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Informationen auf den Punkt gebracht

# Pro und Contra der KI in der AMInfo- Büchse der Pandora oder unterstützende Technologie?

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Krankenhausapotheke Heidelberg  
Universitätsklinikum Heidelberg





## Pro

schneller Zugang zu  
Arzneimittelinformationen

Zusammenfassung großer  
Datensätze, viele Sprachen

Individualisierte  
Antworten



## Contra

Fehlerhaft  
Unvollständig

Keine Nuancierung  
Kein Kontext

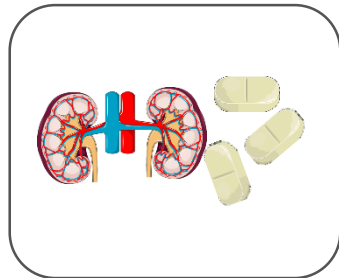
Haftung?

Risiko für Fehlinterpretation

RESEARCH

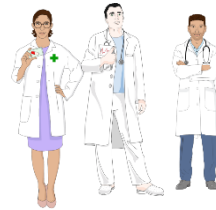
## Poor performance of ChatGPT in clinical rule-guided dose interventions in hospitalized patients with renal dysfunction

Merel van Nuland<sup>1</sup> · JaapJan D. Snoep<sup>2</sup> · Toine Egberts<sup>3,4</sup> · Abdullah Erdogan<sup>1</sup> · Ricky Wassink<sup>1</sup> · Paul D. van der Linden<sup>1</sup>



172 Niereninsuffizienz - Alerts in 80 Patienten

①



Beantwortung durch Experten-Panel

②



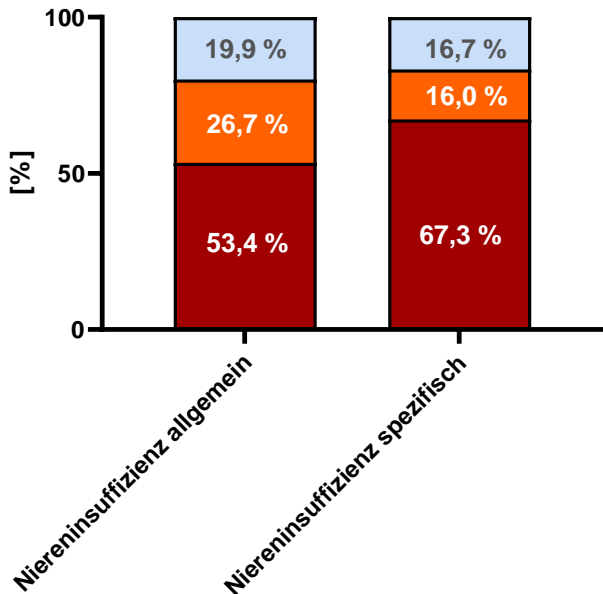
Beantwortung durch ChatGPT

Einteilung in

Korrekt und identisch

Korrekt aber unterschiedlich

Falsch



- Korrekt und identisch
- Korrekt und unterschiedlich
- Falsch

#### With patient variables

An 82-year-old female with an eGFR (CKD-EPI) of 14 ml/min is admitted to the Department of Geriatrics with pneumonia influenza A. She is treated with alendronic acid 70 mg once per week for osteoporosis. Her renal function prior to hospitalization was 47 ml/min and the reason for decline in eGFR is prerenal due to dehydration. No co-medication affecting renal function is being used. What dose for alendronic acid would a healthcare professional recommend?

#### Correct

Continue treatment and monitor renal function

Before hospitalization, the renal function of this patient was adequate, and it is anticipated to recover since renal function was attributed to dehydration. Alendronic acid, administered weekly, is not expected to impede this recovery, and renal function is anticipated to normalize within short period. Hence, treatment continuation is deemed feasible, with close monitoring of renal function recommended.

#### Correct but different

Cease treatment during hospitalization

The treatment indication of this patient is osteoporosis. It is feasible to discontinue treatment during hospitalization without compromising efficacy. Nonetheless, resuming treatment upon hospital discharge is crucial to mitigate potential risks. Given the associated risk, the expert panel advises maintaining treatment continuity.


#### Incorrect

Reduce the dose to 30 mg once per week

A dose reduction to 30 mg once per week is not described in literature and is therefore not recommended.

## Performance of ChatGPT on Factual Knowledge Questions Regarding Clinical Pharmacy

The Journal of Clinical Pharmacology  
2024, 64(9) 1095–1100  
© 2024, The American College of  
Clinical Pharmacology  
DOI: 10.1002/jcp.2443


Merel van Nuland, PharmD, PhD<sup>1</sup> , Abdullah Erdogan, BSc<sup>1</sup>, Cenkay AÇar, PharmD<sup>1</sup>, Ramon Contrucci, PharmD<sup>2</sup>, Sven Hilbrants, PharmD<sup>3</sup>, Lamyae Maanach, PharmD<sup>4</sup>, Toine Egberts, PharmD, PhD<sup>5,6</sup>, and Paul D. van der Linden, PharmD, PhD<sup>1</sup>

Received: 26 April 2023 | Revised: 1 August 2023 | Accepted: 14 August 2023  
DOI: 10.1111/oxp.15896

ORIGINAL ARTICLE




## Evaluating the performance of ChatGPT in clinical pharmacy: A comparative study of ChatGPT and clinical pharmacists

Xiaoru Huang<sup>1,2</sup> | Dannya Estau<sup>1,2</sup> | Xuening Liu<sup>1,2</sup> | Yang Yu<sup>1,2</sup> | Jiguang Qin<sup>1,2</sup> | Zijian Li<sup>1,2,3</sup> 

Research in Social and Administrative Pharmacy 19 (2023) 1590–1594

Contents lists available at ScienceDirect

Journal of the American Pharmacists Association

ELSEVIER 

journal homepage: [www.japha.org](http://www.japha.org)

### RESEARCH

## Effectiveness of ChatGPT in clinical pharmacy and the role of artificial intelligence in medication therapy management



Don Roosan<sup>\*</sup>, Pauline Padua, Raiyan Khan, Hasiba Khan, Claudia Verzosa, Yanting Wu

Original Research Article



NEALIN

## Evaluating ChatGPT's efficacy in assessing the safety of non-prescription medications and supplements in patients with kidney disease

Mohammad S. Sheikh<sup>1</sup>, Erin F. Barreto<sup>2</sup>, Jing Miao<sup>1</sup>, Charat Thongprayoon<sup>1</sup> , James R Gregoire<sup>3</sup>, Benjamin Dreesman<sup>2</sup>, Stephen B. Erickson<sup>1</sup>, Iasmina M. Craici<sup>1</sup> and Wisit Cheungpasitporn<sup>2</sup> 

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Research in Social and Administrative Pharmacy

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## Assessing the accuracy and consistency of ChatGPT in clinical pharmacy management: A preliminary analysis with clinical pharmacy experts worldwide

Zahraa Al-Dujaili<sup>\*</sup>, Sarah Omari<sup>2</sup>, Jey Pillai<sup>3</sup>, Achraf Al Faraj<sup>4,\*</sup>

<sup>\*</sup> College of Pharmacy, American University of Iraq – Baghdad (AUIB), Baghdad, Iraq

<sup>4</sup> Department of Epidemiology and Population Health, American University of Beirut (AUB), Beirut, Lebanon



## Ergebnisse heterogen, je nach Kontext und benötigter Datengrundlage

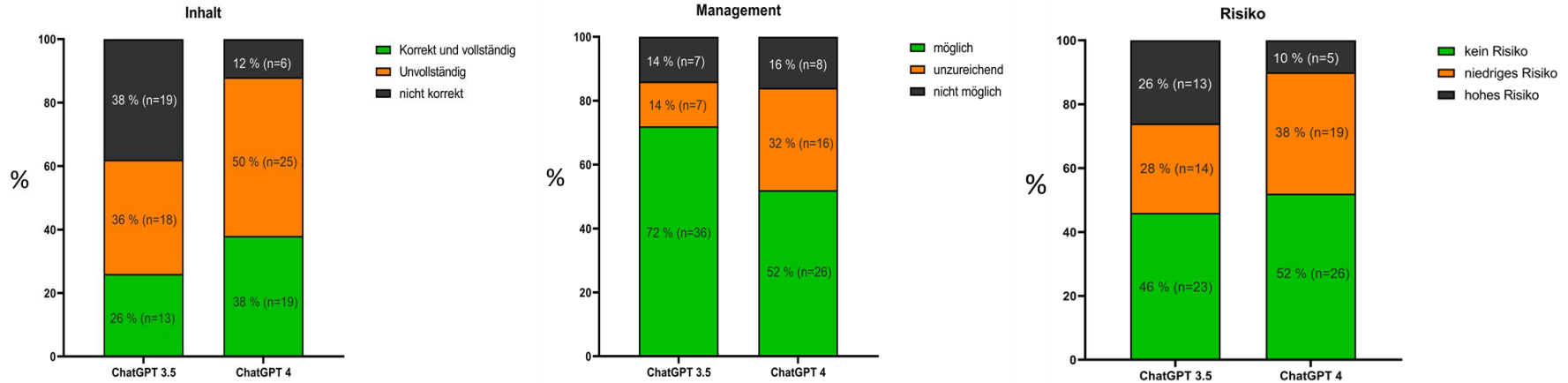


Books1



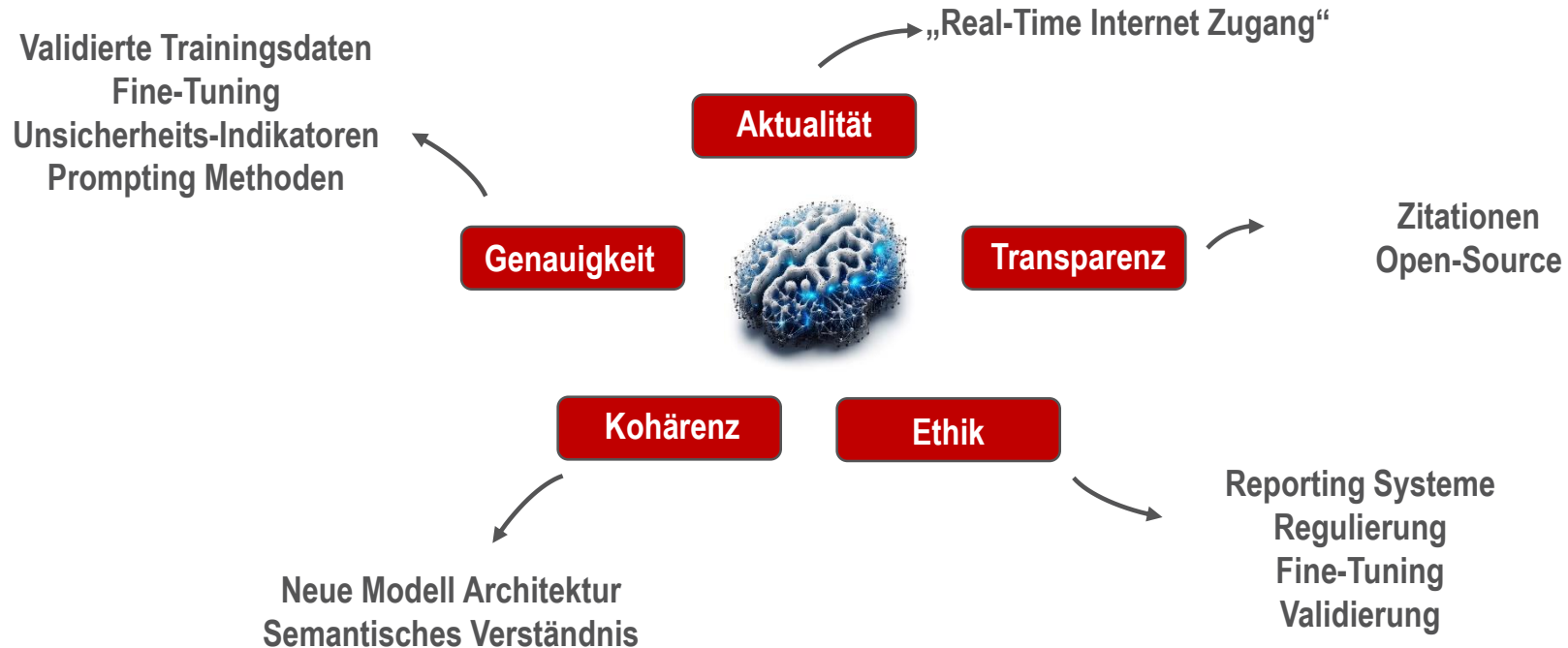
Books2

Enorme Datenmengen



**Keine relevante Verbesserung zwischen ChatGPT 3.5 und ChatGPT 4.0**





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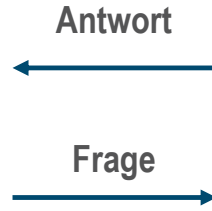
# Large language models should be used as scientific reasoning engines, not knowledge databases

[Daniel Truhn](#), [Jorge S. Reis-Filho](#) & [Jakob Nikolas Kather](#) 

*Nature Medicine* 29, 2983–2984 (2023) | [Cite this article](#)

3275 Accesses | 23 Citations | 21 Altmetric | [Metrics](#)

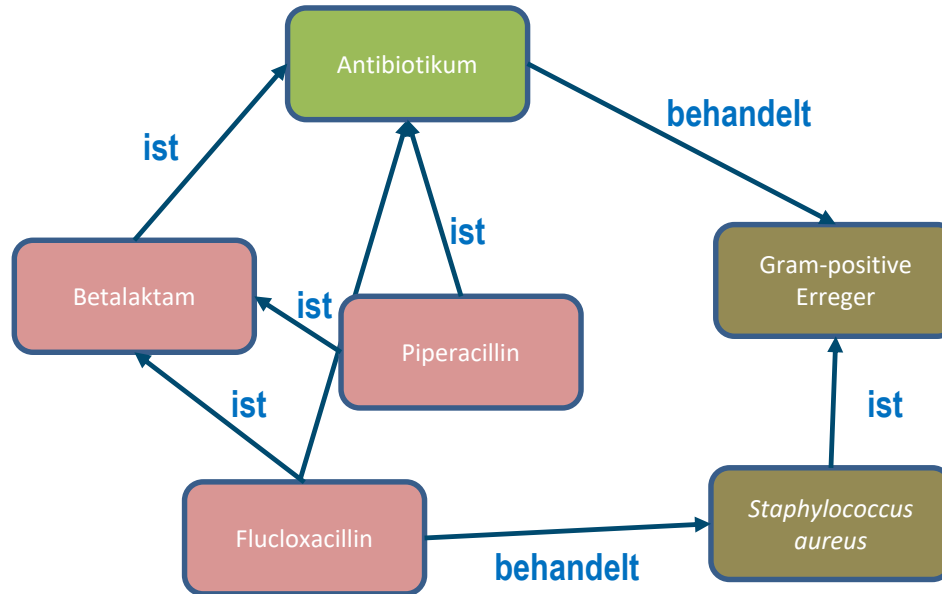




Zugriff auf externe  
Datenquellen:

Leitlinien  
Internet  
SOP  
Etc.



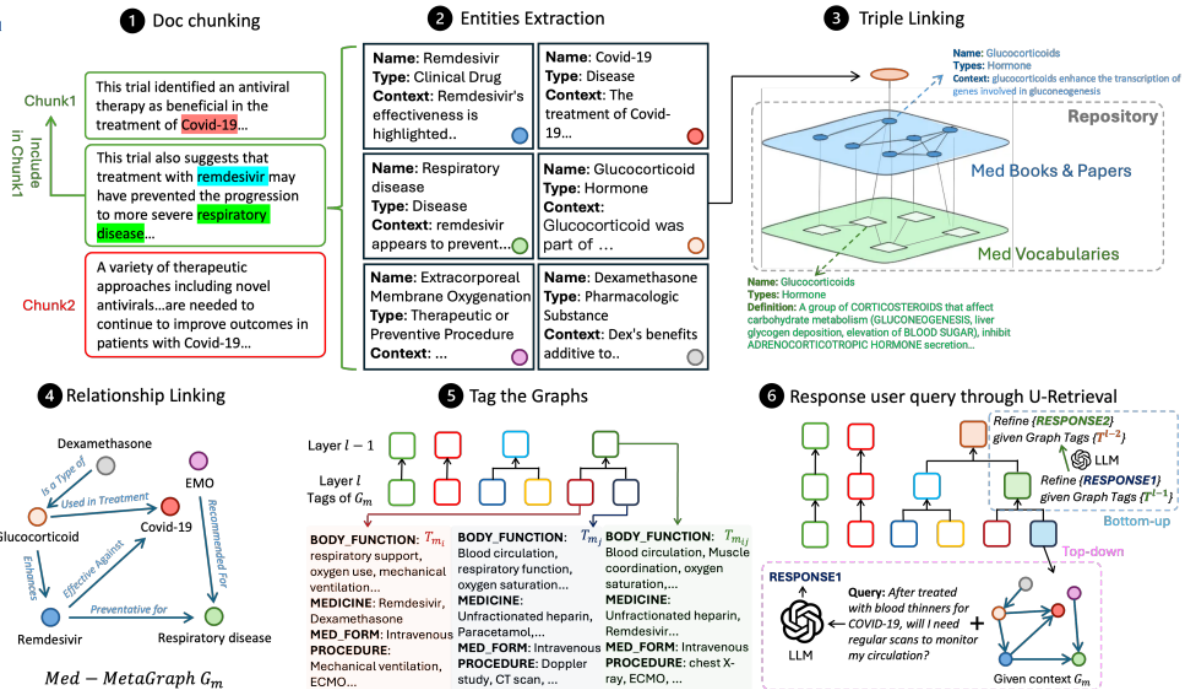


## MEDICAL GRAPH RAG: TOWARDS SAFE MEDICAL LARGE LANGUAGE MODEL VIA GRAPH RETRIEVAL-AUGMENTED GENERATION

Junde Wu  
University of Oxford  
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Jiayuan Zhu  
University of Oxford

Yunli Qi  
University of Oxford



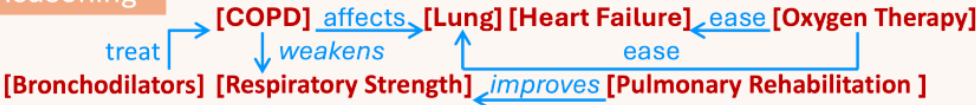
Question

In patients with both chronic obstructive pulmonary disease (COPD) and heart failure, how can lung function be improved?

GraphRAG

In patients with both COPD and heart failure, managing lung function without worsening heart symptoms requires an integrated approach. Treatment involves bronchodilators, supplemental oxygen therapy to ease heart and lung workload, and pulmonary rehabilitation to improve respiratory strength. Close monitoring by healthcare professionals is crucial to ensure balanced treatment for both conditions.

Graph Reasoning



## MedGraphRAG

In patients with both COPD and heart failure, the combination of bronchodilators and cardioselective beta-blockers can be used effectively to manage both conditions without significantly worsening respiratory symptoms or heart function [1,4]. Cardioselective beta-blockers, such as bisoprolol or metoprolol, are safe for COPD patients because they primarily block beta-1 receptors in the heart, minimizing the risk of bronchoconstriction associated with non-selective beta-blockers [1,2]. Bronchodilator therapy, including long-acting beta-2 agonists and muscarinic antagonists, should be continued to improve lung function in COPD [3].....

### References:

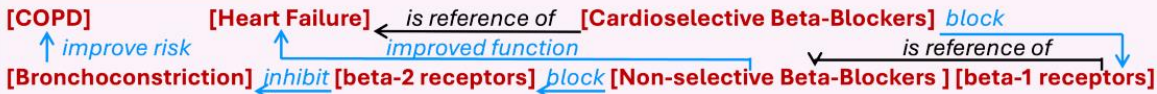
1. Salpeter SR, Ormiston TM, Salpeter EE. "Cardioselective beta-blockers for chronic obstructive pulmonary disease." *Cochrane Database of Systematic Reviews*. 2005
2. Du Q, Sun Y, Ding N, Lu L. "Beta-blockers reduced the risk of mortality and exacerbation in patients with COPD: A meta-analysis of observational studies." *PLoS ONE*. 2016;11(11):e0166861.

.....

### Terminological Clarification:

COPD:..., heart failure:..., bronchodilators:..., cardioselective beta-blockers:..., beta-blockers:...

## Graph Reasoning



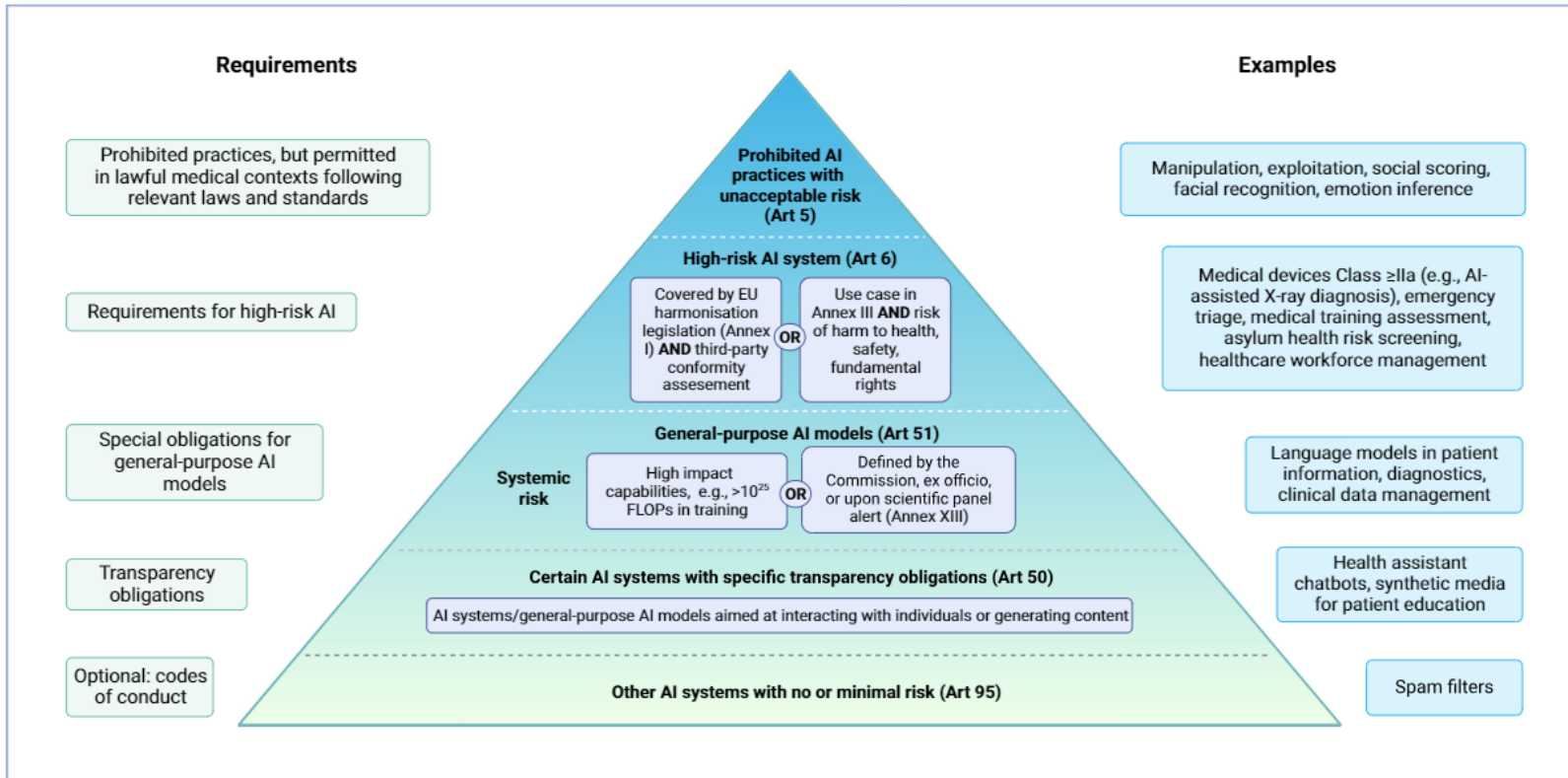
- Antwort korrekt im Detaillevel
- Kontext berücksichtigt
- Geringes Risiko für Halluzination
- Referenzen

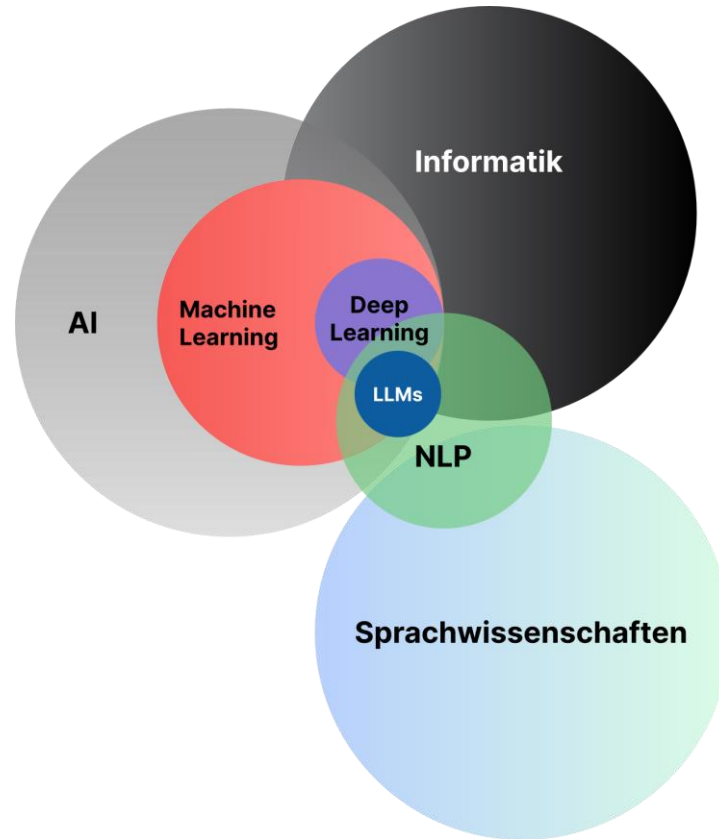
Model	Fake Health	Pub Health	MedQA	Med MCQA	Pub MedQA	MMLU Col-Med	MMLU Col-Bio	MMLU Pro-Med	MMLU Anatomy	MMLU Gene	MMLU Clinic
<i>Baselines without retrieval</i>											
Llama2-13B	53.8	49.4	42.7	37.4	68.0	60.7	69.4	60.3	52.6	66.0	63.8
Llama2-70B	58.9	56.7	43.7	35.0	74.3	64.2	84.7	75.0	62.3	74.0	71.7
Llama3-8B	51.1	53.2	59.8	57.3	75.2	61.9	78.5	70.2	68.9	83.0	74.7
Llama3-70B	64.2	61.0	72.1	65.5	77.5	72.3	92.5	86.7	72.5	83.9	82.7
Gemini-pro	60.6	63.7	59.0	54.8	69.8	69.2	88.0	77.7	66.7	75.8	76.7
GPT-4	71.4	70.9	78.2	72.6	75.3	76.7	95.3	93.8	81.3	90.4	86.2
<i>Baselines with RAG</i>											
Llama2-13B	56.2	54.3	48.1	42.0	68.6	62.5	68.3	63.7	51.0	64.5	67.4
Llama2-70B	64.6	63.2	56.2	49.8	75.2	69.6	85.8	77.4	63.0	75.8	73.3
Llama3-8B	60.5	59.6	64.3	58.2	76.0	68.6	84.9	73.2	72.1	85.2	77.8
Llama3-70B	76.2	72.1	82.3	72.5	80.6	86.8	94.4	89.7	84.3	87.1	87.6
Gemini-pro	72.5	68.4	64.5	57.3	76.9	79.0	91.3	86.4	79.5	80.4	83.9
GPT-4	78.6	77.3	88.1	76.3	77.6	81.2	95.5	94.3	83.1	92.9	93.1
<i>Baselines with GraphRAG</i>											
Llama2-13B	58.7	57.5	52.3	44.6	72.8	64.1	73.0	64.6	52.1	66.2	67.9
Llama2-70B	65.7	63.8	55.1	52.4	74.6	68.0	86.4	79.2	64.6	73.9	75.8
Llama3-8B	61.7	61.0	64.8	58.7	76.6	69.2	84.3	73.9	72.8	85.5	77.4
Llama3-70B	77.7	74.5	84.1	73.2	81.2	87.4	94.8	89.8	85.2	87.9	88.5
Gemini-pro	73.8	70.6	65.1	59.1	75.2	79.8	90.8	85.8	80.7	81.5	84.7
GPT-4	78.4	77.8	88.9	77.2	77.9	82.1	95.1	94.8	82.6	92.5	94.0
<i>Baselines with MedGraphRAG</i>											
Llama2-13B	64.1	61.2	65.5	51.4	73.2	68.4	76.5	67.2	56.0	67.3	69.5
Llama2-70B	69.3	68.6	69.2	58.7	76.0	73.3	88.6	84.5	68.9	76.0	77.3
Llama3-8B	79.9	77.6	74.2	61.6	77.8	89.2	95.4	91.6	85.9	89.3	89.7
Llama3-70B	81.2	79.2	88.4	79.1	<b>83.8</b>	91.4	96.5	93.2	89.8	91.0	94.1
Gemini-pro	79.2	76.4	71.8	62.0	76.2	86.3	92.9	89.7	85.0	87.1	89.3
GPT-4	<b>86.5</b>	<b>83.4</b>	<b>91.3</b>	<b>81.5</b>	83.3	<b>91.5</b>	<b>98.1</b>	<b>95.8</b>	<b>93.2</b>	<b>98.5</b>	<b>96.4</b>

Als Technologie durch externe Anbieter denkbar z. B. CDSS aktuell vor allem Start Ups










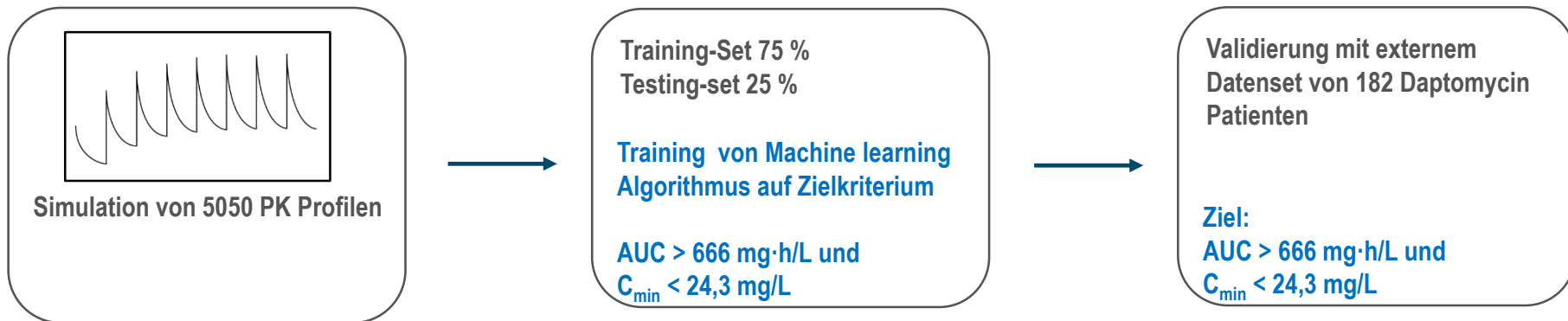


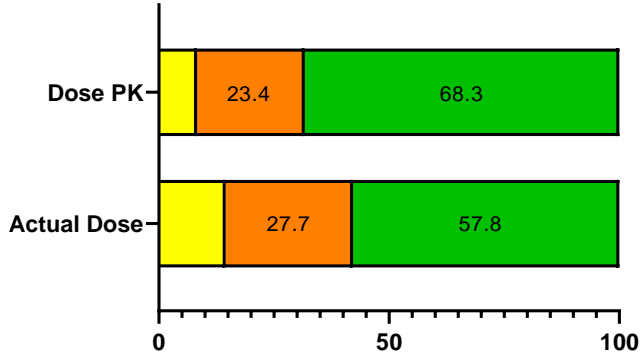
## A Machine Learning Algorithm to Predict the Starting Dose of Daptomycin

Florence Rivals<sup>1</sup> · Sylvain Goutelle<sup>2,3,4</sup> · Cyrielle Codde<sup>5,6</sup> · Romain Garreau<sup>2,3,4</sup> · Laure Ponthier<sup>6</sup> · Pierre Marquet<sup>1,6</sup> · Tristan Ferry<sup>4,7,8</sup> · Marc Labriffe<sup>1,6</sup> · Alexandre Destere<sup>9</sup> · Jean-Baptiste Woillard<sup>1,6</sup> 

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- AUC < 666 mg\*h/l und Cmin < 24.3 mg/l
- AUC > 666 mg\*h/l und Cmin > 24.3 mg/l
- AUC > 666 mg\*h/l und Cmin < 24.3 mg/l

### Daptomycin starting dose using Machine Learning

Proposed dose by machine learning

Glomerular filtration rate using Cockcroft (ml/min/1.73m<sup>2</sup>):

Values between 14 and 150 are accepted, model has not been tested for values out of this range.

Body weight (Kg):

Values between 48 and 153 kg are accepted, model has not been tested for values out of this range.

Sex:

Calculation of the success treatment probability based on desired dose

Dose (mg):

[daptomycinstartingdose.shinyapps.io/application/](https://daptomycinstartingdose.shinyapps.io/application/)



# Zusammenfassung

Die Einsatz-Szenarien von LLM in der Arzneimittelinformation bleiben durch die Architektur der Modelle limitiert.

Retrieval Augmented Generation erscheint ein vielversprechender Ansatz aktuelle Daten und Kontext in die Beantwortung einfließen zu lassen.

Der EU-AI Regulation Act wird die Anwendung von AI im Medizin Bereich neu ordnen und hoffentlich für mehr Transparenz sorgen.

AI ist ein großes Feld das nicht auf LLM begrenzt ist und vor allem auch der Machine Learning Bereich scheint interessante Anwendungszzenarien für die AMInfo zu bieten.

