Twenty-one manual and four automated sessions were observed (a smaller sample of automated sessions were used as these showed little variation in ULD risk), table 1.

	Manual	Automated
Number of sessions observed	21	4
Number of operators observed	6	2
Mean duration of session	108 minutes (95%CI 96 to 120 mins) (range 39 to 148 mins)	94 minutes (range 60 to 135 mins)
Mean number of doses compounded per session	17 (95% CI 14 to 20) (range 4 to 33)	8 (range 8 to 8)
Mean number of high risk drugs compounded per session*	2 (IQR 1 to 3) (range 0 to 7)	2 (range 1 to 3)

Table 1. Characteristics of manual and automated compounding sessions observed. *High risk drugs were doxorubicin, epirubicin, etoposide, paclitaxol and docetaxol, as listed in local standard operating procedure. CI: confidence interval for the mean, IQR: interquartile range.

- Manual sessions were associated with a higher median ULD risk score (9.8, IQR 8.8 to 12.0) than automation (1.0, IQR 0.9 to 1.3).
- Fourteen manual sessions were low-risk and seven were medium-risk. All automated sessions were low-risk.
- Overall, eight domains scored higher in the manual sessions than automated session; four domains scored the same (figure 1).
- The largest difference in median risk score was for domains regarding 'force', 'arm movement' and 'arm posture'.



HSE ART tool assessment

Figure 1. A comparison of the median upper limb disorder (ULD) risk score for each individual domain and overall between manual and automated cytotoxic compounding (error bars represent interquartile range). HSE: Health and Safety Executive and ART: Assessment of Repetitive Tasks.

Discussion

- Our findings support the hypothesis that manual compounding is associated with a greater ULD risk than automation; which, to our knowledge, had not previously been reported.
- The magnitude of the overall ULD risk difference should be interpreted with caution as the manual and automated sessions were not matched for the number and types of doses made.
- Potential contributory factors for the large difference in 'force' exerted by the operator include: handling large volumes, viscous drugs, strength and skill of the operator.
- Scores for 'arm movement' and 'arm posture' were related to the manipulations used in manual compounding and the fixed position of the gloves in the isolator which required the operator to have their arms raised for the majority of the session duration.
- A number of other potential manual- and automation-specific ULD risks was noted from observations (data not presented).

Conclusion

Automation is an alternative to manual compounding that does not compromise operator safety from ULD risks. The ART tool and observation notes enabled a detailed comparison of ULD risks to be made. Our findings can also be used to suggest how ULD risk may be assessed and/or compared in other pharmacy aseptic units using the ART tool.

References

1. Health and Safety Executive. Assessment of repetitive tasks of the upper limbs (the ART tool). Sudbury: Health and Safety Executive; 2010.
2. Health and Safety Executive. The Health and Safety Executive Statistics 2009/10. Sudbury: Health and Safety Executive; 2010.