

Development and Implementation of a Multi-Agent-System for the Detection of Medication Errors and Reduction of Adverse Drug Events

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Alert Fatigue

Appropriateness of Overridden Alerts in Computerized Physician Order Entry¹

Overall

- Overridden: 46.2%-96.2%
- Appropriate: 29.4%-100%

Drug-Drug Interaction

- Overridden: 56.3%-95.6%
- Appropriate: 0%-95%

Renal Dose Adjustment

- Overridden: 74.4%-97.1%
- Appropriate: 27%-87.5%

KPharm: Our Goals

Approach

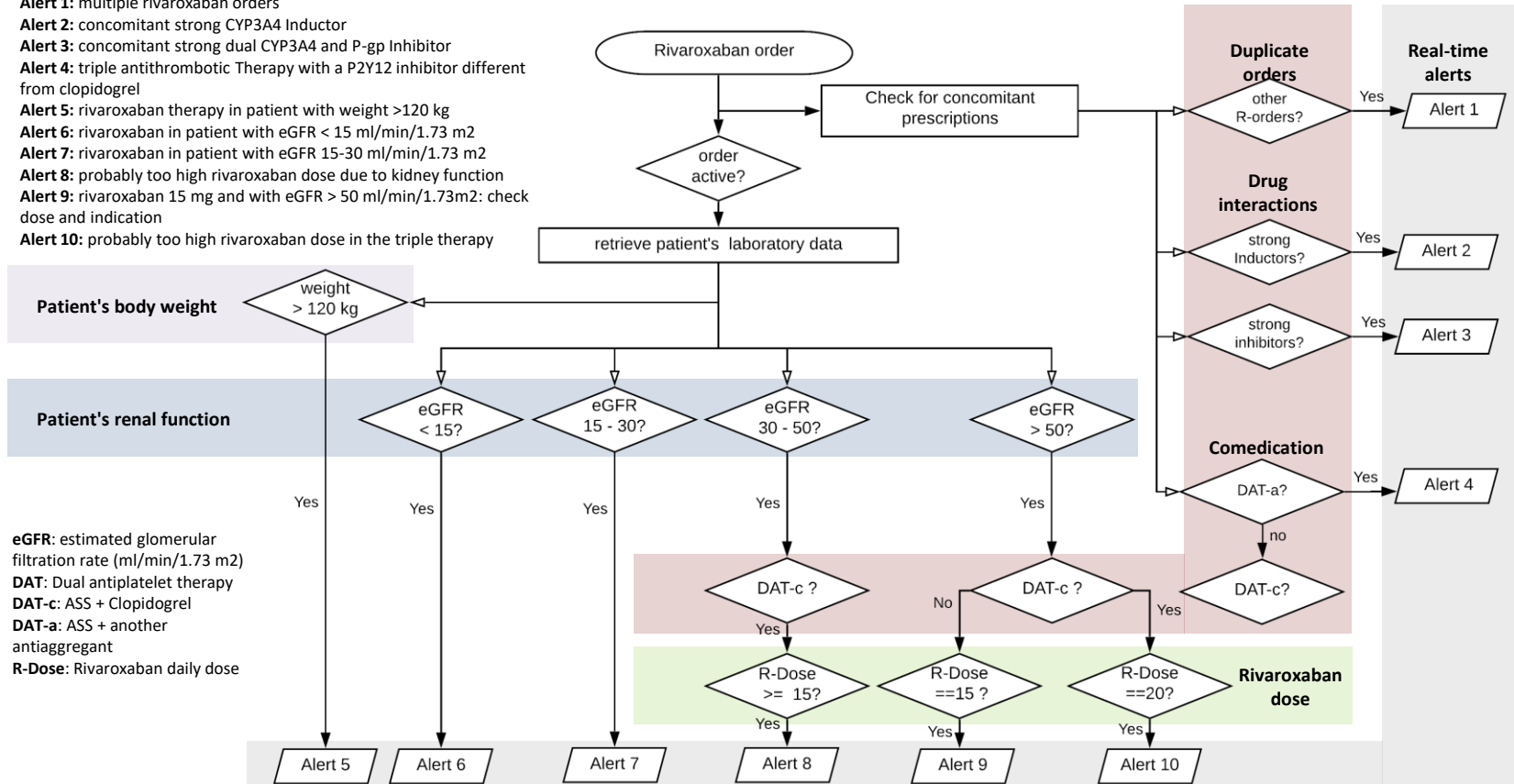
- Individualised Surveillance of Pharmacotherapy
 - Consideration of Patients' electronic health records (KISIM)
 - Algorithm-based Multi-Agent-System
 - = Electronic Surveillance of Medication Orders

Outcome

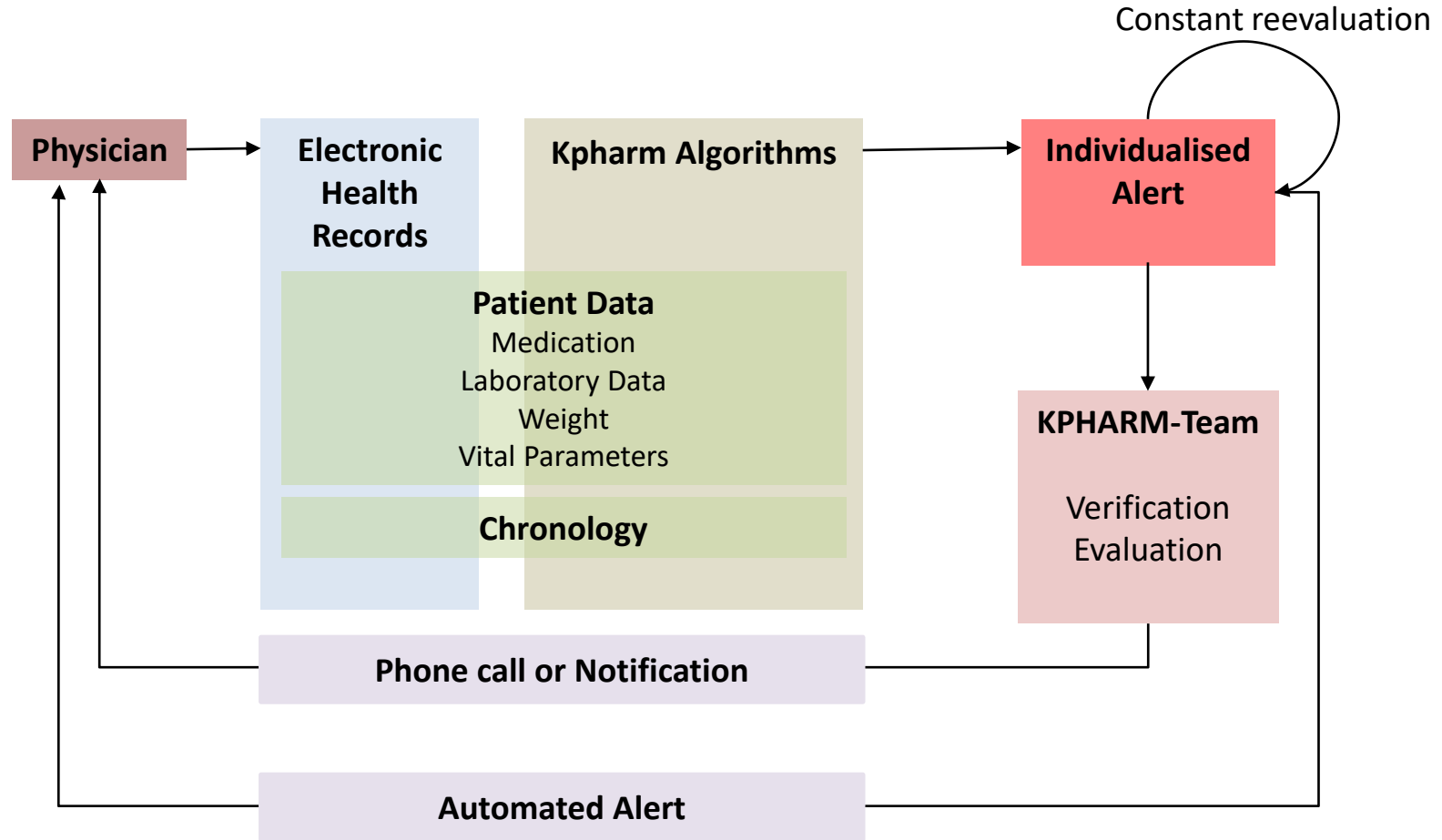
- Early Detection of potential Medication Errors
 - Prevention of Adverse Drug Reactions
 - Improvement of Patient Safety
 - Reduction of Costs

Algorithm Rivaroxaban

- Alert 1:** multiple rivaroxaban orders
- Alert 2:** concomitant strong CYP3A4 Inductor
- Alert 3:** concomitant strong dual CYP3A4 and P-gp Inhibitor
- Alert 4:** triple antithrombotic Therapy with a P2Y12 inhibitor different from clopidogrel
- Alert 5:** rivaroxaban therapy in patient with weight >120 kg
- Alert 6:** rivaroxaban in patient with eGFR < 15 ml/min/1.73 m2
- Alert 7:** rivaroxaban in patient with eGFR 15-30 ml/min/1.73 m2
- Alert 8:** probably too high rivaroxaban dose due to kidney function
- Alert 9:** rivaroxaban 15 mg and with eGFR > 50 ml/min/1.73m2: check dose and indication
- Alert 10:** probably too high rivaroxaban dose in the triple therapy



Clinical Decision Support at KSA: **KPharm**



KPHARM: Daily Processing of Alerts

Controlling MAS

Di bis Di Kategorie: Status:

Patient:

	Kat.	Pat-Nr	Fall-Nr	Patient	Alter	Betreff	Erstellt am	Gesehen am	Erledigt am	Status
0		T1306	999992056	TestPat_1306 Test, 01.01.1980	41	Duplikationen Antikoagulantien [7]	08.11.2021 11:27:46			
1		T1301	999992051	TestPat_1301 Test, 01.01.1980	41	Duplikationen Antikoagulantien [1]	08.11.2021 11:25:28			Mitteilung
3		T1424	999991424	TestPat_1424						
4		T1424	999991424	TestPat_1424						
3		T1310	999992060	TestPat_1310						
2		T1310	999992060	TestPat_1310						
3		T1301	999992051	TestPat_1301						KG öffnen
3		T1311	999992061	TestPat_1311						
3		T1307	999992057	TestPat_1307	Alter: 97 Geschlecht: M Gewicht: 70.5 (04.11.2021) eGFR (ml/min/1.73 m2): 47 (04.11.2021 08:47)					
1		T1305	999992055	TestPat_1305						Mitteilung
3		T1446	999991446	TestPat_1446		Betroffene Verordnungen:				
2		T1446	999991446	TestPat_1446		Digoxin Juvisé (Tabl 0.25 mg) Blist / Digoxin 0.25 mg 0.5 - 0 - 0 - 0 Tabl p.o. 2021-11-01 00:15:00 - 2021-11-05 23:00:00				
6		T1501	999991503	TestPat_1501		Verordnete Digoxin-Tagesdosis : 0.125 mg				
2		T2138	999900449	Kpharm_12 S						Erledigt: Pr
3		T1342	999992092	TestPat_1342		Zusätzliche Informationen:				
4		T1346	999992096	TestPat_1346		Kalium (mmol/l): 3.3 (04.11.2021 08:47) Magnesium (mmol/l): 0.82 (30.10.2021 15:18)				

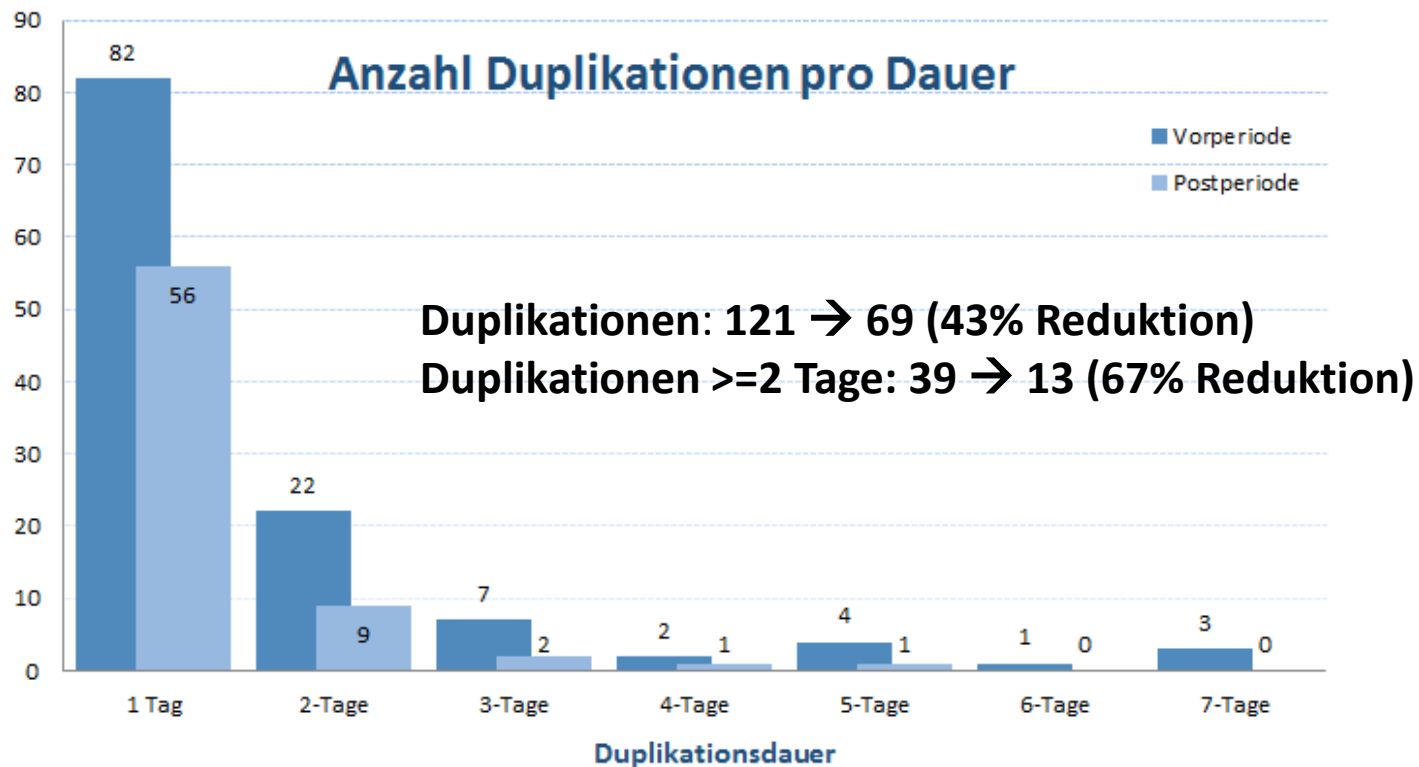
Toxizitätsrisiko der Digoxin-Therapie bei tiefem Kalium- oder Magnesiumspiegel

Bei dieser Patientin/ diesem Patienten ist eine Digoxin-Therapie verordnet. Gemäss Labor sind die Kalium- und/oder Magnesiumspiegel tief. Hypokaliämie und Hypomagnesiämie erhöhen das Risiko für Digoxin-Toxizität.

Wir empfehlen, eine Elektrolytsubstitution zu starten und auf Toxizitätsanzeichen zu achten (u.a. Herzrhythmusstörungen, Übelkeit, Erbrechen, Sehstörungen).

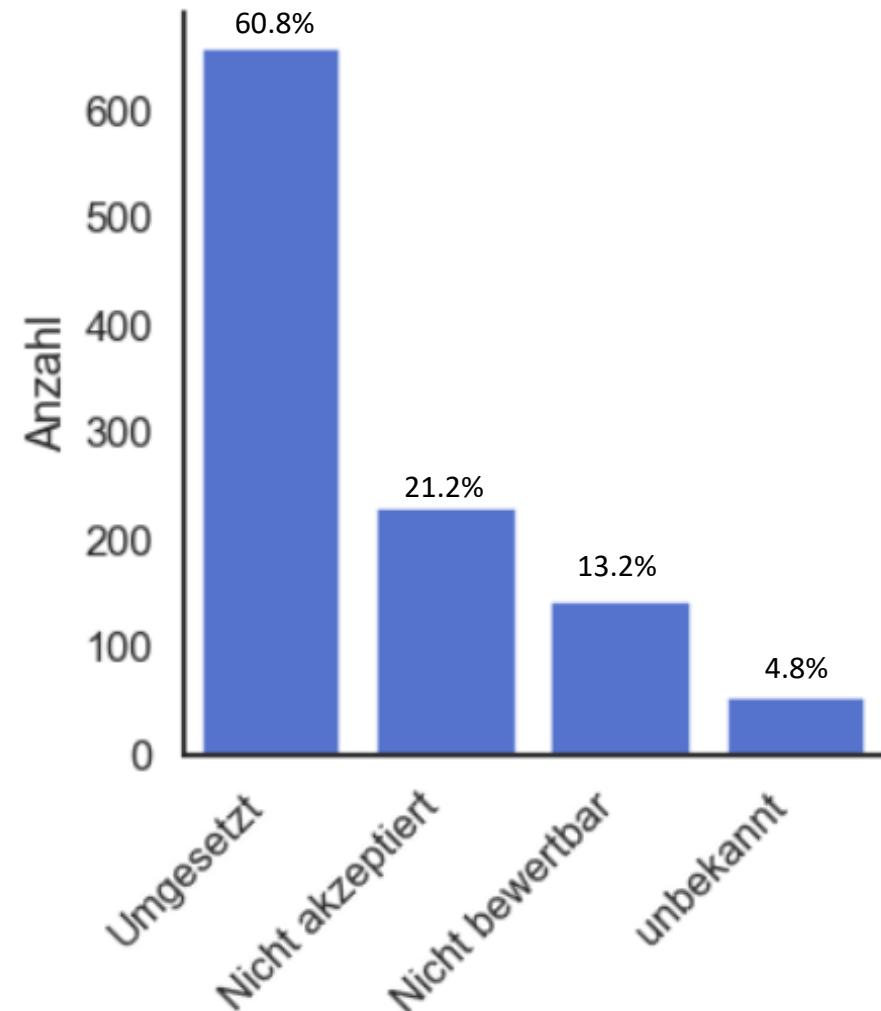
Reduction of Anticoagulant Duplication (before/after)

- Introduction 21.8.2018
- Pre- and postperiod: 12 Months
- Patients with DOAK: 1179/1873



Current Status

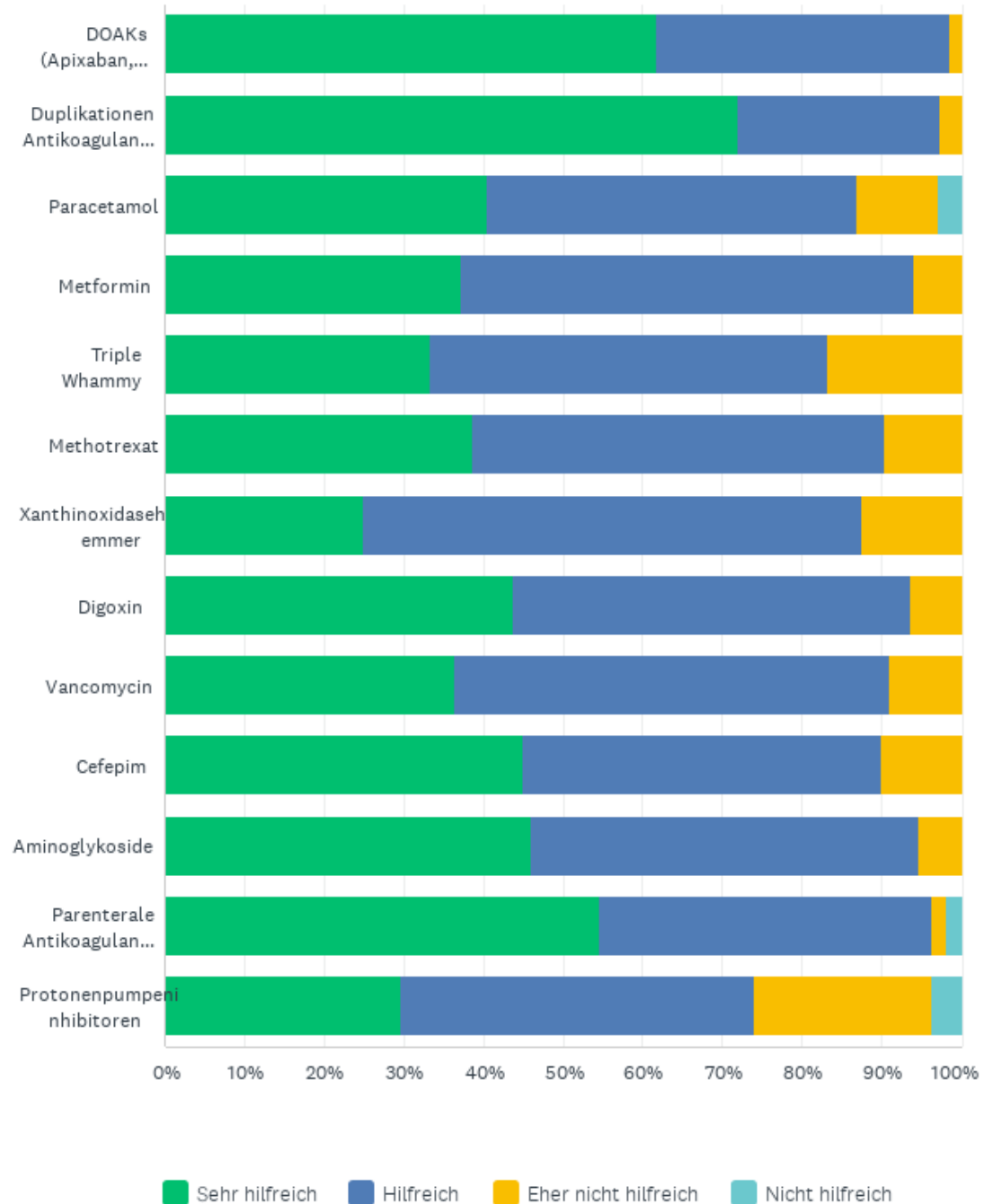
- 18 Agents finished (1 paused)
- 2 Agents in Development (CISTEC)
- 04/2021: Implementation in Spital Zofingen (Long Care Hospital)
- Number of Alerts in the first half of 2021: 1085
- Overall Acceptance of Alerts: >60%
- Big differences per Algorithm
 - Antigoagulant Duplication: 100%
 - Apixaban Underdosing: 50%



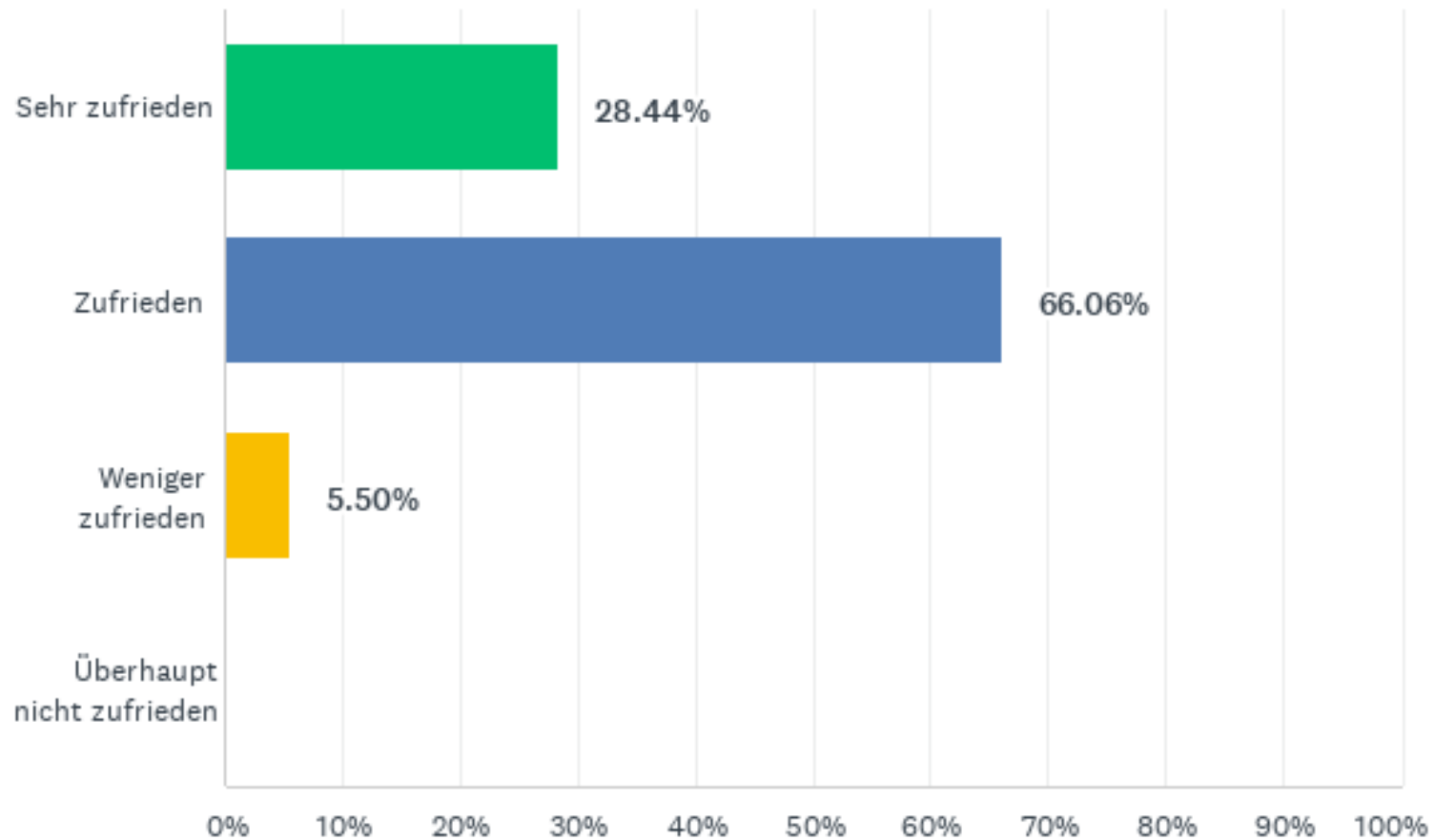
Helpfulness

Survey amongst physicians at
KSA in September 2021

- Number of participants: 153
- Response rate: 26.8 %
- Overall:
 - Very helpful (green):
43.4% (range: 25.0-72.0%)
 - Helpful (blue):
47.2% (range: 25.3-62.5%)
- High number of
'Algorithm unknown'
61.4% (range: 34.0-86.6%)



Overall Satisfaction



Next Steps

- Implementation of new Agents:
 - Combination errors (incl. Delphi-Survey)
 - Heparin-induced Thrombocytopenia
- Goal 2022: 10 new Agents

- Evaluation of Agents:
 - Metformin
 - Triple Whammy
 - Duplications Anticoagulants
 - Comparison with KSA/KSB (same KIS)

 Any Questions?

Thank you for your attention.

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