Chronic Kidney Disease

A patient is said to have chronic kidney disease (CKD) if they have abnormalities of kidney function or structure present for more than 3 months. [1]

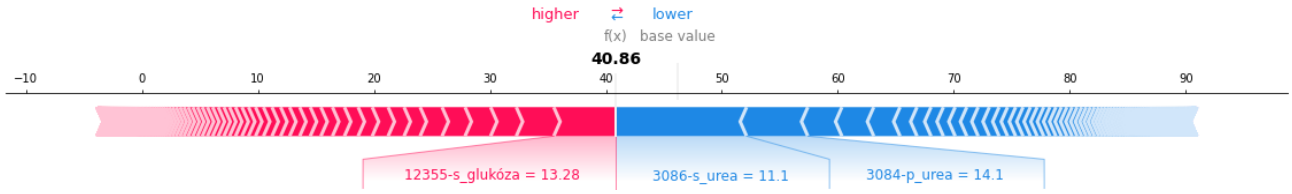
In general, it is recommended to test patients which meet one of the followings:

- They were not tested in last 4 years
- They have diabetes
- They are over 60 years old
- They suffer from hypertension
- They suffer from cardiovascular disease

Your Patients profile:

Name	Age	Sex	BMI	Related Diseases Diagnosed
Anne Smith	81	Female	34	Diabetes

Based on models'** prediction, following key drivers suggest sending her for eGFR tests:

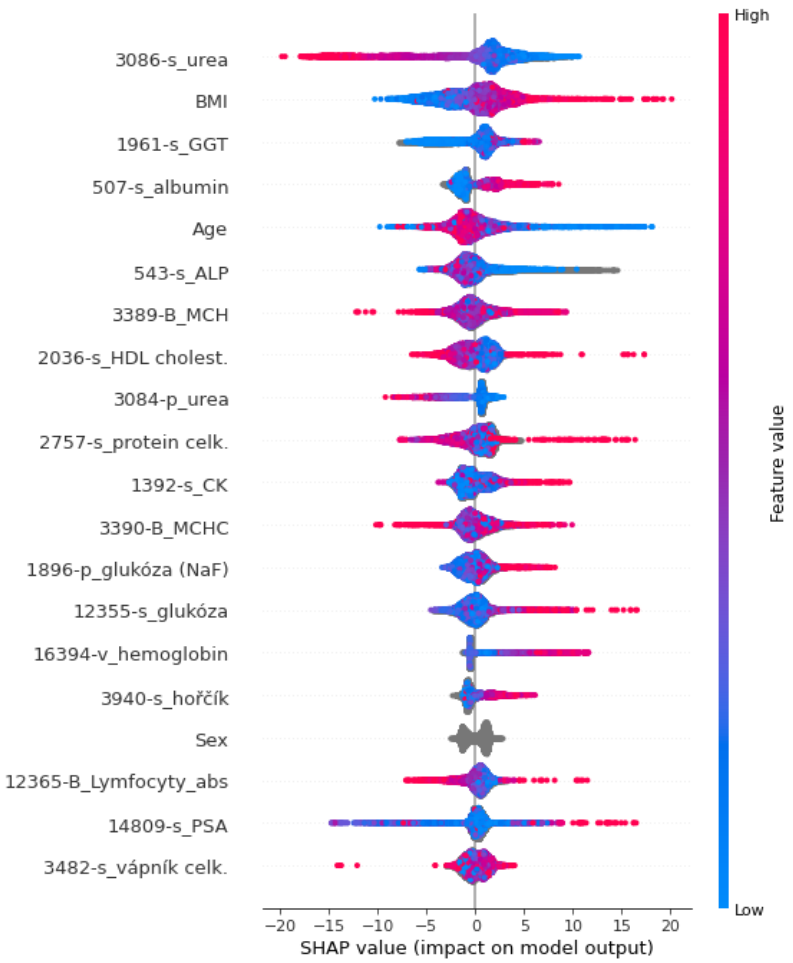


Interpretation: Based on the CKD watcher algorithm, for this specific patient even when the eGFR test is missing, its expected result value is bad - 40.86 , mainly suggested by the glucose (12355) and urea (3086, 3084) tests drivers. Additionally, the patient is susceptible to bad eGFR results based on the high age and diabetes diagnosis risk factors. It therefore triggers the alert in the application.

CKD in Population

Project **CKD Watch** has discovered following:

- Only 25% of patients in dataset* who were at very high risk of disease progression [1] based on eGFR were diagnosed with CKD.
- 11% of patients, who has more than 25% decrease in their GFR measure were not diagnosed with CKD
- Only 0.7% of patients in hackathon dataset* without other relevant diagnosed condition*** were diagnosed with CKD
- In comparison 4.5% of patients in hackathon dataset* with other relevant diagnosed condition*** were diagnosed with CKD
- Next to ACR and GMR several other indicators were identified** as potentially great CKD predictors (see graph below)



Note that that the GFR and creatinine tests can be used as definitive indicators for CKD diagnosis. Therefore, we purposely omitted them from the model variables with the goal of discovering alternative lab test results and patient characteristics that may indicate risk of bad eGFR test results and alert the doctor. We found that urea, BMI, GGT, albumin and age are among the most important indicators.

* Data used during EHH health hackathon 2022 contained diagnosis from years 2015 and 2022 of `15663 Patients`. Laboratory tests for 2127 were also included, out of which 1885 (88%) were at least once tested for eGFR. This would probably not be true in general population sample.

** Model: Model was trained with Catboost algorithm. It is build to predict eGFR score using both laboratory test results of nearly 1000 tests as well as personal info (BMI, Age, Sex). This approach was selected as the preferred one as we know a part of population goes undiagnosed even though they suffer from CKD according to test results.

***as relevant diseases we considered following ones:
The list might not be complete and should be re-evaluated for future use.

Name	List of international codes
Nephrolithiasis	["n20"]
diabetes	["e10", "e11", "e12", "e13", "e14"]
Obesity	["e66"]
cardiovascular disease	["i25", "i48", "i50", "i63", "i65", "i67", "i73", "i20", "i21", "i25", "i10", "e55", "e78", "e88", "r73"]
hematuria	["r31", "n02"]
Localized adiposity	["e65"]
Unspecified kidney failure	["n19"]
Acute renal failure	["n17"]
hyperkalemia	["e87"]
hypertension	["i10", "i11", "i12", "i13", "i14", "i15"]
chronic kidney failure	["n18"]

Sources:

[1] https://ukkidney.org/health-professionals/information-resources/uk-eckd-guide/ckd-stages