



Discrete-event simulation model for German PSAPs

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INTRODUCTION

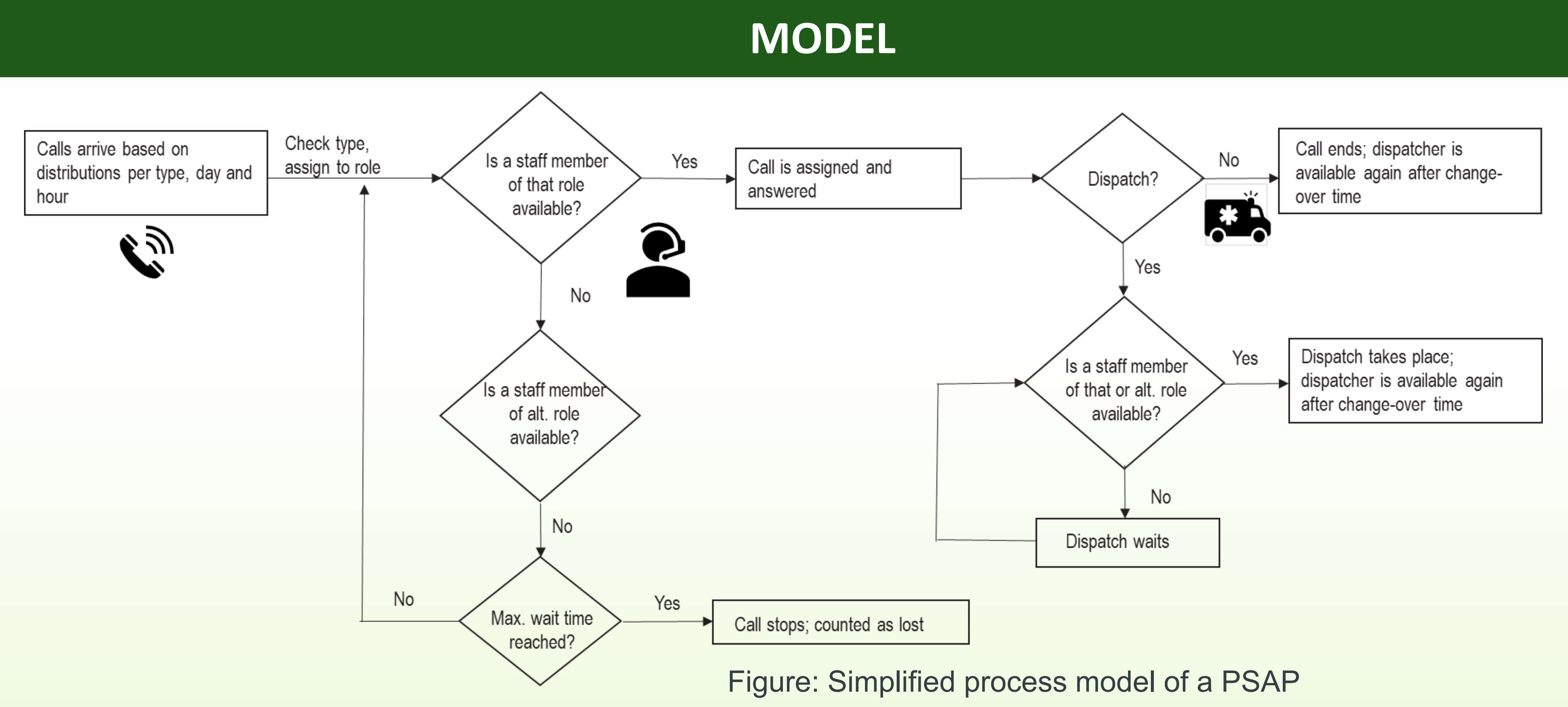
- Public Safety Answering Points (PSAP) or call centres still neglected and often overlooked, rarely a research focus
- Central role in emergency care as “gate-keepers” and coordinators; decide about care levels for emergency patients
- 112 calls and demand for emergency services increasing in Germany, while facing staff shortages in all areas
- Extreme weather events and crises put additional pressure on PSAPs
- AI and software solutions not widely used yet, but could be disruptive

AIM

- Promote PSAP research
- Promote the importance of PSAP logistics
- Showcase the usefulness of Operations Research approaches
- Analyse potential impact of future developments on PSAPs
- Support PSAPs in preparing for future developments
- Support PSAPs in managing their staffing levels
- Provide a simple and easily extendable tool for PSAPs which they can use themselves

GERMAN PSAPs

- 230 PSAPs in Germany
- Federal state laws (16)
- No standards in call-taking, dispatching, training/education etc.
- Handling (urgent) medical and fire emergencies via 112 and patient transports via 19222
- Dispatch emergency ambulances (RTW), transport ambulances (KTW), emergency physicians (NEF) and all kinds of fire service vehicles, sometimes also HEMS



METHOD

- Process analysis in German PSAPs (on-site visits and surveys)
- Development of potential scenarios based on literature and input from practice (surveys and interviews)
- Mathematical simulation, i.e. discrete-event simulation model
 - Generic model that can be applied to different PSAPs
 - Implementation in Python
 - Development of an HCCM model for evaluation
 - Data collection in several German PSAPs, design of an artificial instance for further analysis and publication

CONCLUSIONS and OUTLOOK

- More research should focus on PSAPs and their processes and digitalisation
- A discrete-event simulation model is a powerful tool for analysing staffing levels and effects of different scenarios
- Further analysis (qual. and quant.) of implementing AI- and data-based software solutions in German PSAPs + development of these solutions
- Comparison of PSAP processes internationally, e.g. Germany, New Zealand, Australia, Austria, UK, The Netherlands + development of a generic simulation model applicable in all those countries

RESULTS

- Impacts on staff utilisation and fulfilment of response time targets could be analysed for all defined scenarios
- Impacts vary for the scenarios

Role	BASE CASE	CALL INCREASE (7%)	PT Tool	sSNA
	Utilisation	Utilisation	Utilisation	Utilisation
EMS Dispatcher	52.35%, 58.94%	+1.1 %		
FS Dispatcher	37.01%	+1.3 %		
112 Call-takers	35.83%, 36.42%, 37.76%, 39.23%, 41.03%, 41.64%	+2.2 %		+ 2.4 %
Patient transport (PT) Dispatcher	80.82%		- 23.7 %	
PT Call-takers	45.69%, 47.10%		- 15.3 %, - 16.2 %	
Backup	7,32%	+ 4.6 %		
Response targets	Fulfilment	Fulfilment		Fulfilment
3 seconds	97.78%	- 0.2 %		- 0.3 %
5 seconds	98.26%	- 0.2 %		- 0.3 %
10 seconds	99.17%	- 0.1 %		- 0.2 %
Other	Percentage	Percentage		Percentage
Lost calls (112)	1.03%	+ 0.1 %		+ 0.3 %

Table: Exemplary results of a simulation study with artificial data input for German PSAP

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