

Effect of Clinical Decision Support Systems on Anticoagulant Duplications in Two Swiss Cantonal Hospitals

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Background

- Erroneous anticoagulant duplications increase the risk of bleeding events.¹
- This risk can be mitigated by using Clinical Decision Support Systems (CDSS).² However, it is not yet established which CDSS design is most suitable to prevent medication errors.
- We investigated the effect of implementing two different CDSS designs in two different hospitals with the same electronic health record software (KISIM) on the number of erroneously duplicated anticoagulants.
- The satisfaction of the physicians with the respective designs was also examined.

Methods

- **Study design:** Observational study with time-series cross-section longitudinal data of two Swiss cantonal hospitals
- **Hospital A:** The CDSS alerts clinical pharmacists who then send non-interruptive alerts with a specific recommendation to the physician (KPharm integrated in KISIM)
- **Hospital B:** The CDSS produces generic interruptive pop-up alerts at the time of prescribing (CDS.CE Check integrated in KISIM)
- **Database:** Clinical patient data from the KISIM.
- **Patient population:** All patients who were of legal age, consented to the use of their health-related personal data and were treated with 2 or more anticoagulants per day.
- **Observation period:** One year before and after implementation of the CDSS in KISIM.

	Monday		Tuesday		Wednesday		Thursday		Friday	
	Anticoagulant 1	Anticoagulant 2	Anticoagulant 1	Anticoagulant 2	Anticoagulant 1	Anticoagulant 2	Anticoagulant 1	Anticoagulant 2	Anticoagulant 1	Anticoagulant 2
7:30	Apixaban		Apixaban		Apixaban		Apixaban			
17:30	Apixaban		Apixaban		Apixaban		Apixaban			
20:00				Dalteparin		Dalteparin		Dalteparin		Dalteparin

(I)

	Monday		Tuesday		Wednesday		Thursday		Friday	
	Anticoagulant 1	Anticoagulant 2	Anticoagulant 1	Anticoagulant 2	Anticoagulant 1	Anticoagulant 2	Anticoagulant 1	Anticoagulant 2	Anticoagulant 1	Anticoagulant 2
7:30	Apixaban		Apixaban		Apixaban					
17:30	Apixaban		Apixaban		Apixaban					
20:00						Dalteparin		Dalteparin		Dalteparin

(II)

Figure 1. Visual representation of anticoagulant duplication with a prescription scheme of two anticoagulants. A yellow background represents the start and a green background the end of a duplication. Anticoagulants with a blue background are considered involved in a duplication. We considered two scenarios as anticoagulant duplications: Scenario (I) represents the case in which two anticoagulant prescriptions are overlapping. Scenario (II) represents the case in which an Anticoagulant is prescribed too soon after discontinuation of the first.

- **Analysis:** Calculation of relative risk (RR) and relative risk reduction (RRR) for cases with anticoagulant duplication in the post-period compared to the pre-period for both hospitals. The mean duration of duplications before and after implementation was assessed.
- **Secondary objective:** A cross-sectional survey on satisfaction with the respective CDSS was conducted in both hospitals.

Results

Anticoagulant duplications

- **Hospital A:** The RR of cases containing a duplication in the post-period compared to the pre-period was 0.57 (95% CI = 0.44, 0.74)
- The RRR was 43%.
- **Hospital B:** The RR of cases containing a duplication in the post-period compared to the pre-period was 0.79 (95% CI = 0.61, 0.98)
- The RRR was 21%.

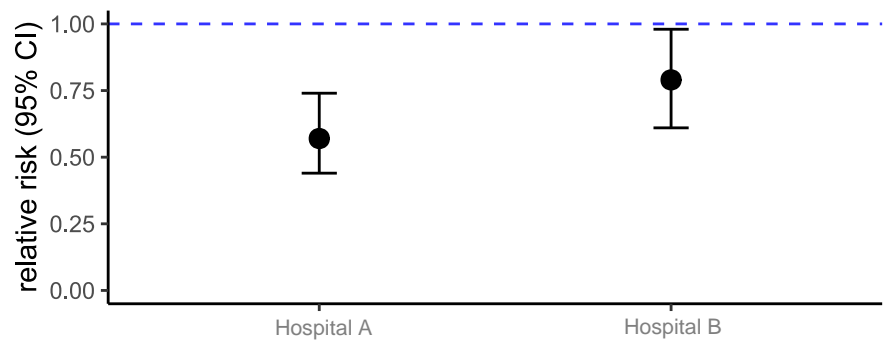


Figure 2. Relative risk of cases with anticoagulant duplication in the period after CDSS introduction compared to the period before CDSS introduction for hospital A (left) and hospital B (right).

- The duration of anticoagulant duplications was reduced to a mean of 1.05 days (SD 0.22, $p < 0.05$).
- There was no change in mean duration of duplications after implementation (1.71 days, SD 1.70, $p = 0.44$).

Survey

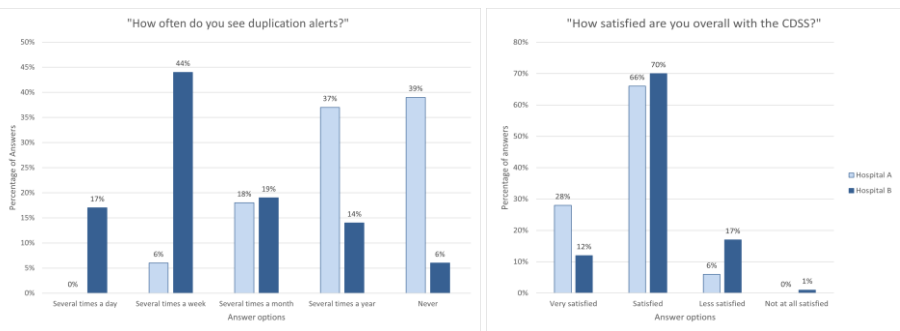


Figure 3. Responses from the cross-sectional survey conducted in hospital A (light blue) and hospital B (dark blue). The survey questions are stated in the titles.

- The survey revealed that physicians at the KSB perceived a higher alert burden, while physicians at the KSA were more satisfied with their CDSS.

Conclusion

- The implementation of a CDSS led to a significant decrease of the number of cases with erroneously duplicated anticoagulants in both hospitals. The effect was stronger at hospital A.
- A decrease in the mean duration of anticoagulant duplications could only be shown for the hospital A.
- Physicians from hospital A were more satisfied with their CDSS than physicians at hospital B.
- These findings highlight that the design of a CDSS is important for its efficacy.

References

1. Barr D et al. "Direct oral anticoagulants: a review of common medication errors." J Thromb Thrombolysis. 2019;47(1):146-154
2. Kuperman GJ et al. "Medication-related clinical decision support in computerized provider order entry systems: a review." J Am Med Inform Assoc. 2007;14(1):29-40