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Handout of Screening Tool for Chronic Kidney Disease Identification

SCREENING TOOL FOR Chronic Kidney Disease Identification

1. What is your age? (¿Cuál es tu edad?)

   ☐ <20 ☐ 20-44 ☐ 45-65 ☐ >65

2. What is your Race Group? (¿Cuál es tu grupo de carreras?)

   ☐ Black ☐ Hispanic ☐ White ☐ Other

3. Do you have Hypertension? (¿Tienes hipertensión?)

   ☐ Yes ☐ No

4. Do you have Diabetes? (¿Tienes diabetes?)

   ☐ Yes ☐ No

5. Do you have Peripheral Vascular Disease? (¿Tienes enfermedad vascular periférica?)

   ☐ Yes ☐ No

6. Has a doctor ever told that you had angina pectoris, myocardinal infarction or stroke? (¿Alguna vez un médico le dijo que tenía angina de pecho, infarto de miocardio o accidente cerebrovascular?)

   ☐ Yes ☐ No

7. How active you are? (¿Qué tan activo eres?)

   ☐ Mostly Sit (Principalmente sentarse)

   ☐ Stand or Walk a lot (Pararse o caminar mucho)

   ☐ Lift light loads or climb stairs (levantar cargas livianas o subir escaleras)

   ☐ Heavy work or heavy loads (Trabajo pesado o cargas pesadas)

8. Do you have Anemia? (¿Tienes anemia?)

   ☐ Yes ☐ No

9. Has a doctor ever told you that you have Congestive Heart Failure? (¿Alguna vez el adorador le ha dicho que tiene insuficiencia cardíaca congestiva?)

   ☐ Yes ☐ No

Scoring Matrix:

The important features were selected based on p-value of logistic regression that determines the importance of variables, correlation of these variables with CKD as well as through some research findings that stated that the selected variables are important indicators of CKD. Scores were assigned accordingly to each variable based on their importance determined through above stated methods. Final scores were calculated for the three buckets to identify the no risk, moderate risk and high-risk patients for CKD. We also verified the variable set and their importance from decision tree which gave similar results from our findings. All of this was performed on the 6000-training dataset and applied on the 2819 validation data.

Below is the scoring matrix created for the important variables for screening tool.

Variable	Category	Percentage of people with CKD (6000 training data)	Score
Age (Range)	>=65	6.2	3
	45- 64	1.2	2
	20-44	0.2	1
	<20	0.02	0
Race group (Category)	Black	1.28	2
	Hispanic	1.16	2
	White	5.18	1
	Other	0.10	0
Hypertension	Yes	6.12	3
	No	1.61	0
Diabetes	Yes	2.16	2
	No	5.56	0
PVD	Yes	1.15	1
	No	6.58	0
CVD	Yes	1.92	1
	No	5.82	0
Activity	1 - Mostly Sit	3.2	2
	2 - Stand or Walk a lot	3.76	1
	3 - Lift light loads or climb stairs	0.65	0
	4 - Heavy work or heavy loads	0.08	0
Anemia	Yes	0.36	1
	No	7.36	0
CHF	Yes	0.95	1
	No	6.78	0

Person filling the survey will have to answer the 9 questions based on the above variable set. Based on his answers, total score will be calculated and he will be identified as a high/moderate/no risk patient for CKD based on which of the three buckets he falls into given below:

Total Score (Range)	Category Buckets	Risk Level
0-6	1	No Risk of having CKD
7-10	2	Moderate Risk of having CKD
11-16	3	High Risk of having CKD

As the screening tool designed is used to identify high risk patients for CKD, we will recommend Category 3 people to get their kidneys checked by doctor as they have high chances of having CKD.

Category 2 people should also get their kidneys checked for CKD to ensure whether they are at moderate risk or not and take precautionary measures as required.

However, Category 1 people have very less chances of having CKD, so we need not recommend them to doctor.

Research Findings:

Some research was performed on the Case Study Data and Survey tool was created based on the findings and not on the training data itself.

Age:

Anyone at any age can develop CKD. However, it was mostly found that people above 65 years are at a high risk for developing CKD. It has the highest correlation with CKD when compared to other variables. Also, its p value is very significant compared to others.

Race group:

The percentage of population from the training dataset (6000) for Race group category - Black and Hispanic are almost the same and likewise from research we found that Black-African Americans (17.01%) and Hispanic (14%) are more likely to have CKD. So equal score weightage is given for both. However, whites (US population) are overrepresented in our dataset and therefore the percentage is higher but according to research they are less likely to have CKD than Black and Hispanic category. P value is significant for Hispanic.

Hypertension:

This is the major factor contributing to CKD. Over time, uncontrolled high blood pressure can cause arteries around the kidneys to narrow, weaken or harden. These damaged arteries are not able to deliver enough blood to the kidney tissue. It has the second highest correlation with CKD after Age when compared to other variables. Also, its p value is very significant (after Age) when compared to others so 3 points given for this variable based on its importance.

Diabetes:

According to the Centers for Disease Control, over 17 million Americans have diabetes. Unfortunately, one-third does not realize they have the disease. In 1999, almost 44% of patients who needed dialysis had diabetes as the underlying cause for their kidney disease. P value is very significant (after Hypertension) and also next to Hypertension in terms of correlation with CKD so 2 points given.

PVD & CVD:

PVD and CVD are associated with CKD and it is also proven from research that the prevalence of eGFR <60 was highest among those aged more than 60 years (21.1%) and those with SR CVD (26.3%), followed by those with DM (18.7%), HTN (16.1%), and higher BMI (7.3%).

Activity:

Most of the doctors have given the advice to make the physical activity part of daily routine. Study tells to be active more 30 minutes or more on most days. Physical activity can help reduce stress, manage weight, and achieve blood pressure and blood glucose goals. So, the more the activity lesser risk of having Hypertension, Diabetes or any heart symptoms and hence low risk of developing CKD. As Activity 3 and 4 are usually more active people having less likely to develop CKD no scores were given for both. But Activity 1 is at the highest risk so score of 2 was given.

Anemia:

People affected by CKD have damaged kidneys as a result of which bone marrow makes fewer RBC which causes anemia and reduces oxygen level.

CHF:

Congestive heart failure damages both blood vessels in kidneys and in heart and this increases the risk of heart attack and stroke which can lead to CKD.