Developing an application for calculating the MERIS score from real-world data

Dr. Bertalan Ádám[1], Király Gyula[2], Angyal Viola[1], Prof. Dr. Dinya Elek[1]

[1] Semmelweis Egyetem Doktori Iskola Egészégtudományi Tagozat

[2] Hospitaly Kft.

The MERIS calculation

The MERIS (Medication Risk Score) algorithm was developed by Eva Saedder and her colleagues at Aarhus University in Denmark. It is based on the risk categorization developed by her, and the aim of its development was to create a medication risk score that is as accurate as possible using the least amount of strictly objective data. This algorithm can be automated by classifying medications into one of the 54 risk categories declared by the Danes based on their ATC codes. For the calculation, only the ATC codes of the concurrently used medications and the patient's eGFR value are required. It is an innovative medical decision-support tool for the profession.

Medication Risk Score (MERIS)

Variable	Interval	Points
Impaired renal function	eGFR > 60	0
	60 > eGFR > 30	5
	eGFR < 30	10.6
Total number of drugs	0–5	0
	6–11	5
	>12	10.6
Number of drugs with	Low risk of harm (Max. number of drugs = 3)	0.25
	Medium risk of harm (Max. number of drugs = 8)	0.5
	High risk of harm (Max. number of drugs = 7)	1
	Low + medium risk of interaction (Max. number of drugs = 12)	0.25
	High risk of interaction (Max. number of drugs = 2)	0.5

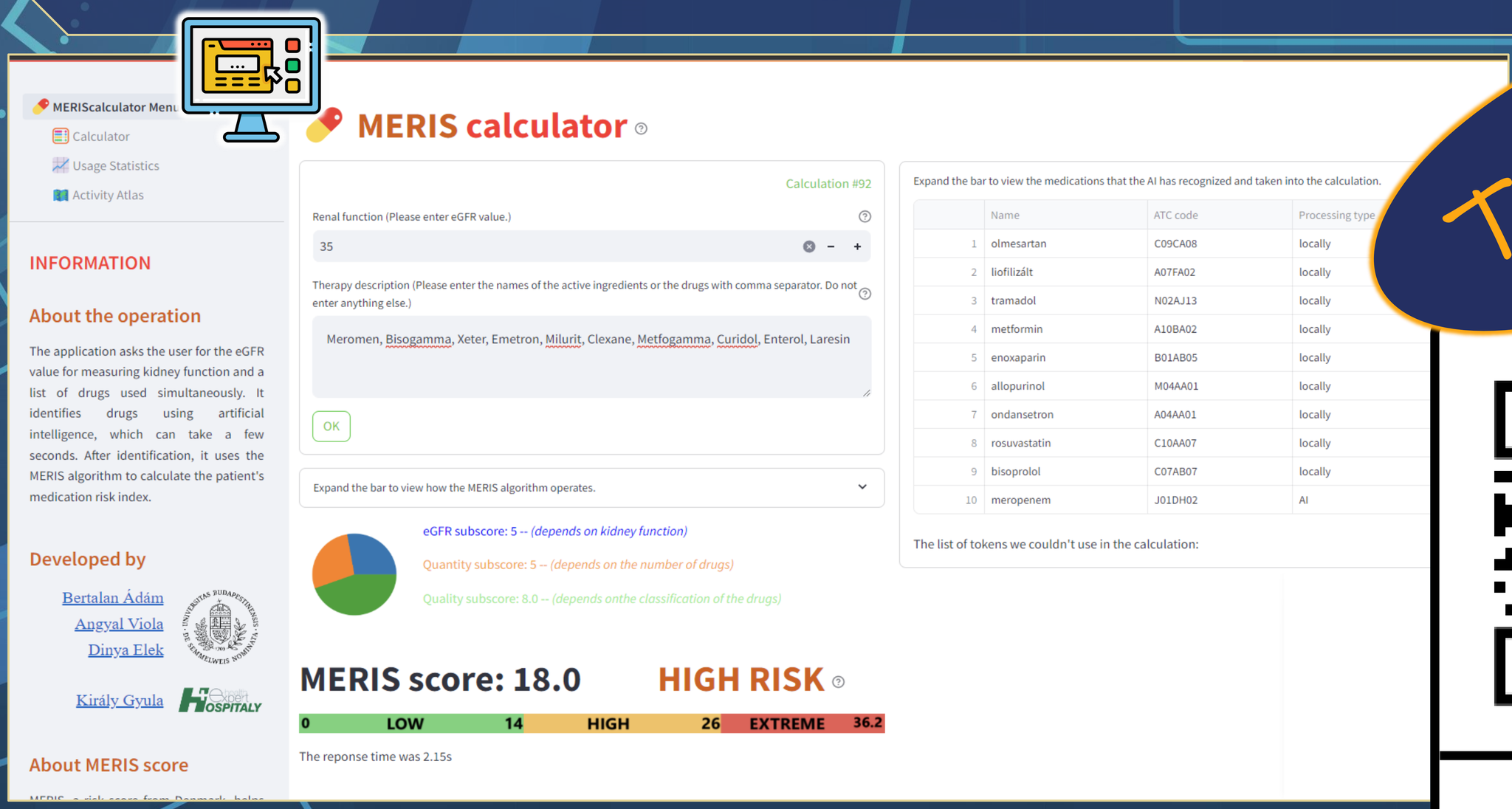
Hybrid data miner

To generate ATC codes from free text, we employ a hybrid text processing module that combines the reliability of rule-based algorithms with the flexibility of Artificial Intelligence. This enables us to generate data required for MERIS evaluation with high accuracy, even from real-world data. The process involves tokenization followed by token validation, and only then does ATC code generation commence. The rule-based algorithm runs first, and if there are any "remaining" tokens, we use the GPT model to identify them.

1. Tokenization
   - Validation
2. Rule-based algorithm
3. OpenAI GPT-4 model

The application

To test the tool, we have created a Python application using a streamlit framework in which users can try the MERIS evaluation on their own or their patient's medication. For the calculation, the system asks for an eGFR value and a free text therapy description. Thus, the user does not need to know the ATC codes of medicines. We have placed a lot of auxiliary information on the interface so that the procedure can be understood by laypeople and the explanation of the risk category can be viewed when evaluating the outcome. In addition to displaying the MERIS subpoint numbers, the ratio of subpoints is also represented using a circular chart. The medicines taken into account in the calculation can be viewed by the user in tabular form, where we also indicate which method of the hybrid data miner recognized the drug. In two additional pages, you can view time statistics on the use of the app and the distribution of activity across continents.



Try me!

meriscalculator.streamlit.app

References

1. Saedder, Eva Aggerholm, et al. "Classification of drugs with different risk profiles." Dan Med J 62.8 (2015): 1-6.
2. Saedder, E. A., Lisby, M., Nielsen, L. P., Rungby, J., Andersen, L. V., Bonnerup, D. K., & Brock, B. (2016). Detection of patients at high risk of medication errors: development and validation of an algorithm. Basic & clinical pharmacology & toxicology, 118(2), 143-149.
3. Høj, K., Pedersen, H. S., Lundberg, A. S. B., Bro, F., Nielsen, L. P., & Sædder, E. A. (2021). External validation of the Medication Risk Score in polypharmacy patients in general practice: A tool for prioritizing patients at greatest risk of potential drug-related problems. Basic & Clinical Pharmacology & Toxicology, 129(4), 319-331.
4. Thoegersen, T. W., Saedder, E. A., & Lisby, M. (2022). Is a High Medication Risk Score Associated With Increased Risk of 30-Day Readmission? A Population-Based Cohort Study From CROSS-TRACKS. Journal of Patient Safety, 18(4), e714-e721.
5. Adam Bertalan, Elek Dinya "Clinical pharmacists' role in electronic medication administration" Journal of Hungarian Interdisciplinary Medicine

National Research, Development and Innovation Office Hungary

PROJECT FINANCED FROM THE NRDI FUND