A Platform for DRG development with seamless integration of medical decision trees and cost calculation

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Agenda

- **Background: The SwissDRG System**
- An In-House Built DRG Development Platform
- Example of a Development Step

Since 2012, Hospitals reimbursed based on DRG System

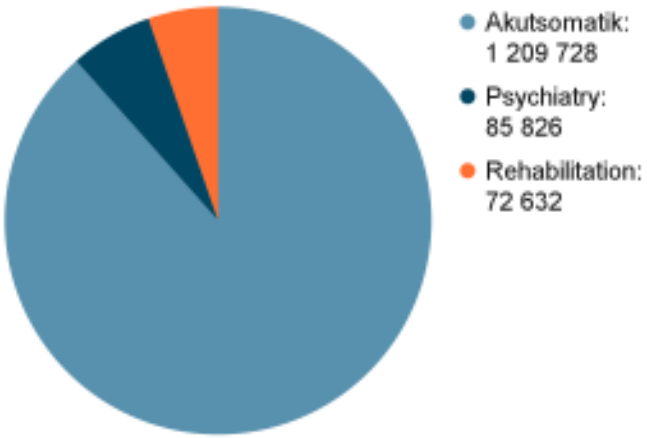
- DRG system categorizes patients into ~1000 DRGs.
  Hospitals reimbursed by DRG-based flat rate.
- DRG system should cover ***average*** yearly costs of all Swiss hospitals
  ⇒ maximize R2 (proportion of cost variance explained by DRG grouping)
- DRG system should make **sense in medical terms**
  transparent and comprehensible

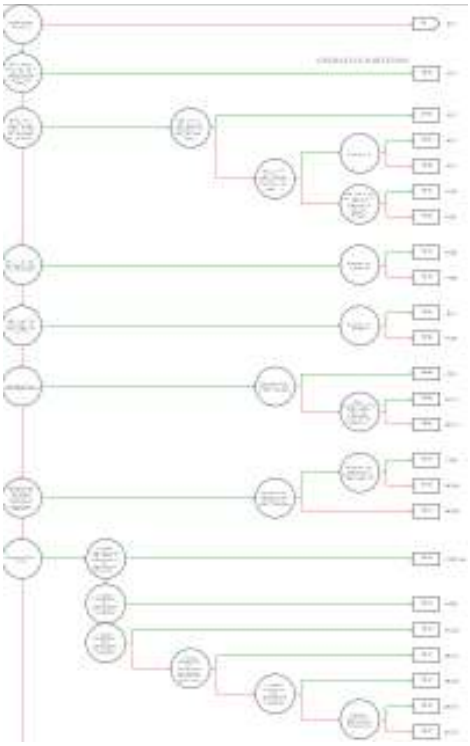
DRG System Adapted Yearly

- …to new diagnoses and procedures
- Change requests from the healthcare community must be evaluated and, if useful, integrated

SwissDRG System Based on all Hospitals' Patient Data

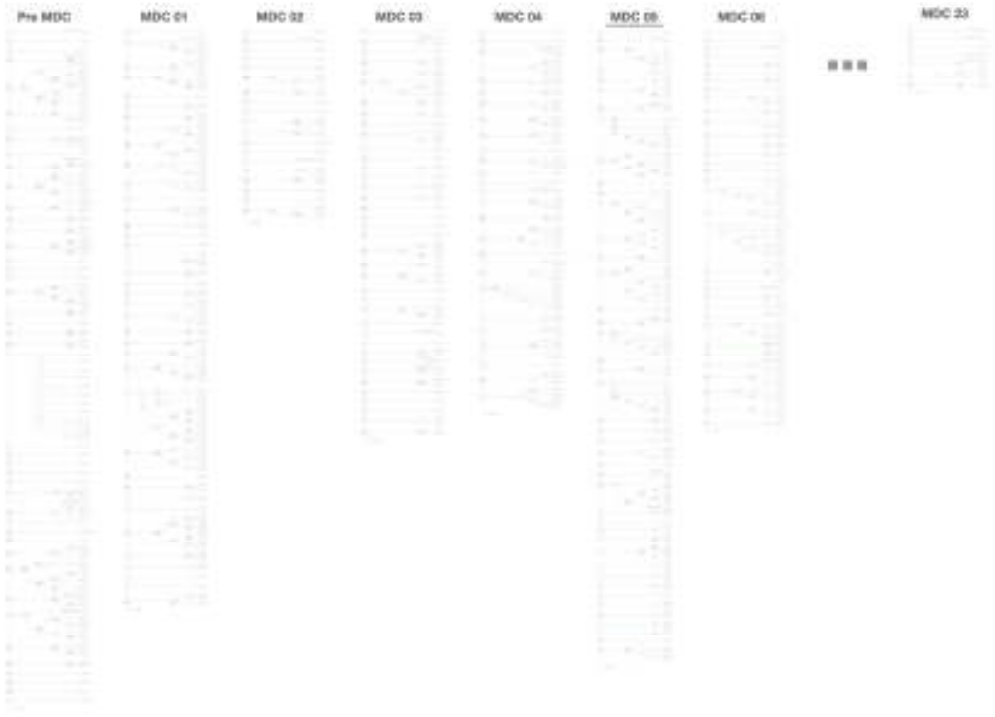
- Yearly data collection from most Swiss hospitals (**285** in 2021)





Set of Rules as a Hierarchical Decision Tree

- Nodes with If-Then decisions with refined medical logics
- Leafs with DRGs



Example DRG “F98A”

“Endovascular heart valve surgery, with aortocoronary bypass or intensive care complex treatment with > 196 /360 cost points.”

Decision Nodes Contain Logical Expressions

“artoconoral bypass *or* intensive care complex treatment with > 196/360 points”

Aortokoronarer Bypass od. IntK > 196 / 360 Pkt.

```
1   SRG IN TABLE(A02870RA)
2   OR SRG IN TABLES (CO2798NO, CO2801NO)
```

SRG = “surgery”
= any procedure

Logics can be nested or refer to functions which encapsulate other logic.

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Motivation: New Medical Requirements

- Before 2020 SwissDRG Inc. has worked for almost 10 years with standalone Windows based system.
- To facilitate collaboration and cover new needs and gain flexibility to adapt to future needs of the medical development team, SwissDRG developed a tool in-house

Faster System Development

- Changes in the DRG system are evaluated immediately *within* the tool:

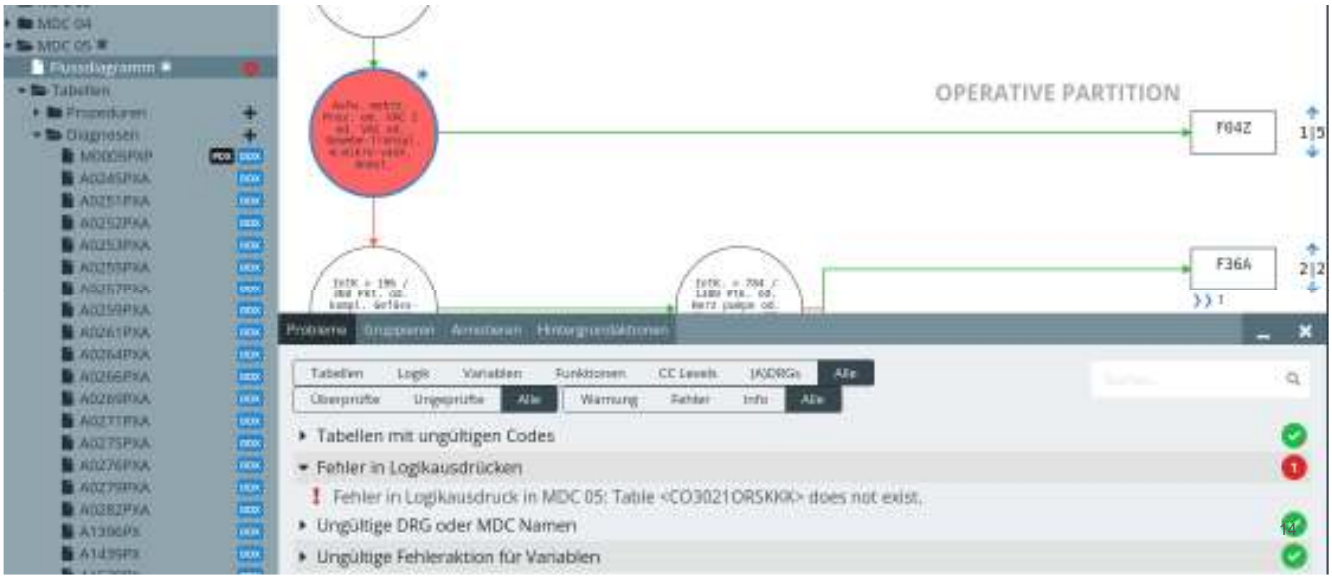
  ⇒ integrated…
  - system development **and**
  - calculation with patient data

Higher Quality through Immediate Feedback

- A set of validations runs concurrently while editing; e.g.
  - table with invalid diagnosis codes
  - invalid logic expressions
  - invalid DRG names
- Users can tick off validations and comment on them.

  Before: validation only at the end of a development cycle
  => over 1000 warnings, many of them irrelevant

Validations: List Links to Problem Position



Monitoring: Machine Load; Automatic Replication

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Example Overview

1. extend a rule system by adding a conditional split
2. group the patient data with the changed rule system
3. compare the differences between current and new grouping
4. calculate the new catalog
5. compare the catalog between current and new catalog

Extend a System by Adding a Conditional Split

Start: base DRG **F04:**

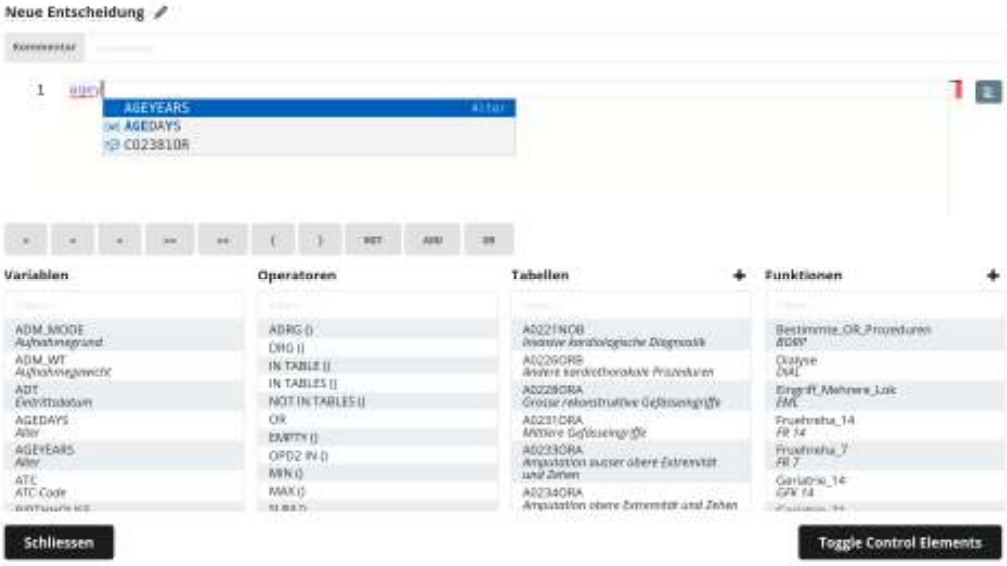
“Elaborate multi-stage procedures or complex vacuum treatment with existing intervention or tissue transplantation with microvascular anastomosis for diseases and disorders of the circulatory system”

Adding the split

insert a new decision node
and a new DRG

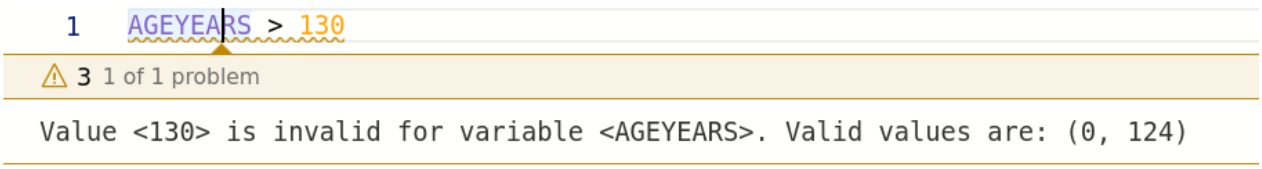
Red: missing logic, missing DRG name

Editor assists in writing correct logic expressions



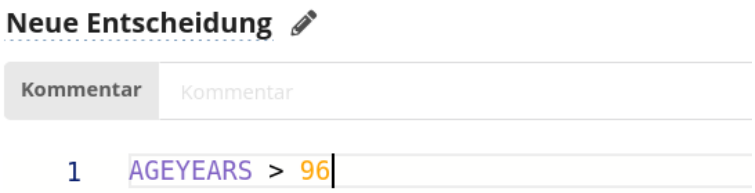
The editor suggests existing function or variable or table names.

Editor checks syntax and semantics



Check happens ***while*** writing logical expressions.

Adding the split logic



“age older than 96 (years)”

Name the new DRG

All elements affected by the change are marked.

Changes in Fitness Criteria

Difference in fitness criterion R2 (variance explained by the DRG grouping specified by this changed set of grouping rules)

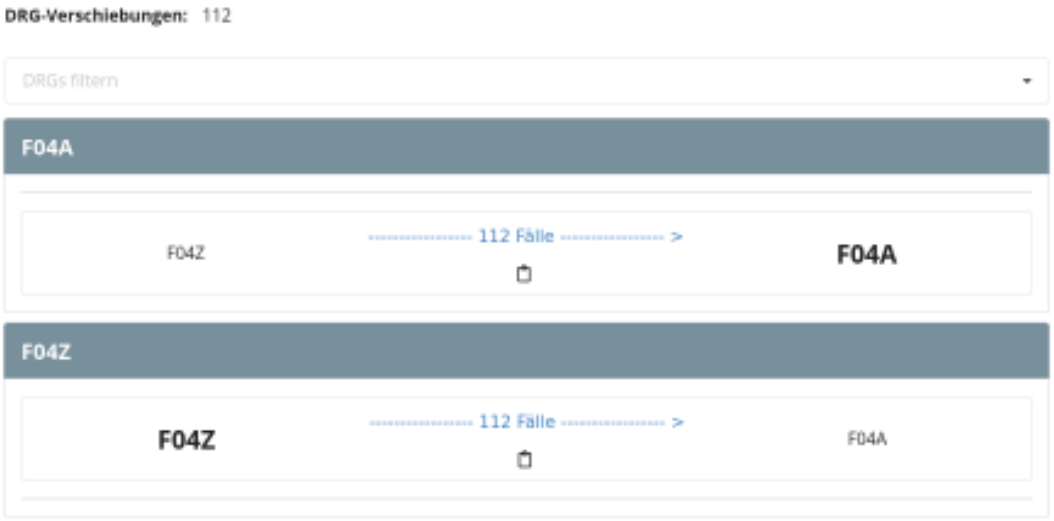
Statistics of the Differences between the two Groupings

Rang	DRG	Fallanzahl alle	Kosten Mw alle	Kosten Str alle	Kosten HK alle	Tagesk. MW alle	VWD Mw alle	Diffk. Mw alle	Fallanzahl inlier	Kosten Mw inlier	Kosten Str inlier	Kosten HK inlier	Tagesk. MW inlier	VWD Mw inlier	VWD Str inlier	VWD HK inlier	Diffk. Mw inlier	OVMV	L-TP	H-TP
0	F04A	0	0	0	0.0%	0	0.00		0	0	0	0.0%	0	0.00	0.00	0.00		0	0	0
5	F04A	112	94000	40670	69.8%	2351	42.29		87	81639	30704	72.7%	2449	34.56	9.78	77.94		V	12	53
5	F04A	112	94000	40670	69.8%	2351	42.29	94000	87	81639	30704	72.7%	2449	34.56	9.78	77.94	81639		12	53
5	F04Z	124	90973	40734	69.1%	2338	41.32		95	79083	30872	71.9%	2424	33.78	10.00	77.15		V	11	52
6	F04Z	12	62713	29971	67.7%	2215	32.25		8	53798	21267	71.7%	2161	26.50	12.13	68.60		A	10	47
1	F04Z	-112	-28260	-10763	-1.4%	-123	-9.07	94000	-87	-25285	-9605	-0.3%	-263	-7.28	2.13	-8.55	81408		-1	-5

Shows statistics of differences in number of patients, cost and length of stay:

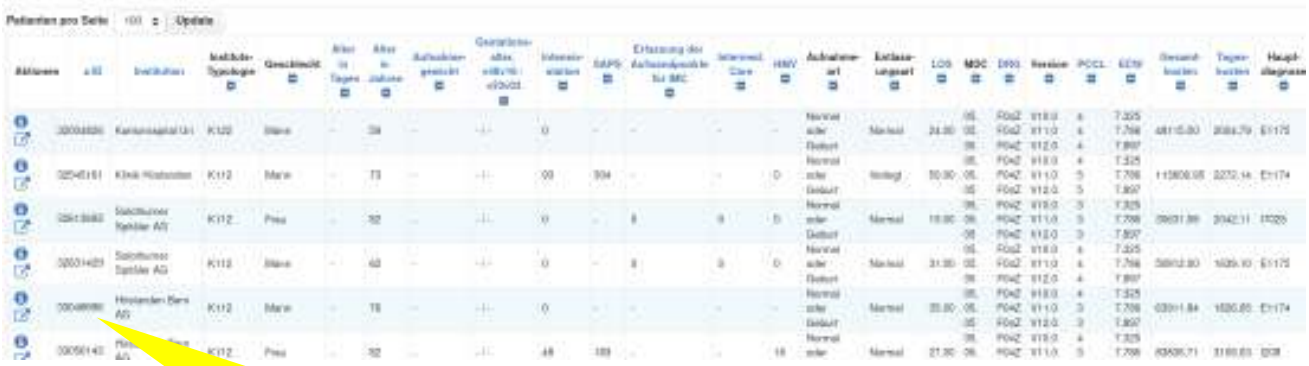
- average
- standard deviation

Evaluate shifted patient cases



Which patients “moved” into new DRG “F04A”?

Examine individual shifted patients



Drill down into database
to examine individual shifted patient cases

Catalog: Statistics per DRG

Katalog

Kennzahlen | Katalog | Grafiken

PCG	nr_cases	n_cases_tr_out	n_hosp	avg_costs	med_costs	std_costs
Egin	63075	3487	62	25333	18093	26870
TP21A	135	10	27	17793	13277	15363
TP21B	6940	501	46	17322	12197	17530

...

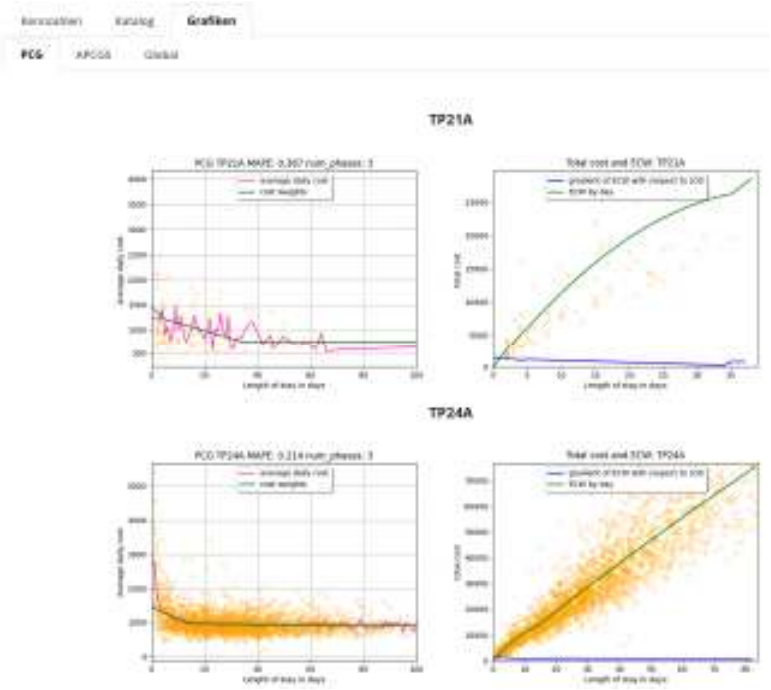
DMI	CMI	r2	BIC	MAPE	MAE	RMSE	rmsl_R2
1.800	32.945	0.675	798.947	0.215	4658	9499	0.118
1.186	23.148	0.776	873.697	0.367	5098	7302	0.080
0.967	22.526	0.682	743.472	0.202	2959	6016	0.080

DMI: Day Mix Index
CMI: Case Mix Index

Based on the changed rule system, a catalog with new cost-weight was calculated.

Using this new catalog, cost and demographic statistics were calculated.

Catalog diagrams



Diagrams show
average cost
and compensation, given this catalog.

Conclusion

We developed an infrastructure that allows…

- graphical manipulation of system rules
  AND
  quick simulation of the effects - all the way to generating cost weights per DRG and calculating case mix indices for all patients.
- quick adaptation of the system, e.g. in case of pandemics
- implementation of new features based on user requirements within 2-4 weeks

Join us for the **Live Demo**

Join us for a demo (and a drink):

today 17:30 in Room “D”

We are happy to answer your questions:

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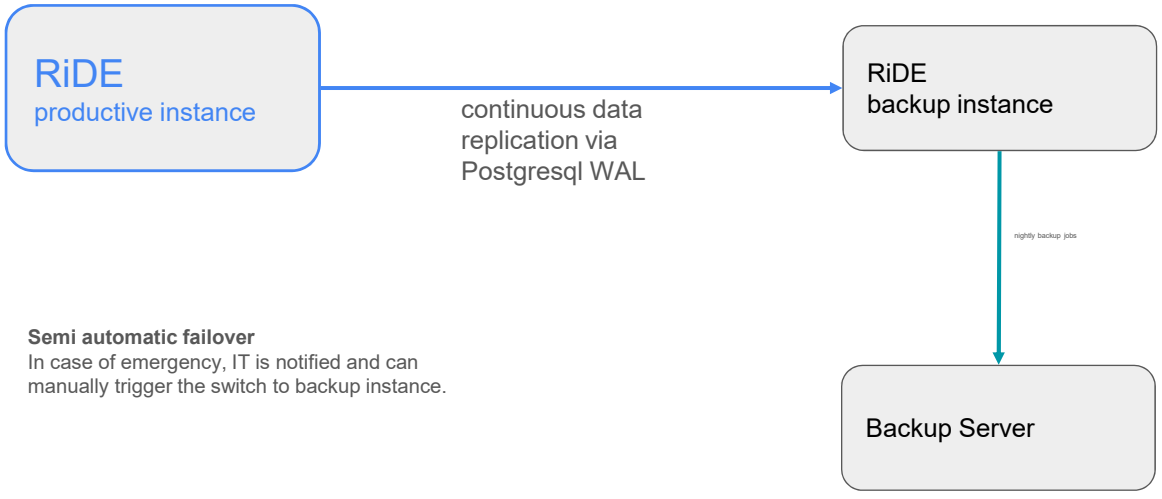
Urs Gerber: urs.gerber@swissdrg.org

Simon Hölzer: simon.hoelzer@swissdrg.org

Since 2012: SwissDRG System and comprehensive flat rates for reimbursement in Switzerland

- Since 2012: patients categorized (grouped) into DRGs
- Comprehensive flat rate as an objective: DRG valuation (cost weights) includes operating costs as well as costs for infrastructure
- Reimbursement mechanism:
  Individual baserate x Cost weight (of DRG catalogue) + additional payments = payment per hospitalized patient (inpatient case) = flate rate
- Hospital financing mechanism: sum of flat rates (of inpatient cases) + payment for community services

Continuous Mirroring and Backup



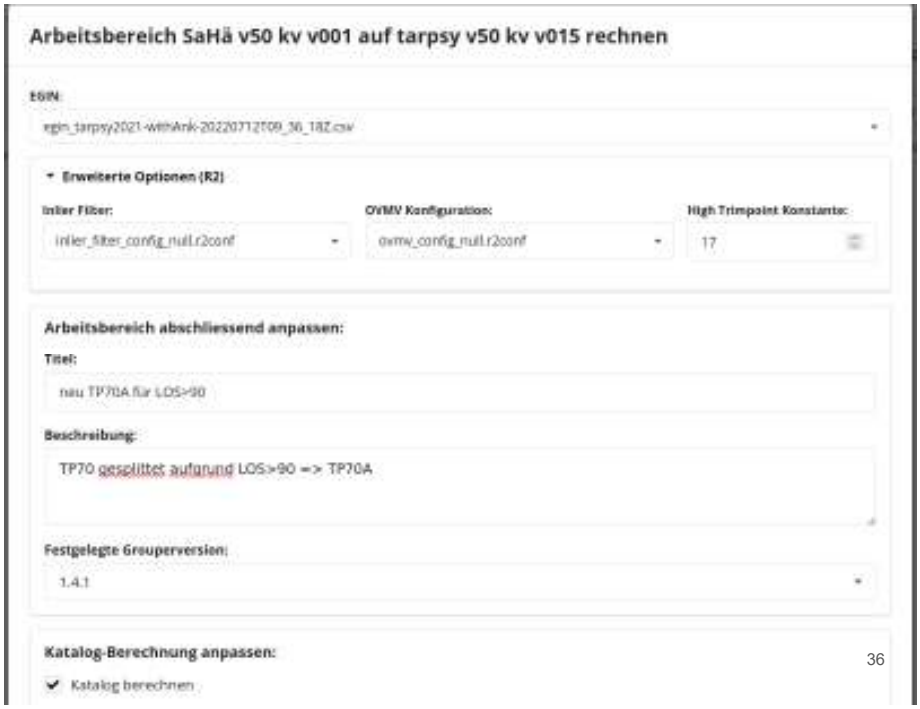
Semi automatic failover
In case of emergency, IT is notified and can manually trigger the switch to backup instance.

Monitoring:

Application Performance

Group patient set with updated rules, calculate statistics

“Egin”: patient data set



Catalog with fitness statistics

Katalog

Kennzahlen | **Katalog** | Grafiken

MAPE	RMSE	Correlation Coefficient	Bezugsgrösse
0.21394066144115 79	9443.942641463724	0.9363332071383937	768.9465195139311

pcg	mape	num_cases	num_phases	norm_factor	regpt_1	regpt_2	regpt_3
TP21A	0.318	215	3	1	1	7	62
TP21B	0.201	6943	3	1	1	8	80

- Overall fitness statistics (for entire patient set)
- Fitness statistics per DRG

Technology