

## Supplementary material: Predicting sensitivity to adverse lifestyle risk factors for cardiometabolic morbidity and mortality.

### Supplementary tables

#### Supplementary Table S1. VHU Criteria for exclusions on cardiometabolic traits

<ul style="list-style-type: none"> <li>• Height: &lt;130 cm or &gt;210 cm</li> <li>• Weight: &lt;35 kg</li> <li>• BMI: &lt;15 kg/m<sup>2</sup> or &gt;70 kg/m<sup>2</sup></li> <li>• Systolic blood pressure: &lt;20 or &gt;300</li> <li>• Diastolic blood pressure: &lt;20 or &gt;250</li> <li>• Total cholesterol: &lt;0.5 mmol/l or &gt;15 mmol/l</li> <li>• Triglycerides: &lt;0.15 mmol/l or &gt;20 mmol/l. Triglycerides values lower than 0.8 mmol/l were additionally excluded due to the sensitivity of the Reflotron benchtop analyser</li> <li>• HDL-cholesterol: &lt;0.15 mmol/l or &gt;7 mmol/l</li> <li>• LDL-cholesterol: Not defined. LDL cholesterol values lower than 0.5 mmol/l and higher than 13 mmol/l were excluded</li> <li>• Fasting glucose: &lt;1 mmol/l or &gt;25 mmol/l. Fasting glucose values lower than 2 mmol/l were additionally excluded as they were considered biologically implausible</li> <li>• *2hr glucose: &lt;1 mmol/l or &gt;35 mmol/l. 2hr glucose values lower than 2 mmol/l were additionally excluded as they were considered biologically implausible</li> </ul>
<p>* Not applied to MDCS dataset.            Note: To convert cholesterol to mg/dl multiply by 38.67, blood glucose multiply by 18.0182, triglycerides multiply by 38.67</p>

#### Supplementary Table S2. VHU Criteria for implausible values for lifestyle variables

<p>Distance to work in kilometres (one way): All answers beyond 200 km were excluded            Grams of tobacco smoked per week: All answers equal or beyond 350 gr/week were excluded            Arachidonic acid (ARA) intake (g/day): All answers equal or beyond 0.9 gr/day were excluded            Eicosapentaenoic acid (EPA) intake (g/day): All answers equal or beyond 2 gr/day were excluded            Sodium intake (mg/day): All answers equal or beyond 10000 mg/day were excluded</p>
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#### Supplementary Table S3. Variables removed during data processing.

Trait	Variables: VHU	Variables: MDC
Fasting glucose	-	<i>gcelhfn</i>
Diastolic blood pressure	<i>sm_duration.1; sm_duration.2; sbt.1;.2</i>	<i>systolic</i>
2hr glucose	<i>ssn_time.1;sn_time.2 ;sm_status2.1 ;sm_status2.2</i>	
High-density lipoprotein cholesterol (HDL-C)	-	<i>kole_s</i>
Low-density lipoprotein cholesterol (LDL-C)	<i>FA160_sum1.1; FA160_sum1.2; MONOsum1.1; MONOsum1.2; mfetsum1.1; mfetsum1.2; FA140_sum1.1; FA140_sum1.2; fettsum1.1; fettsum1.2; FA170_sum1.1; FA170_sum1.2</i>	<i>f140_s</i>
Body mass index (BMI)	<i>sn_time.1;sn_time.2; sm_num_cig.1; sm_num_cig.2; FA226_sum1.1; FA226_sum1.2; karosum1.1; karosum1.2; kolhsum1.1; kolhsum1.2; protsum1_anim.1; protsum1_anim.2 ; sm_duration.1; sm_duration.2; fettsum1.1; fettsum1.2; Folasum1.1; Folasum1.2; MONOsum1.1; MONOsum1.2 ;FA160_sum1.1; FA160_sum1.2; kolesum1.1</i>	<i>gcelhfn, gberrtf, rbapot, gpotdfri, rfrpotdi, rfrpoul, rbopoul, gfishm, rpifish, rcosandw,rwasandw</i>
Systolic blood pressure	<i>dbt.1; dbt.2</i>	<i>diastolic</i>
Total cholesterol	<i>FA160_sum1.1;FA160_sum1.2; FA226_sum1.1; FA226_sum1.2; karosum1.1; karosum1.2; mfetsum1.1;mfetsum1.2; POLYsum1.1; POLYsum1.2;fettsum1.1; fettsum1.2; Folasum1.1; Folasum1.2; MONOsum1.1;</i>	<i>f140_s, f204_s</i>

	<i>MONOsum1.2;</i> <i>NATRsum1.1</i> <i>;NATRsum1.2; NIACsum1.1;</i> <i>NIACsum1.2;</i> <i>sm_duration.1; sm_duration.2</i>	
Triglycerides	<i>sn_time.1; sn_time.2;</i> <i>karosum1.1;karosum1.2;</i>  <i>MONOsum1.1;</i> <i>MONOsum1.2; sm_cig_groups.1;</i> <i>sm_cig_groups.2; sm_duration.1;</i>	<i>gmarglf1, gmarglf2, gmarglf3</i>

Trait	Variables: VHU	Variables: MDC
	<i>sm_duration.2;</i> <i>FA226_sum1.1;</i> <i>FA226_sum1.2</i>	
(-): Not applicable		

## Supplementary Table S4. VHU variable meaning

VHU Variable	Meaning (units)
livskvalitet_d9	Fitness status
sf_3f	Physical limitation to participate in moderately demanding activities: bending down or kneeling
sf_3d	Physical limitation to participate in moderately demanding activities: walking up several stairs
sf_3a	Physical limitation to participate in strenuous activities: running, lifting heavy objects, taking part in physically demanding sports
sf_1	Self-rate of overall health
g5	Everyday exercise satisfaction
sf_3g	Physical limitation to participate in moderately demanding activities: walking more than 2 km
sf_11d	Excellent health
halsoar	Overall state of health during the last year
beskbltr	Informed of having high blood pressure
g6	Exercise during the last three months
livskvalitet_d12	Energy status
sf_3e	Physical limitation to participate in moderately demanding activities: walking up one flight of stairs
halsojf	Overall state of health compared to other your age
sf_7	Pain during the last four weeks
sf_3b	Physical limitation to participate in moderately demanding activities: moving a table, vacuuming, walking in the forest or gardening
sf_8	How much has the pain during the last four weeks disturbed your normal work?
pa_index_miss	Cambridge physical activity index
g1_3	Cycle to work vs passive travel to work
sf_11b	As healthy as anyone
sf_9a	For how much of the time during the last four weeks have you felt really alert and strong?
sf_3h	Physical limitation to participate in moderately demanding activities: walking more than a few hundred meters
sf_4b	Physical limitation that made you do less than you wanted during the last four weeks
kottport	Average portion size of meat/fish
sf_9g	For how much of the time during the last four weeks have you felt worn out?
sf_9e	For how much of the time during the last four weeks have you felt Full of energy?
protsum1_anim	Animal based protein intake (g/day)
potport	Average portion size of potatoes/rice/pasta

VHU Variable	Meaning (units)
gramnew47	Sausage as main dish
sf_3j	Physical limitation to participate in moderately demanding activities: bathing or getting dressed
Lig_Secsum1	Secoisolariciresinol intake ( $\mu\text{g}/\text{day}$ )
FA204_sum1	Arachidonic acid (ARA) intake ( $\text{g}/\text{day}$ )
sf_4c	Physical limitation that made you not being able to perform certain work tasks or other activities during the last four weeks
sf_9i	For how much of the time during the last four weeks have you felt tired?
NIACsum1	Vitamin B3 intake ( $\text{mg}/\text{day}$ )
Lig4sumsum1	Sum of Lariciresinol, Matairesinol, Pinoresinol, Secoisolariciresinol intake ( $\mu\text{g}/\text{day}$ )
sf_11a	Get sick more often than other people
sf_3i	Physical limitation to participate in moderately demanding activities: walking a hundred meters
fibesum1	Fibre intake ( $\text{g}/\text{day}$ )
sf_4d	Physical limitation that limited your ability to perform certain work tasks or other activities during the last four weeks
diab_foraldrar_syskon	Parents or siblings have diabetes
NATRsum1	Sodium intake ( $\text{mg}/\text{day}$ )
g3_a	Frequency of walking during leisure time
g3_b	Frequency of cycling during leisure time
gramnew65	Sodas, soft drinks, juice
gramnew43	Minced meat dishes
sjukskriften	Long-term sickness
g4	Changed every day exercise during the last year
Lig_Pinsum1	Pinoresinol intake ( $\mu\text{g}/\text{day}$ )
Folasum1	Folate ( $\mu\text{g}/\text{day}$ )
gramnew46	Bacon
Lig_Larsum1	Lariciresinol intake ( $\mu\text{g}/\text{day}$ )
gramnew34	Fried potatoes, pommes frites
Dsum1	Vitamin D intake ( $\mu\text{g}/\text{day}$ )
g7	If you exercise, change in exercise habits during the last year
sf_3c	Physical limitation to participate in moderately demanding activities: lifting or carrying grocery bags
scorning	Participation in sports or physical exercise associations

VHU Variable	Meaning (units)
protsum1	Total protein intake (g/day)
utbild	Educational level
sf_11c	Worsen health in the future
11_4	Porridge w/o sandwich for breakfast vs does not breakfast at all
MONOsum1	Monounsaturated fat intake (g/day)
MOSAsum1	Monosaccharides intake (g/day)
gramnew45	Steak, chop, e.g.,
gramnew8	Salad dressing with oil
sf_6	Extent to what your physical and emotional health disrupted your usual social life during the last four weeks
11_5	Gruel w/o sandwich for breakfast vs does not breakfast at all
gramnew48	Hamburger
gramnew67	Boiled coffee
kolesum1	Cholesterol intake (g/day)
Lig_Matsum1	Matairesinol intake ( $\mu$ g/day)
sm_status2	Former smokers vs non-smokers
sf_10	For how much of the time during the last four weeks has your physical health or your emotional problems limited your ability to interact with others?
gramnew44	Meat stew
gramnew62	Low fat milk (0.5%)
11_3	Sour milk, cereals, w/o sandwich for breakfast vs does not breakfast at all
sf_5b	Emotional problems that made you do less than you wanted during the last four weeks
ansttyp_a	Permanent employment
gramnew18	Sausage, liver pâté on bread
gramnew72	Wine
FULLKsum1	Whole grain intake (g/day)
sf_4a	Physical limitation that reduced the normal time spent at work or in other activities during the last four weeks
gramnew41	Pancake, waffle, Swedish dumpling
protsum1_veg	Plant based protein intake (g/day)
Lig_Sumsum1	Sum of all lignans intake ( $\mu$ g/day)
kolhsum1	Carbohydrates intake (g/day)

VHU Variable	Meaning (units)
Bstrsum1	Beta-sitosterol intake (mg/day)
ansttyp_g	Retirement pensioner full-time
g3_f	Frequency of hunting or fishing during leisure time
B12sum1	Vitamin B12 intake (µg/day)
sacksum1	Sucrose intake (g/day)
gramnew31	White cabbage, lettuce, lettuce cabbage, spinach, borecole
livskvalitet_d5	Satisfaction with leisure time
askosum1	Vitamin C intake (mg/day)
gramnew42	Pizza
15a	Eat breakfast
Tstrsum1	Sum of phytosterols intake (mg/day)
g3_g	Frequency of picking berries or mushrooms during leisure time
FA160_sum1	Palmitic acid intake (g/day)
selesum1	Selenium intake (µg/day)
Sstrsum1	Stigmasterol intake (mg/day)
socforening_e	Participation in other association
gramnew6	Margarine for cooking
gramnew24	Fibre cereals
gramnew30	Tomato, cucumber
Lig_Equsum1	Equol intake (µg/day)
alkosum1	Alcohol intake (g/day)
gramnew3	Low fat margarine on bread
karosum1	beta-carotene intake (mg/day)
g3_c	Frequency of dancing during leisure time
sf_5c	Emotional problems that made you do be less thorough than usual in work or other activities during the last four weeks
fettsum1	Total fat intake (g/day)
gramnew68	Tea
MAGNsum1	Magnesium intake (mg/day)
sf_2	Self-rate of overall health compared to a year ago

VHU Variable	Meaning (units)
arbtala	Possibility to speak with colleagues during breaks
gramnew73	Liquor, spirits
sn_quantity	Number of snuff boxes per week
sf_5a	Emotional problems that reduced the normal time spent at work or in other activities during the last four weeks
B6sum1	Vitamin B6 intake (mg/day)
gramnew29	Root vegetable tables, carrot
sf_9h	For how much of the time during the last four weeks have you felt happy?
g2_c	Light and physically active work
gramnew66	Brewed (filtered) coffee
sf_9c	For how much of the time during the last four weeks have you felt so depressed that nothing could cheer you up?
livskvalitet_d10	Appetite status
sm_num_cig	Number of cigarettes smoked per day
gramnew26	Berries (fresh or frozen)
g1_2	Walk to work vs passive travel to work
gramnew33	Boiled or baked potato
FA205_sum1	Eicosapentaenoic acid (EPA) intake (g/day)
sn_time	Years using snuff
sf_9f	For how much of the time during the last four weeks have you felt gloomy and sad?
sm_duration	Years smoking
g2_a	Sedentary or standing work
FA226_sum1	Docosahexaenoic acid (DHA) intake (g/day)
11_2	Coffee/tea and wheat buns or rusk for breakfast vs does not breakfast at all
gronport	Average portion size of vegetables
gramnew7	Oil for cooking
gramnew12	White (soft) bread, thin crisp bread
civil3	Marital status: Single vs Divorced/separated
Lig_Syrsum1	Syringaresinol intake ( $\mu\text{g}/\text{day}$ )
12	Eat lunch
skiftarbete	Work shifts/weekends

VHU Variable	Meaning (units)
gramnew64	Milk, sour milk (3%)
socforening_b	Participation in study circles
j10	Suggestions that you drink less
ansttyp_h	Retirement pensioner part-time
l5b	Eat lunch
l1_1	Coffee/tea and sandwich for breakfast vs does not breakfast at all
g9	Amount of exercise during the last 12 months
gramnew69	Light beer
sf_9d	For how much of the time during the last four weeks have you felt calm and serene?
gramnew55	Salty fish
gramnew38	Pasta
gramnew20	Oatflake, whole wheat, rye or barley porridge
gramnew22	Sour milk, yoghurt (3% fat)
g10	Time spent in a week in moderately strenuous activities
sn_status2	Former snuff users vs non-snuff users
FA170_sum1	Heptadecanoic acid intake (g/day)
livskvalitet_d13	Patience status
ansttyp_d	Unemployment
ZINCsum1	Zinc intake (mg/day)
Cstnsum1	Campestanol intake (mg/day)
j2	Amount of alcohol drunk in a day
arbfort	Job demands to work very fast
gramnew32	Mixed frozen vegetables
gramnew70	Medium beer
gramnew16	Soft cheese
Bstnsum1	Beta-sitostanol intake (mg/day)
gramnew35	Mashed potato
j3	Frequency of drinking six or more glasses at the same occasion
retisum1	Vitamin A intake (mg/day)

VHU Variable	Meaning (units)
antal_km	Distance to work in kilometres (one way)
sleep_h8a	Snore during sleep
j1	Frequency of alcohol consumption
hjärtinf_foraldrar_syskon	Parents or siblings had a cerebral haemorrhage/thrombosis or cardiac infarction before the age of 60
gramnew59	Sugar, honey, marmalade, jam
livskvalitet_d6	Hearing status
mfetsum1	Saturated fat intake (g/day)
g1_4	Irregular travel mode to work vs passive travel to work
livskvalitet_d15	Sleep status
sleep_h7b	Risk of sleeping while watching TV
gramnew23	Sour milk, yoghurt (low fat)
livskvalitet_d4	Satisfaction with economy
j8	Times during last year that you drink so much that you were not able to remember what you did
gramnew40	Blota (broth + bread)
arbkontakt	Frequent social contacts with colleagues during work
livskvalitet_d3	Satisfaction with work situation
FA150_sum1	Pentadecanoic acid intake (g/day)
gramnew25	Corn flakes
DISAsum1	Disaccharide intake (g/day)
soclago	Would you say that the number of people that you meet in your everyday life is enough or would you like to meet more or fewer people?
arbrut	Repetitive job
sm_gr_tobacco	Grams of tobacco smoked per week
soctrost	Receive hugs to comfort and support you
gramnew61	Chips, popcorn, salted nuts
FOSFsum1	Phosphate intake (mg/day)
livskvalitet_d11	Mood status
gramnew27	Apple, pear, peach, orange, mandarin and grapefruit
gramnew17	Soft whey cheese
Lig_Endsum1	Enterodiol intake ( $\mu$ g/day)

VHU Variable	Meaning (units)
gramnew9	Cream, creme fraiche, sour cream
sleep_h7g	Risk of sleeping while sitting still after having lunch
jernsum1	Iron intake (mg/day)
gramnew60	Cookies, pastry
gramnew28	Banana
Lig_Medsum1	Medioresinol intake ( $\mu\text{g}/\text{day}$ )
sleep_h7f	Risk of sleeping while sitting and talking with someone
gramnew58	Sweets
sleep_h7c	Risk of sleeping while sitting inactive in a public place
j6	Times during last year that you felt you needed a drink after drinking the day before
gramnew19	Meat on bread
gramnew2	Butter on bread
sn_status1	Snuff user vs non-snuff user
socsam	Number of social interactions during a normal week
l3	Eat dinner
gramnew49	White meat (poultry)
socstod	Support from others
B2sum1	Vitamin B2 intake ( $\mu\text{g}/\text{day}$ )
g3_e	Frequency of gardening during leisure time
livskvalitet_d1	Satisfaction with home and family situation
l1_0	Only coffee/tea for breakfast vs does not breakfast at all
TRANSsum1	Trans fat intake (g/day)
JODIsum1	Iodine intake ( $\mu\text{g}/\text{day}$ )
Lig_Enlsum1	Enterolactone intake ( $\mu\text{g}/\text{day}$ )
sambo2	Cohabitation: Live alone vs Only children
graviditetsdiabetes	Had gestational diabetes
sochem	Number of friends that can come to your home at any time and feel at home
socdelta	Participation in associations or voluntary organizations
sleep_h7e	Risk of sleeping while lying down resting in the afternoon

VHU Variable	Meaning (units)
livskvalitet_d14	Confidence status
i1	Teetotaler
j4	Times during last year that you felt inability to stop drinking
gramnew63	Milk, sour milk (1,5%)
gramnew56	Smoked fish/meat
ensum1	Total energy intake (kcal/day)
POLYsum1	Polyunsaturated fat intake (g/day)
sleep_h7h	Risk of sleeping in a car which has stopped for a few minutes
Cstrsum1	Campesterol intake (mg/day)
gramnew5	Butter for cooking
socupps	Appreciation of the ones at home or others
livskvalitet_d16	Do you feel important and appreciated outside your home?
livskvalitet_d2	Satisfaction with accommodation
arbski	Skill demand from job
gramnew14	Cheese 28%
sleep_h7a	Risk of sleeping while sitting and reading
FA140_sum1	Formic acid intake (g/day)
sleep_h7d	Risk of sleeping as a passenger in a car for one hour without break
ansttyp_c	Work at home
FA182_sum1	Linoleic acid intake (g/day)
arbvad	Control over own work assignment
gramnew10	Whole grain crisp bread
gramnew15	Cheese 10-17%
g2_b	Light but partly physically active work
gramnew4	Margarine on bread
i3	Receive critics about your alcohol consumption
sambo1	Cohabitation: Live alone vs Only one adult (spouse, partner)
ansttyp_f	Self-employed
livskvalitet_d17	Do you feel important and appreciated in your home?

VHU Variable	Meaning (units)
arbhin	Enough time for job assignments
i2	Feel the need to reduce alcohol consumption
i4	Feel uneasy or guilty because of your way of drinking
socforening_d	Participation in choir
gramnew52	Lean fish (e.g., perch, bass, cod)
gramnew13	Coffee rolls/buns, rusk
gramnew1	Bregott on bread
arbpsyk	High mental demand from job
j7	Times during last year that you felt guilty because of your drinking
i5	Drunk alcohol first thing in the morning
TIAMsum1	Tiamin intake (mg/day)
arbhur	Control over planning and execution of the workday
j9	Hurt people because of your drinking
arbnytt	Learn new things at job
gramnew37	Rice
soclana	People to ask for favours from
soctala	Number of people with whom you can speak openly
sm_status5	Former occasional smoker vs non-smoker
gramnew51	Liver, kidney
kalcsum1	Calcium intake (mg/day)
sm_status1	Smoker vs non-smoker
gramnew71	Strong beer
sambo4	Cohabitation: Live alone vs Other/others
gramnew50	Blood based food
socforening_c	Participation in theatre group
gramnew39	Brown beans, pea soup
sockont	Number of social contacts with the same interests as you
sf_9b	For how much of the time during the last four weeks have you felt very nervous?
gramnew21	Rosehip, sweet syrup soup

VHU Variable	Meaning (units)
l5c	Eat dinner
ansttyp_e	Student
gramnew57	Ice cream
arbfritud	Frequency of social contacts with colleagues during leisure time
civil4	Marital status: Single vs Widow/widower
arbfys	High physical demand from job
socanfo	Person to confide in
sambo3	Cohabitation: Live alone vs Adult and children
j5	Times during last year that something was not done due to your drinking
KALlsum1	Potassium intake (mg/day)
socnara	Close relationship with anyone
socofta	Frequency of engaging in clubs, associations or study circles
gramnew53	Fatty fish (e.g. herring, whitefish, salmon)
g2_e	Physically straining work most of the time
gramnew54	Shellfish (e.g. shrimps, scallops)
arblamna	Possibility to leave your work for a while to speak with a colleague
tokosum1	Vitamin E intake (mg/day)
ansttyp_b	Temporary employment
gramnew36	Potato salad
g3_d	Frequency of shovelling snow during leisure time
sochelp	People to ask for help apart from the ones at home
sm_cig_groups	Number of cigarettes smoked per day (in groups)
soclyck	Special person to share feelings
g2_d	Sometimes physically straining work
arbkrav	Contradictory demands in job
arbbesok	Last time a colleague visited you at home
livskvalitet_d7	Vision status
sm_num_cigar	Number of cigars smoked per day
gramnew11	Whole grain soft bread

VHU Variable	Meaning (units)
sm_status4	Occasional smoker vs non-smoker
FA183_sum1	Linolenic acid intake (g/day)
arbide	Ingenuity or creativity demand from job
livskvalitet_d8	Memory status
civil2	Marital status: Single vs Married/partner
sleep_h8b	Breath-holds during sleep
ansttyp_i	Retirement pensioner unspecified

**Supplementary Table S5. Rank-ordered most important variables among 9 cardiometabolic traits in VHU.**

Variable	BMI	HDL-C	LDL-C	TC	TG	SBP	DBP	FG	2hr G	score
Training or exercising during the last 3 months	1	1	1	1	1	0	1	1	1	8
Portion size of green vegetables	1	1	0	1	1	0	1	1	1	7
State of health during the last year	1	1	0	0	1	1	1	1	1	7
Number of cigarettes smoked per day (in groups)	1	1	0	1	0	1	1	1	1	7
Smokers vs non-smokers	0	1	0	1	1	1	1	1	1	7
Cycle to work vs passive travel to work	1	1	0	1	1	1	0	0	1	6
Frequency of cycling during leisure time	1	1	0	1	1	0	0	0	1	5
Brewed (filtered) coffee	1	0	0	0	1	1	1	0	1	5
Sodas, soft drinks, juice	1	0	1	1	1	0	0	0	1	5
Portion size of meat/fish	1	0	1	1	0	1	0	0	1	5
Monosaccharide intake	1	0	0	1	1	0	0	1	1	5
Plant protein intake	1	0	1	1	1	0	0	1	0	5
Former smokers vs non-smokers	1	0	0	0	1	1	1	1	0	5
Snuff users vs non-snuff users	0	1	0	0	1	1	1	0	1	5
Participation in associations, voluntary organizations	0	0	0	0	1	1	1	1	1	5

HDL-C: High-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; HbA1c: Glycated haemoglobin; 2hr G: 2h glucose tolerance; FG: Fasting glucose; TG: Triglycerides; TC: Total cholesterol, SBP: Systolic blood pressure; DBP: Diastolic blood pressure.

**Supplementary Table S6. AUCs for each trait in VHU.**

FRS non-laboratory-based	FRS non-laboratory-based + Sensitivity status	FRS laboratory-based risk score	FRS laboratory-based risk score + Sensitivity status	ACC/AHA risk score	ACC/AHA risk score + Sensitivity status
			Total cholesterol		
0.72	0.73	-		-	-
			SBP		
0.73	0.74	-		-	-
			DBP		
0.73	0.73	-		-	-
			LDL-C		
0.71	0.76	0.72		0.74	0.76
			HDL-C		
0.69	0.62	0.67		0.70	0.68
			BMI		
0.73	0.74	0.71		0.73	0.74
			2h glucose		
0.73	0.74	0.70		0.71	0.71
			Fasting glucose		
0.73	0.73	0.71		0.72	0.72
			Triglycerides		
0.70	0.69	-		-	-

" - " it was not possible to estimate the number; HDL-C: High-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; FG: Fasting glucose; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; FRS: Framingham risk score; ACC/AHA: American College of Cardiology/American Heart Association.

**Supplementary Table S7. R packages used for the analyses in the current study.**

Step	R Package	Version
Variable processing	<i>caret</i>	6.0-90
Missing data imputation	<i>missForest</i>	1.4
Multicollinearity	<i>car</i>	3.0-12
Performance and model assumption	<i>Performance</i>	0.8.0
Quantile regression modelling	<i>quantreg</i>	5.88
Quantile regression forest modelling	<i>quantregForest ; randomForest</i>	1.3-7; 4.7-1
Cox modelling	<i>Survival</i>	3.2-13
Cox proportional assumption	<i>Rms</i>	6.2-0
Incidence rate ratio	<i>fmsb</i>	0.7.2
Meta-analysis	<i>Meta</i>	5.2-

**Supplementary Table S8. Hazard ratios and 95%CI of prediction interval categories and clinical outcomes**

Trait/study	Categories	n	CVD					T2D					CVD-mortality									
			Event s	*Person -years	HR	95% (CIs)	p	n	Event s	*Person -years	HR	95% (CIs)	p	n	Event s	*Person -years	HR	95% (CIs)	p			
<i>Fasting glucose</i>																						
	Ref (Neutral)	13596	446	10854,5	1,0 0					13566	186	10838,4	1,0 0					13596	31	10854,5	1,0 0	
VHU	Resilient	261	11	193,1	1,2 1	0,8 2	1,8 0	0,34	574	8	485,1	0,7 3	0,1 8	2,97	0,67	261	0	193,1	-	-	-	-
	Sensitive	576	26	486,5	1,5 4	0,8 5	2,8 1	0,16	261	2	193,1	0,8 3	0,4 1	1,68	0,60	576	2	486,5	1,3 1	0,3 1	5,51	0,71
	Ref (Neutral)	1537	345	94,2	1,0 0				996	106	65,3	1,0 0				1538	243	97,5	1,0 0			
MDC	Resilient	70	9	4,7	0,4 8	0,2 5	0,9 4	<b>3,28E-02</b>	52	3	3,7	0,4 7	0,1 5	1,48	0,20	70	13	4,7	1,0 0	0,5 7	1,75	0,99

Trait/study	Categories	CVD							T2D							CVD-mortality						
		n	Events	*Person-years	HR	95% (CIs)		p	n	Events	*Person-years	HR	95% (CIs)		p	n	Events	*Person-years	HR	95% (CIs)		p
	Sensitive	66	15	4,1	1,0 1	0,6 0	1,7 0	0,96	32	6	1,2	4,8 1	2,0 8	11,1 2	<b>2,4E-04</b>	79	14	4,7	1,1 8	0,6 9	2,03	0,54
	<i>2-h Glucose† / HbA1c</i>																					
VHU †	Ref (Neutral)	12233	392	10063,7	1,0 0				12210	110	10049,4	1,0 0				12233	23	10063,7	1,0 0			
	Resilient	535	16	457,9	0,7 7	0,4 7	1,2 7	0,31	535	8	457,9	1,4 2	0,6 9	2,91	0,34	535	0	457,9	-	-	-	-
	Sensitive	192	6	160,3	1,3 3	0,5 9	2,9 8	0,49	192	2	160,3	1,4 6	0,3 6	5,94	0,59	192	0	160,3	-	-	-	-
MDC	Ref (Neutral)	1524	323	93,9	1,0 0				1018	110	66,4	1,0 0				1512	233	96,2	1,0 0			
	Resilient	71	14	4,3	0,7 8	0,4 5	1,3 3	0,36	48	1	3,3	0,1 8	0,0 2	1,28	0,09	73	9	4,6	0,7 5	0,3 8	1,47	0,40
	Sensitive	69	21	3,9	1,5 1	0,9 6	2,3 6	0,07	30	2	1,3	1,0 3	0,2 5	4,20	0,96	79	12	4,6	1,1 1	0,6 2	2,00	0,72
	<i>DBP</i>																					
VHU	Ref (Neutral)	13127	429	10873,5	1,0 0				13094	175	10851,3	1,0 0				13127	33	10873,5	1,0 0			
	Resilient	456	6	374,1	0,3 9	0,1 7	0,8 7	<b>2,10E-02</b>	456	4	374,1	0,9 4	0,3 9	2,28	0,89	456	0	374,1	-	-	-	-
	Sensitive	252	19	202,6	2,2 5	1,4 9	3,4 0	<b>1,05E-04</b>	251	3	201,7	0,7 8	0,2 5	2,44	0,67	252	1	202,6	1,3 6	0,1 9	9,99	0,76
MDC	Ref (Neutral)	8337	1755	484,8	1,0 0				1089	122	70,7	1,0 0				8337	1317	501,1	1,0 0			
	Resilient	339	64	19,1	0,9 2	0,7 1	1,1 8	0,50	27	1	1,8	0,3 2	0,0 4	2,27	0,25	339	59	19,8	1,0 5	0,8 1	1,37	0,70
	Sensitive	345	90	19,3	1,3 2	1,0 7	1,6 4	<b>9,40E-03</b>	45	3	2,5	0,8 3	0,2 6	2,62	0,75	345	74	20,1	1,4 7	1,1 6	1,86	<b>0,001</b>
	<i>HDL-C</i>																					
VHU	Ref (Neutral)	1855	90	1416,9	1,0 0				1849	31	1413,3	1,0 0				1855	6	1416,9	1,0 0			
	Resilient	95	3	70,5	0,6 4	0,2 0	2,0 3	0,45	95	0	70,5	-	-	-	-	95	0	70,5	-	-	-	-
	Sensitive	91	5	66,9	1,2 2	0,4 9	3,0 1	0,67	90	2	66,1	1,7 1	0,4 0	7,28	0,47	91	1	66,9	4,6 8	0,4 9	44,9 2	0,18
MDC	Ref (Neutral)	1515	329	94,1	1,0 0				996	99	64,9	1,0 0				1513	236	96,8	1,0 0			
	Resilient	75	23	4,3	1,6 9	1,1 0	2,5 8	<b>1,62E-02</b>	44	6	2,3	2,2 2	0,9 6	5,12	0,06	76	13	4,7	1,3 9	0,7 9	2,44	0,25
	Sensitive	62	11	3,7	1,0 7	0,5 9	1,9 6	0,82	44	1	2,9	0,2 2	0,0 3	1,61	0,14	63	7	3,9	0,9 8	0,4 6	2,08	0,96
	<i>BMI</i>																					
VHU	Ref (Neutral)	12951	423	10640,4	1,0 0				12921	161	10621,1	1,0 0				13028	30	25707,9	1,0 0			
	Resilient	636	19	557,1	1,1 8	0,7 2	1,9 4	0,50	636	2	557,1	0,5 8	0,1 4	2,36	0,45	638	0	13024,7	-	-	-	-

Trait/study	Categories	CVD							T2D							CVD-mortality						
		n	Events	*Person-years	HR	95% (CIs)		p	n	Events	*Person-years	HR	95% (CIs)		p	n	Events	*Person-years	HR	95% (CIs)		p
MDC	Sensitive	257	5	198,2	0,53	0,20	1,36	0,19	255	12	196,7	0,64	0,27	1,53	0,32	258	2	4940,0	0,93	0,12	7,01	0,95
	Ref (Neutral)	8217	1751	479,6	1,00				1050	97	68,2	1,00				8217	1297	495,3	1,00			
	Resilient	399	61	23,0	1,04	0,79	1,37	0,77	56	5	3,8	2,74	1,00	7,42	0,05	399	68	23,4	1,57	1,20	2,06	<b>0,001</b>
	Sensitive	401	105	22,0	0,99	0,77	1,27	0,94	44	8	2,3	0,54	0,20	1,43	0,21	401	91	23,1	1,22	0,93	1,61	0,15
<i>LDL-C</i>																						
VHU	Ref (Neutral)		91	1447,2	1,00				1914	38	1442,3	1,00				1921	7	1447,2	1,00			
	Resilient	68	4	49,8	1,52	0,56	4,18	0,41	67	1	49,0	0,82	0,11	5,99	0,84	68	1	49,8	2,92	0,33	25,77	0,34
	Sensitive	114	12	90,8	2,17	1,17	4,02	<b>1,34E-02</b>	112	1	89,9	0,39	0,05	2,85	0,35	114	2	90,8	3,99	0,81	19,70	0,09
MDC	Ref (Neutral)	1443	299	89,4	1,00				942	109	60,6	1,00				1445	222	92,4	1,00			
	Resilient	98	24	6,0	1,32	0,87	2,00	0,20	68	4	4,4	0,54	0,20	1,48	0,23	95	16	6,0	1,26	0,75	2,09	0,38
	Sensitive	91	25	5,3	1,58	1,05	2,39	<b>2,87E-02</b>	58	5	3,7	0,73	0,29	1,79	0,49	92	14	5,7	1,22	0,71	2,09	0,48
<i>Total Cholesterol</i>																						
VHU	Ref (Neutral)	12637	403	10425,3	1,00				12610	150	10408,0	1,00				12637	27	10425,3	1,00			
	Resilient	651	14	523,3	0,78	0,46	1,33	0,37	649	9	522,4	1,18	0,59	2,36	0,63	651	2	523,3	1,74	0,41	7,40	0,45
	Sensitive	466	39	405,2	2,23	1,60	3,10	<b>2,00E-06</b>	463	11	404,0	1,70	0,92	3,14	0,09	466	3	405,2	2,33	0,70	7,72	0,17
MDC	Ref (Neutral)	1486	295	91,9	1,00				975	105	63,2	1,00				1486	218	94,4	1,00			
	Resilient	92	26	5,5	1,70	1,13	2,54	<b>1,04E-02</b>	59	5	3,7	0,90	0,36	2,22	0,82	92	17	5,6	1,56	0,95	2,57	0,08
	Sensitive	90	21	5,3	1,09	0,69	1,71	0,72	53	5	3,1	0,84	0,34	2,09	0,71	90	15	5,5	0,92	0,54	1,58	0,77
<i>Triglycerides</i>																						
VHU	Ref (Neutral)	10498	330	8592,6	1,00				10469	148	8574,8	1,00				10498	29	8592,6	1,00			
	Resilient	1	0	1,1	-	-	-	-	1	0	1,1	-	-	-	-	1	0	1,1	-	-	-	-
	Sensitive	378	16	311,0	1,11	0,67	1,83	0,70	376	4	309,6	0,69	0,25	1,86	0,46	378	2	311,0	1,43	0,34	6,00	0,63
MDC	Ref (Neutral)	1194	277	72,0	1,00				767	80	48,3	1,00				1194	202	74,6	1,00			
	Resilient	68	17	4,2	1,09	0,66	1,78	0,75	41	0	2,7	-	-	-	-	68	10	4,3	0,84	0,44	1,59	0,58
	Sensitive	72	16	4,2	1,02	0,61	1,69	0,94	41	5	2,3	1,51	0,60	3,81	0,38	72	15	4,4	1,39	0,82	2,36	0,22

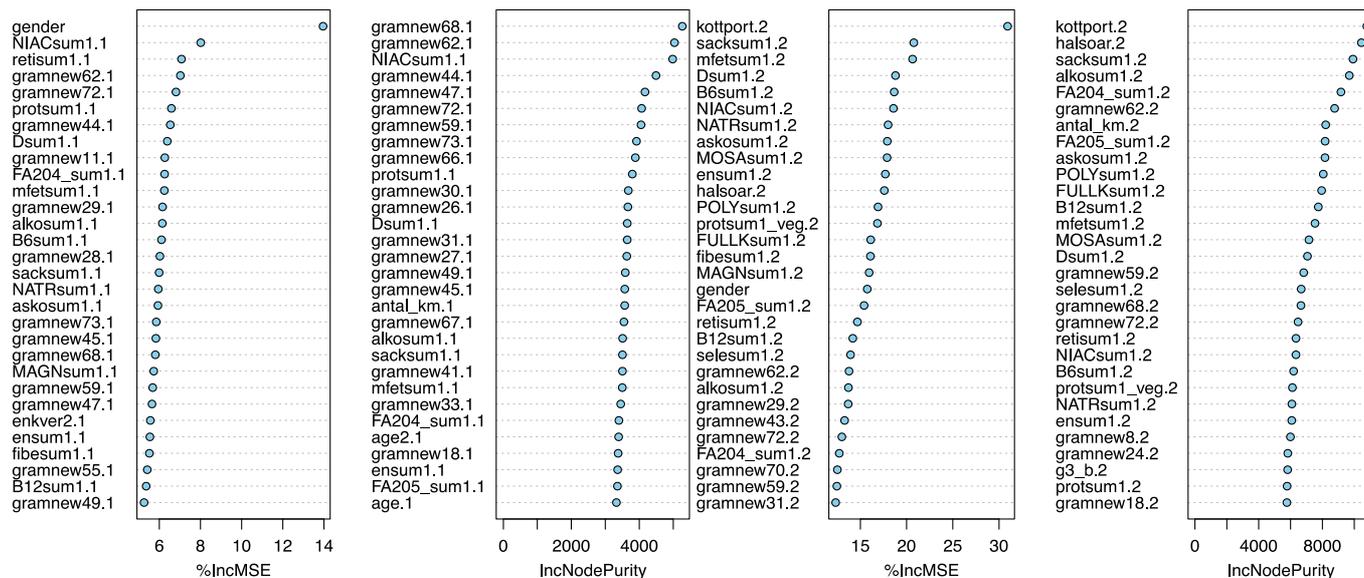
Trait/study	Categories	CVD							T2D							CVD-mortality						
		n	Events	*Person-years	HR	95% (CIs)		p	n	Events	*Person-years	HR	95% (CIs)		p	n	Events	*Person-years	HR	95% (CIs)		p
									<i>SBP</i>													
	Ref (Neutral)	13021	408	10773,1	1,0				12996	170	10757,8	1,0				13021	25	10773,1	1,0			
VHU	Resilient	474	6	377,83	0,4	0,2	1,0	0,06	474,0	5,00	377,83	0,6	0,2	1,64	0,37	474,0	0,00	377,83	-	-	-	-
	Sensitive	201,0	10,00	162,55	1,6	0,8	3,0	0,13	200,0	5,00	161,41	1,7	0,7	4,24	0,22	201,0	1,00	162,55	2,4	0,3	18,4	0,37
	Ref (Neutral)	8236	1708	477,5	1,0				1048	106	67,5	1,0				8236	1307	493,1	1,0			
MDC	Resilient	357	61	21,1	0,8	0,6	1,1	0,30	45	4	3,0	0,8	0,3	2,40	0,79	357	56	21,6	1,0	0,7	1,32	0,93
	Sensitive	429	122	23,4	1,5	1,3	1,8	<b>1,48E-06</b>	51	9	3,1	1,5	0,8	3,17	0,19	429	94	24,8	1,5	1,2	1,88	<b>7,87E-05</b>

" - " it was not possible to estimate the number; † corresponds to VHU; \*Per 100,000 person-years; SBP: systolic blood pressure; DBP: diastolic blood pressure; HDL-C: High-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; BMI: Body mass index; HbA1c: glycated haemoglobin; CVD: Cardiovascular disease. T2D: Type 2 diabetes. Adjustment included age, sex, BMI, fasting status, FFQ version, TEI, educational level and smoking status, physical activity, and alcohol intake.



Feature Importance BMI (visit 1)

Feature Importance BMI (visit 2)

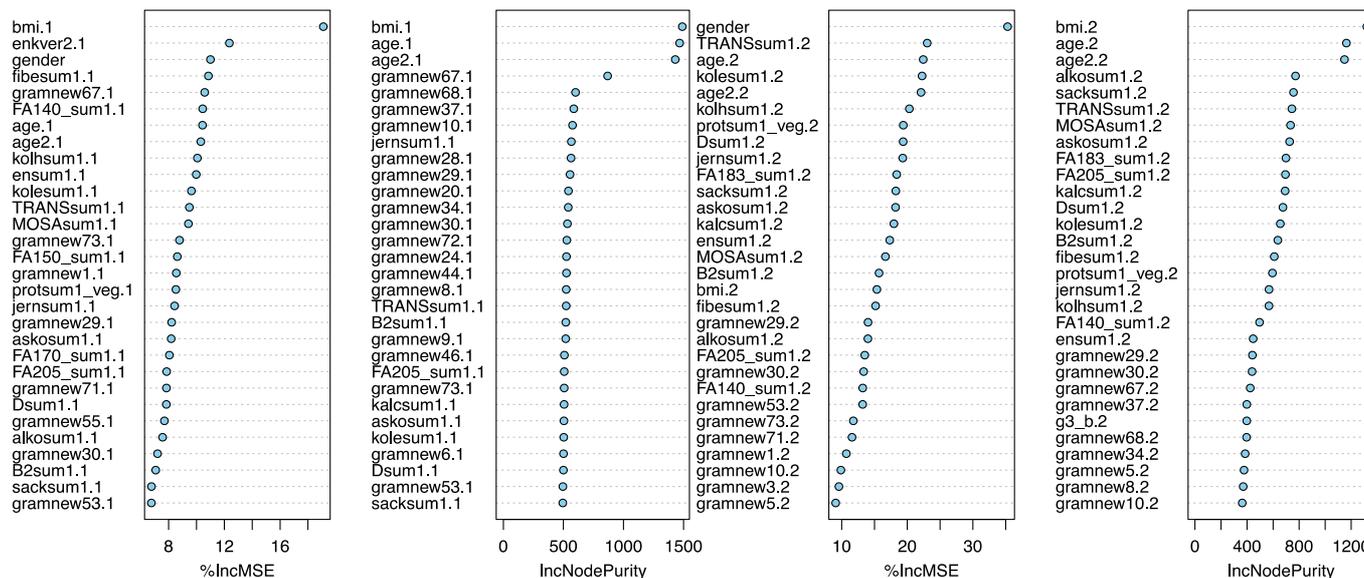


**Supplementary figure S3. Variable importance plot of body mass index (BMI) model in VHU per visit.**

The x-axis shows each all model-variable. %IncMSE: percentage in mean square error is estimated upon mean decrease of accuracy in predictions with out-of-bag samples when each variable is excluded; IncNodePurity: increase in node purity is the total decrease of squared errors for each decision tree.

Feature Importance Cholesterol (visit 1)

Feature Importance Cholesterol (visit 2)

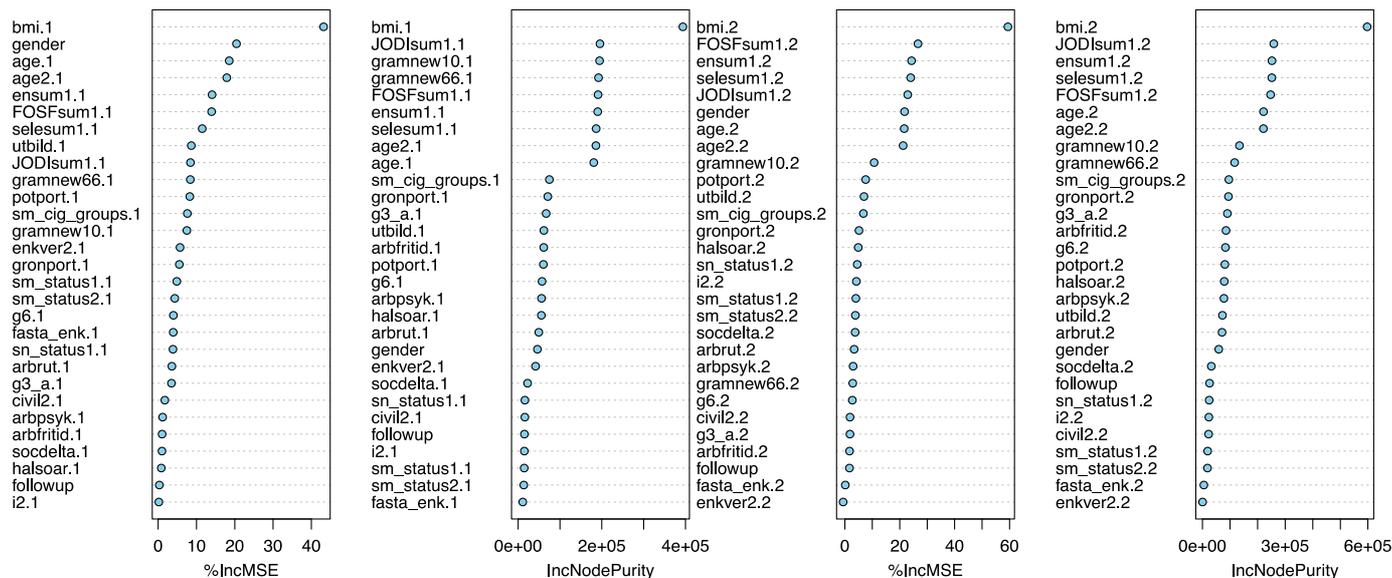


**Supplementary figure S4. Variable importance plot of Cholesterol (total cholesterol) model in VHU per visit.**

The x-axis shows each all model-variable. %IncMSE: percentage in mean square error is estimated upon mean decrease of accuracy in predictions with out-of-bag samples when each variable is excluded; IncNodePurity: increase in node purity is the total decrease of squared errors for each decision tree.

Feature Importance DBP (visit 1)

Feature Importance DBP (visit 2)

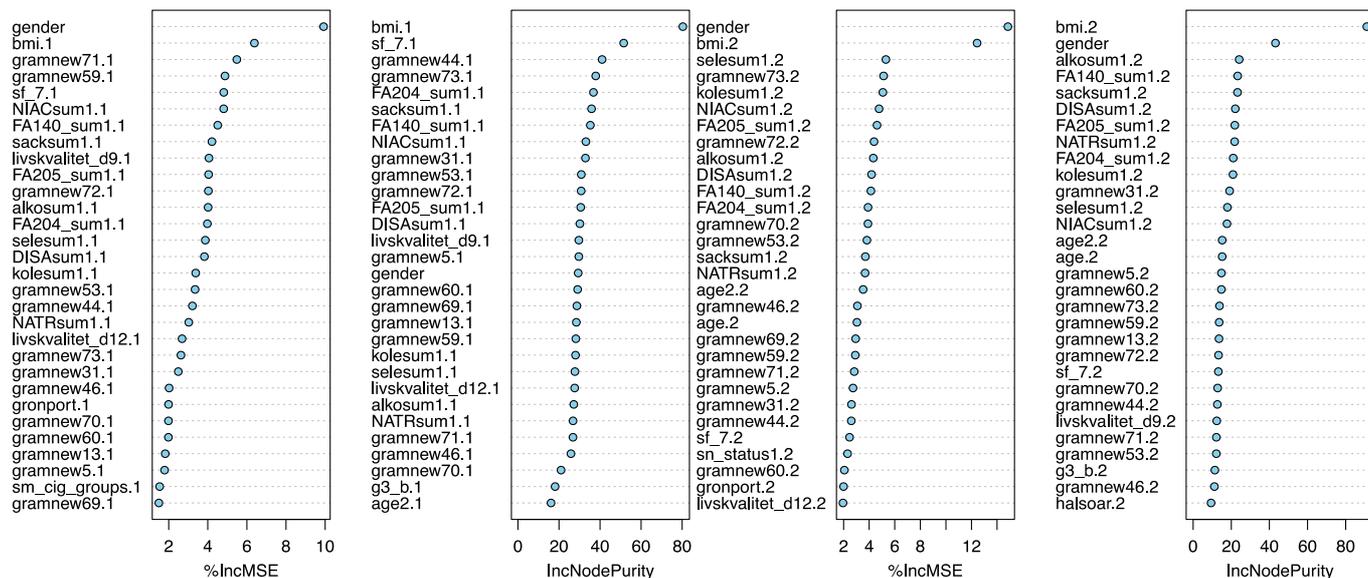


**Supplementary figure S5. Variable importance plot of diastolic blood pressure (DBP) model in VHU per visit.**

The x-axis shows each all model-variable. %IncMSE: percentage in mean square error is estimated upon mean decrease of accuracy in predictions with out-of-bag samples when each variable is excluded; IncNodePurity: increase in node purity is the total decrease of squared errors for each decision tree.

Feature Importance HDL-C (visit 1)

Feature Importance HDL-C (visit 2)

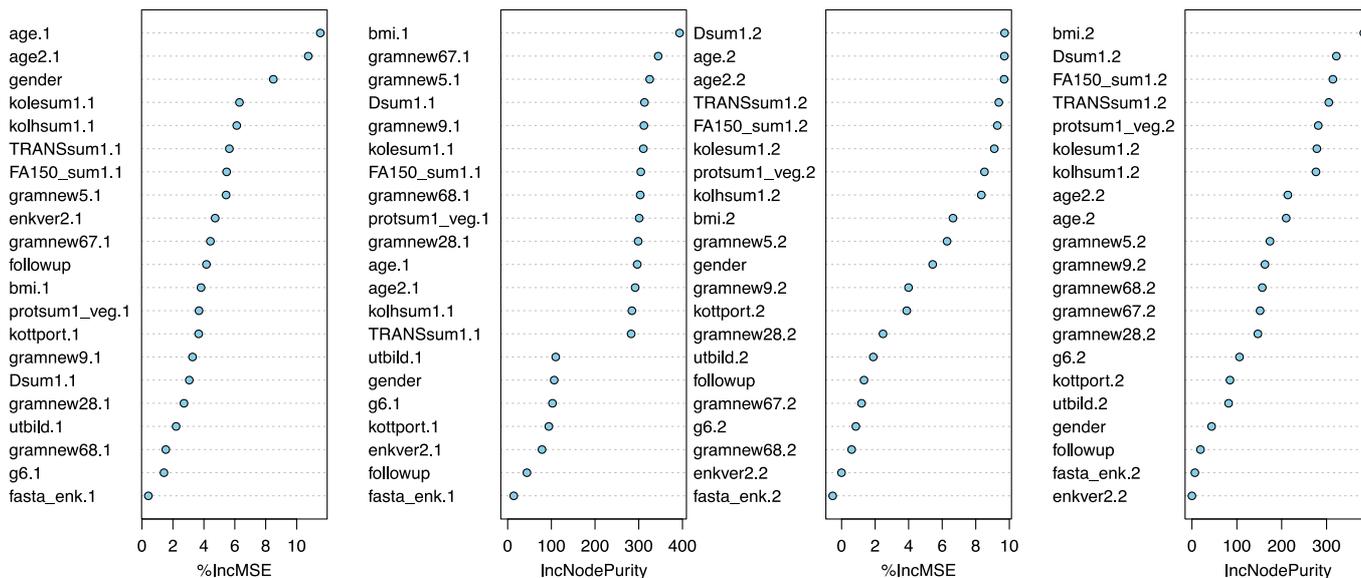


**Supplementary figure S6. Variable importance plot of high-density cholesterol (HDL-C) model in VHU per visit.**

The x-axis shows each all model-variable. %IncMSE: percentage in mean square error is estimated upon mean decrease of accuracy in predictions with out-of-bag samples when each variable is excluded; IncNodePurity: increase in node purity is the total decrease of squared errors for each decision tree.

Feature Importance LDL-C (visit 1)

Feature Importance LDL-C (visit 2)

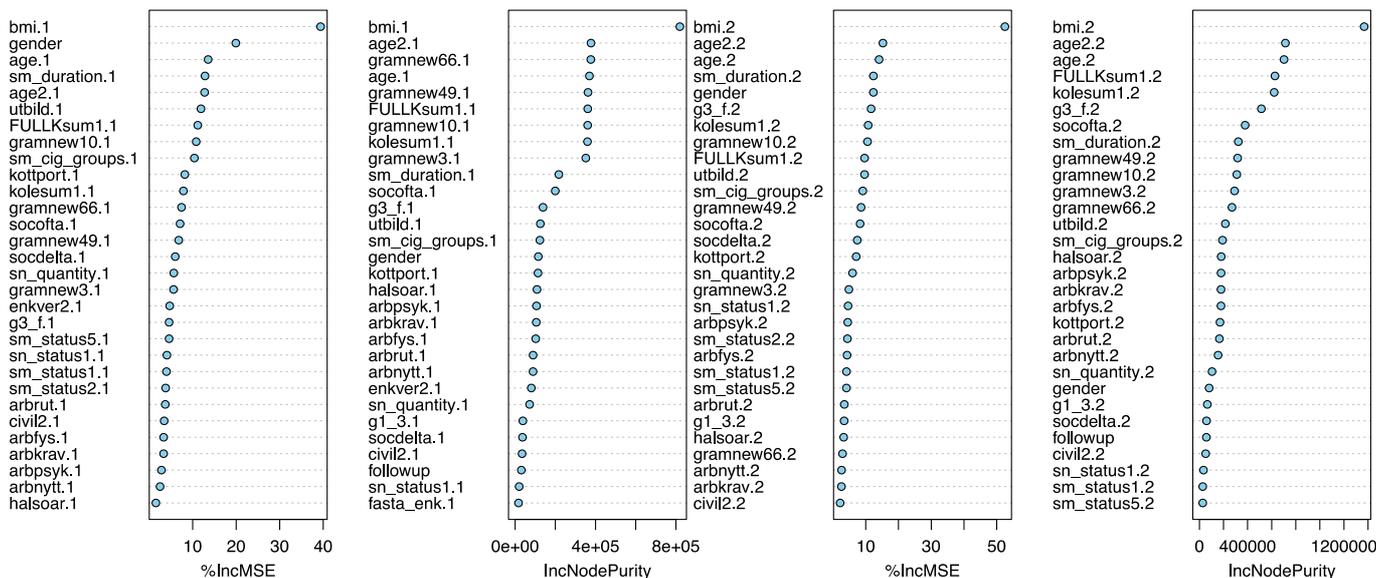


**Supplementary figure S7. Variable importance plot of low-density cholesterol (LDL-C) model in VHU per visit.**

The x-axis shows each all model-variable. %IncMSE: percentage in mean square error is estimated upon mean decrease of accuracy in predictions with out-of-bag samples when each variable is excluded; IncNodePurity: increase in node purity is the total decrease of squared errors for each decision tree.

Feature Importance SBP (visit 1)

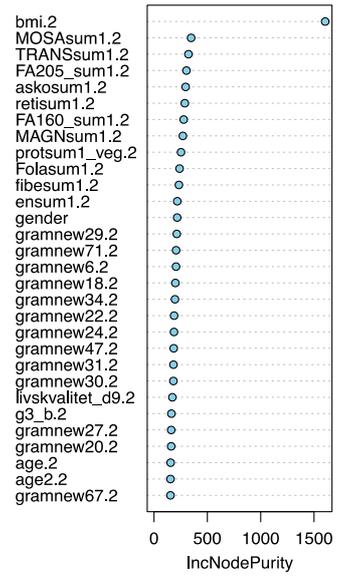
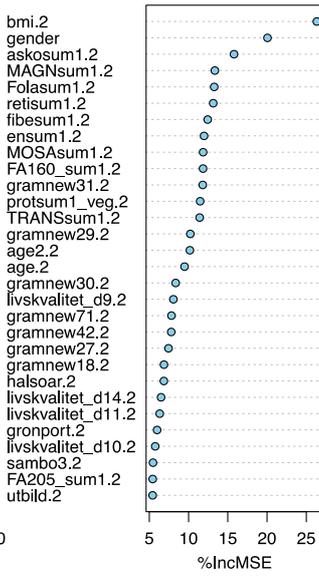
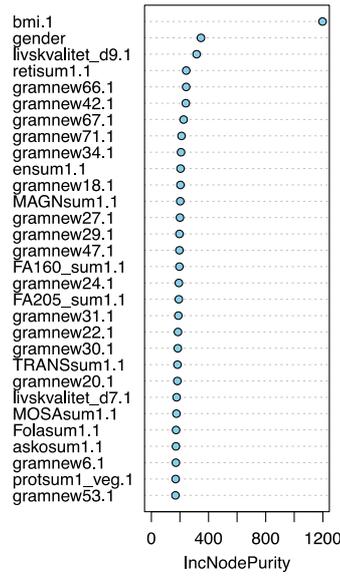
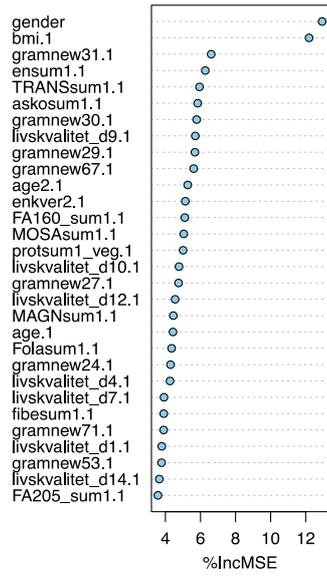
Feature Importance SBP (visit 2)



**Supplementary figure S8. Variable importance plot of systolic blood pressure (SBP) model in VHU per visit.**

The x-axis shows each all model-variable. %IncMSE: percentage in mean square error is estimated upon mean decrease of accuracy in predictions with out-of-bag samples when each variable is excluded; IncNodePurity: increase in node purity is the total decrease of squared errors for each decision tree.

Feature Importance Triglycerides (visit 1)



**Supplementary figure S9. Variable importance plot of triglycerides model in VHU per visit.**

The x-axis shows each all model-variable. %IncMSE: percentage in mean square error is estimated upon mean decrease of accuracy in predictions with out-of-bag samples when each variable is excluded; IncNodePurity: increase in node purity is the total decrease of squared errors for each decision tree.