**Model Variables used:** Top 15 Variables for MrOS Male

|  |  |  |
| --- | --- | --- |
| **MrOS Male (ensemble 2 top 15 after 100 rank average)** | | |
| Variable (100 runs) | Variable Rank Total (100 runs) | Rank Proportion (Rank/100) |
| HA\_MMSE | 100 | 1.00 |
| HA\_AGE | 200 | 2.00 |
| HA\_HEIGHT | 309 | 3.09 |
| HA\_IADL51 | 401 | 4.01 |
| HA\_FND | 502 | 5.02 |
| HA\_WLKSPED | 626 | 6.26 |
| HA\_BMI | 729 | 7.29 |
| HA\_TRLBTS | 792 | 7.92 |
| HA\_THD | 841 | 8.41 |
| HA\_CALCIUM | 1033 | 10.33 |
| HA\_GRIPAVG | 1150 | 11.50 |
| HA\_KIDNYST | 1185 | 11.85 |
| HA\_SMOKE | 1254 | 12.54 |
| HA\_HIPFXFU | 1436 | 14.36 |
| HA\_LSD | 1442 | 14.42 |

**Model Variables used:** Top 15 Variables for SOF Female

|  |  |  |
| --- | --- | --- |
| **SOF Female (ensemble 2 top 15 after 100 rank average)** | | |
| Variable (100 runs) | Variable Rank Total (100 runs) | Rank Proportion (Rank/100) |
| HA\_HEIGHT | 100 | 1.00 |
| HA\_MMSE | 258 | 2.58 |
| HA\_WLKSPED | 260 | 2.60 |
| HA\_WRSTFX | 388 | 3.88 |
| HA\_SLDFX | 494 | 4.94 |
| HA\_AGE | 600 | 6.00 |
| HA\_HIPFXFU | 746 | 7.46 |
| HA\_TRLBTS | 756 | 7.56 |
| HA\_FND | 904 | 9.04 |
| HA\_LSD | 1060 | 10.60 |
| HA\_BMI | 1070 | 10.70 |
| HA\_IADL51 | 1171 | 11.71 |
| HA\_GRIPAVG | 1318 | 13.18 |
| HA\_THD | 1375 | 13.75 |
| HA\_SMOKE | 1500 | 15.00 |

**From MrOS and SOF datasets: Stage 1 (Clinical) and Stage 2 (Clinical + DXA) Variables**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Feature** | **Meaning** | **Range** | **Type** | **Unit** |
| **HA\_GRIPAVG** | Grip strength | 1.5 – 37 | Continuous | kg |
| **HA\_WLKSPED** | Walking speed | 0.0926 – 1.818 | Continuous | m/s |
| **HA\_BMI** | Body Mass Index | 16.41 – 59.08 | Continuous | kg/m² |
| **HA\_MMSE** | Mini-Mental State Examination (3MS) | 15 – 26 | Continuous | score |
| **HA\_AGE** | Age | 65 – >89 | Continuous | years |
| **HA\_CALCIUM** | Serum calcium | 7.9 – 12.2 | Continuous | mg/dL |
| **HA\_HEIGHT** | Height | 137 – 178.6 | Continuous | cm |
| **HA\_IADL51** | Instrumental Activities of Daily Living | 0 – 8 | Continuous | score |
| **HA\_SMOKE** | Smoking status | no / yes / current | Categorical | N/A |
| **HA\_KIDNYST** | Kidney stones history | yes / no | Categorical | Yes/No/NA |
| **HA\_SLDFX** | History of spinal (vertebral) fracture | yes / no | Categorical | Yes/No/NA |
| **HA\_WRSTFX** | History of wrist fracture | yes / no | Categorical | Yes/No/NA |
| **HA\_TRLBTS** | Trail Making B Test (time to complete) | 0 – 300 | Continuous | seconds |
| **DXA FEATURES** | | | | |
| **HA\_THD** | Total hip BMD | 0.306 – 1.764 | Continuous | g/cm² |
| **HA\_FND** | Femoral neck BMD | 0.273 – 1.598 | Continuous | g/cm² |
| **HA\_LSD** | Lumbar spine BMD | 0.4696 – 0.8432 | Continuous | g/cm² |

**To compare internal and external test, three datasets use same variables to build this model:**

Three datasets included nine clinical variables—grip strength, walk pace, history of upper arm/shoulder or wrist fracture, height, weight, age, smoking status, and difficulty walking long distances—and three DXA-derived BMD measures: femoral neck, total spine, and total hip BMD.

**From UK Biobank datasets.: Stage 1(Clinical) and Stage 2 (Clinical + DXA) Variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Feature** | **Meaning** | **Type** | **Unit** |
| **Age at recruitment** | Participant age at entry into the study | Continuous | years |
| **Smoking status | Instance 2** | Current/past smoking habits | Categorical | Never / Previous / Current |
| **Hand grip strength (left) | Instance 2** | Grip strength of left hand | Continuous | kg |
| **Hand grip strength (right) | Instance 2** | Grip strength of right hand | Continuous | kg |
| **Usual walking pace | Instance 2** | Self-reported usual walking pace | Categorical | Slow / Steady average / Brisk |
| **Sex** | Sex of the participant | Categorical | Male / Female |
| **Height | Instance 2** | Participant height | Continuous | cm |
| **Fractured bone site(s) | Instance 2** | Sites of bone fractures | Categorical | Ankle, Leg, Hip, Spine, Wrist, Arm, Other bones, Do not know, Prefer not to answer |
| **Duration to complete alphanumeric path (trail #2) | Instance 2** | Time taken to complete Trail Making Test Part B | Continuous | seconds |
| **Body mass index (BMI) | Instance 2** | BMI calculated from height and weight | Continuous | kg/m² |
| **Difficulty with walking a long distance** | Self-reported difficulty walking long distances | Categorical | No difficulty / Some difficulty / Unable |
| **Weight | Instance 2** | Participant weight | Continuous | kg |
| **DXA FEATURES** | | | |
| **Total BMD (bone mineral density) | Instance 2** | Total bone mineral density measured by DXA | Continuous | g/cm2 |
| **Total BMD (bone mineral density) T-score | Instance 2** | T-score for total BMD indicating osteoporosis risk | Continuous | T-score |
| **Total BMD (bone mineral density) (right) | Instance 2** | Total BMD of right side | Continuous | g/cm² |
| **Total BMD (bone mineral density) (left) | Instance 2** | Total BMD of left side | Continuous | g/cm² |
| **Femur neck BMD (bone mineral density) T-score (left) | Instance 2** | T-score for left femur neck BMD indicating osteoporosis risk | Continuous | T-score |
| **Femur neck BMD (bone mineral density) T-score (right) | Instance 2** | T-score for right femur neck BMD indicating osteoporosis risk | Continuous | T-score |
| **Femur neck BMD (bone mineral density) (right) | Instance 2** | Bone mineral density of right femur neck | Continuous | g/cm² |
| **Femur neck BMD (bone mineral density) (left) | Instance 2** | Bone mineral density of left femur neck | Continuous | g/cm² |
| **Spine BMD (bone mineral density) | Instance 2** | Bone mineral density of the spine measured by DXA | Continuous | g/cm² |