

Calculation errors made in Norwegian hospitals

Alma Mulac*¹, Maria Helle Spence², Ellen Hagesæther³, Anne Gerd Granås¹

1. Department of Pharmacy, University of Oslo

2. Institute for Biosciences University of Oslo

3. Oslo Metropolitan University

Background: Dose errors caused by miscalculation frequently happen in Norwegian hospitals, with outcomes ranging from harmless to severe consequences and death. There is currently little understanding of why these errors happen. This study wishes to shed light on the types of errors made, their causes, and ways of ameliorating the process of calculating patients' medication doses.

Aim: To uncover the major underlying causes of calculation errors made by health care professionals in Norwegian hospitals.

Methods: Over 3,000 medication incidents were reported to the National Incident Reporting System in 2016 and 2017. A total of 231 incidents qualified as *dose errors*, and were classified according to the NCC MERP Index for Categorizing Medication Errors. We identified four main categories of dose errors:

1. *Conceptual error* -Poor understanding of concepts such as dose, strength, flow rate
2. *Math errors* -Numbers are manipulated incorrectly (subtracting/adding, multiplying/dividing etc.)
3. *Measurement errors* -The wrong units are used, or ten or hundred times the ordered dose is given
4. *Calculation omitted* - Calculation is not performed

Results: A total of 70 cases were caused by a miscalculation. The leading cause of miscalculations were conceptual errors (30%), followed closely by math errors (25.7%) and 10 or 100 fold overdoses (25.7%). The errors happened primarily in the administration phase (71%) and involved mostly injectables (69%). The major contributing factors were that the procedures were not adhered to (67%), including lack of dual-check (28.6%). A knowledge deficit was detected in 59% of the cases, suggesting that there is a connection between drug knowledge and calculation errors. Written miscommunication was preminent in 34% of the cases. The two patient age groups most affected by calculation errors were children aged 0-4 years and adults aged 75-79 years.

Conclusion: The dominating cause of miscalculation is a lack of conceptual understanding such as dose, strength and flow rate. Poor understanding of chemical concepts and measurement units are the causes of over 40% of miscalculations. To decrease the risk of miscalculation during medication administration, more attention must be given to train health personnel in the risks of performing conceptual and math errors. It is vital to develop systems that can prevent that ten or hundred times the ordered dose is given. The complexity of miscalculation errors needs further exploration, as they cause patient harm to hospital patients.