Algorithms to enhance safety of high alert medications' prescribing in hospitalized patients.

Keywords:
high alert medication, computerized prescription order system, alert

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Background

High alert medications can cause significant patient harm, when used inappropriately[1]. To enhance patient safety, automated alerts are recommended by the Institute for Safe Medication Practices[1,2].

Aim

To describe the use of automated alerts embedded in a computerized decision order system to identify drug related problems (DRP) for high alert medications in hospitalized patients, and associated pharmacists' interventions.

Method

A retrospective study was conducted at two sites (academic and general) of a tertiary care hospital in Belgium. Seventeen algorithms were designed to identify DRP relevant for high alert medications and were implemented in our computerized decision order system. Alerts were based on the patients' prescriptions and laboratory data. All alerts were checked by a pharmacist every day (except for weekends). All alerts occurring between September 2023 and august 2024 were analyzed. Data collected included: alert type and whether the alert led to an actual DRP requiring a pharmacists' intervention. Descriptive statistics were used to analyse the data.

Results

- 1147 alerts were analyzed by the pharmacists (mean of 4,4 alerts daily)
- 813 alerts = actual DRPs (i.e. pharmacists' interventions were required) (Table and Figure 1)
  - Positive predicted value = 70,9%
- Anticoagulant agents 53,3% of DRPs (Figure 2)
  - Overdosing (according to each drug's individual criteria for adjustments, including weight, renal function, age, and INR): 23,7% of DRPs
  - Underdosing (e.g., «once daily dosing» of apixaban, or underdosing according to weight or INR): 27,6% of DRPs
  - Concomitant administrations of low molecular weight heparin and direct oral anticoagulants: 2,0% of DRPs
- Electrolytes: 33,6% of DRPs
- Insulin: 5,5% of DRPs (all overdosing)
- Opiates: 4,8% of DRPs
- Methotrexate: 4,4% of DRPs
  - Multiple weekly administrations (in inflammatory diseases): 3,2% of alerts

Figure 1: Drug related problems identified per drug category

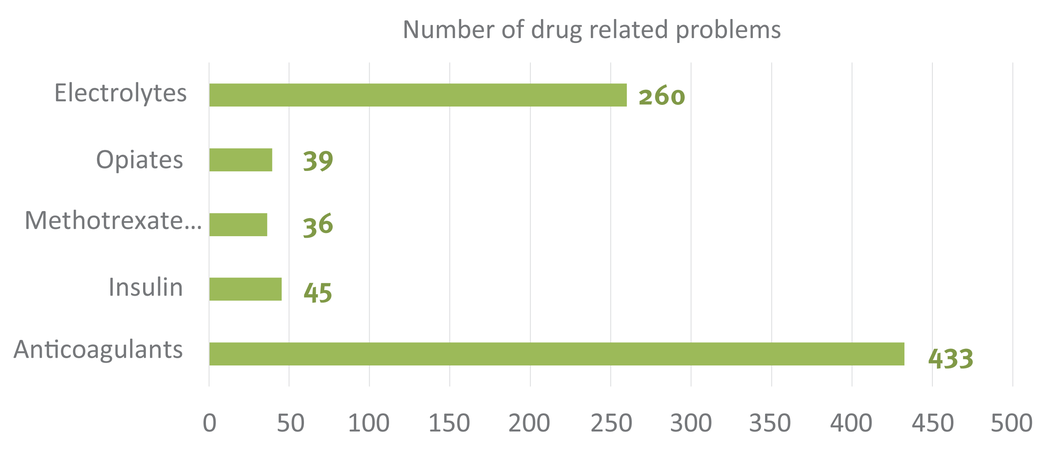

Figure 2: Drug related problems identified in relation with anticoagulants

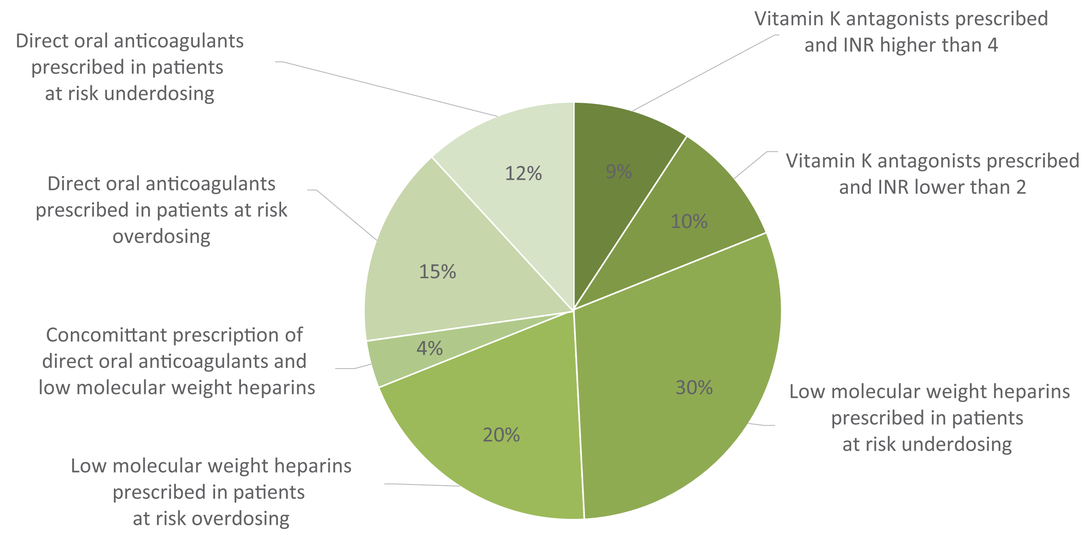

Table 1: Drug related problems identified per drug category and problem type

	Drug related problems n (%)
Anticoagulants	433 (53,3%)
VKA prescribed and INR higher than 4	40 (4,9%)
VKA prescribed and INR lower than 2	42 (5,2%)
LMWH prescribed in patients at risk underdosing	131 (16,1%)
LMWH prescribed in patients at risk overdosing	86 (10,6%)
Concomitant prescription of DOAC and LMWH	16 (2,0%)
DOAC prescribed in patients at risk overdosing	67 (8,2%)
DOAC prescribed in patients at risk underdosing	51 (6,3%)
Insulin	45 (5,5%)
Insulin prescribed at high doses (more than 0,5 UI x body weight)	42 (5,2%)
Basal insulin prescribed more than twice daily	3 (0,4%)
Methotrexate *(only prescriptions for inflammatory disorders)*	36 (4,4%)
Methotrexate prescribed more than once a week	26 (3,2%)
Absence of folates in methotrexate therapy	10 (1,2%)
Opiates	39 (4,8%)
Extended release opiates prescribed to patients with renal failure	39 (4,8%)
Electrolytes	260 (32,0%)
Intravenous potassium prescribed in concentrations higher than 80 mEq/L through a peripheral line	207 (25,5%)
Potassium prescribed to patients with a kaliemia higher than 4 mEq/L	53 (6,5%)
Total général	**813 (**100,0%)

VKA: vitamin K antagonists, LMWH: low molecular weight heparins, DOAC: direct oral anticoagulants

CONCLUSION

Automated alerts tailored to identify DRPs for high alert medications, effectively identify opportunities for pharmacists' interventions, enhancing patient safety.

Références
[1]Institute for Safe Medication Practices ISMP list of high-alert medications in acute care settings. 2024. Available at: www.ismp.org/sites/default/files/attachments/2024-01/20240111.pdf
[2]Cohen MR, Smetzer JL, Tuohy NR, et al. High-alert medications: safeguarding against errors. In: Cohen MR, editor. Medication Errors. Washington, D.C.: The American Pharmacist Association; 2007. pp. 317–412.

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