WATCHING THE RISK FACTORS

WARIFA

ARTIFICIAL INTELLIGENCE AND THE PERSONALIZED
PREVENTION AND MANAGEMENT OF CHRONIC CONDITIONS

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D2.4 - BLUEPRINT FOR THE DESIGN OF THE AI PREVENTIVE SYSTEM INCLUDING INPUT AND OUTPUT VARIABLES

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LIST OF ABBREVIATIONS

Abbreviation	Significance
AI	Artificial Intelligence
BBN	Bayesian Belief Network
NCDs	Non-transmissible chronic diseases
CVD	Cardiovascular diseases (for the purpose of WARIFA restricted to stroke, myocardial infarction, coronary/ischaemic heart disease)
COPD	Chronic Obstructive Pulmonary Disease
DM	Diabetes Mellitus
T1/T2 DM	Type 1/Type 2 Diabetes Mellitus
CM	Cutaneous Melanoma
WHO	World Health Organization
CCs	Chronic Conditions
MI	Myocardial infarction
IARC	International Agency for Research on Cancer
OECD	The Organization for Economic Cooperation and Development
RCTs	Randomized Controlled Trials
NO	Norway
SP	Spain
RO	Romania

1   INTRODUCTION

The current deliverable is the main output of the WP2 **Task 2.4**: "*Consensus of experts in the Project, based on the variables for risk calculators validated in literature, the configuration of risk factors identified in the pilot communities, evidence-based prevention recommendations*".

It builds on the information provided by Deliverable D.2.1 regarding risk calculators validated in the scientific literature and medical practice, by Deliverable D.7.1. regarding the evidence-based recommendations for prevention of major NCDs and by Deliverable D.2.3 regarding the mapping and configuration of risk factors for the studied NCDs, that comprise cardiovascular diseases, diabetes, COPD, and skin cancer.

It integrates the expert opinion of the Consortium members with expertise in clinical and preventive medicine, social and behavioral sciences, software development and computer sciences, as well as patient advocacy representatives' perspective.

The objective of this deliverable is to lay down the initial sets of input and output variables for the development of the WARIFA AI tool, in order for this to fulfill its main roles of innovative instrument for personalized disease risk prediction and recommendations for behavior change towards the prevention of major NCDs.

These initial sets stem from the current scientific knowledge and evidence-based medical practice regarding which variables are relevant for risk prediction and for formulating prevention recommendations respectively. They lay at the basis of the development of WARIFA AI tool.

The research carried out in the next phases of the project will clarify which of these variables can be actually used for WARIFA prototype development, depending on the feasibility of their collection from the study population, the availability of corresponding databases containing these types of variables for machine learning training and testing, and the availability of outcome and follow-up data necessary for evaluating their true relevance for risk assessment and outcome prediction.

In the same time, additional input/output variables may be identified during the in-field analysis of end-users needs, preferences and patterns of WARIFA app use, or as further patients databases become available from studies worldwide. Consequently, the final sets of input and output variable lists that will be used for the final version of the WARIFA prototype will be laid down in Deliverable D.2.8 (M36).

2 BACKGROUND

WARIFA ARCHITECTURE

The WARIFA architecture, shown in Figure 1, uses Artificial Intelligence (AI) and the analysis of data generated by wearables (e.g., wellness trackers or medical devices), in-app questionnaires, community registries, and ubiquitous data to provide a personalized set of recommendations on lifestyle factors according to the risk score of each individual, as output variables.

To gather person-specific information, each Data Source will be queried upon user request for relevant information that will be pre-analysed in the Data Processing module. The information collected from the Data Sources carries a small set of metadata that allows the identification of the user, the source and the type of information it contains. The information is transmitted to the Data Processing module which filters the data and translates it into a communication standard, and sends it to the Prepared Data Storage according to the WARIFA data structure.

The purpose of each AI algorithm included in the WARIFA architecture will determine, based on the meaning that each input variable has to the prediction of the risk score, the role that each input variable has in the WARIFA System.
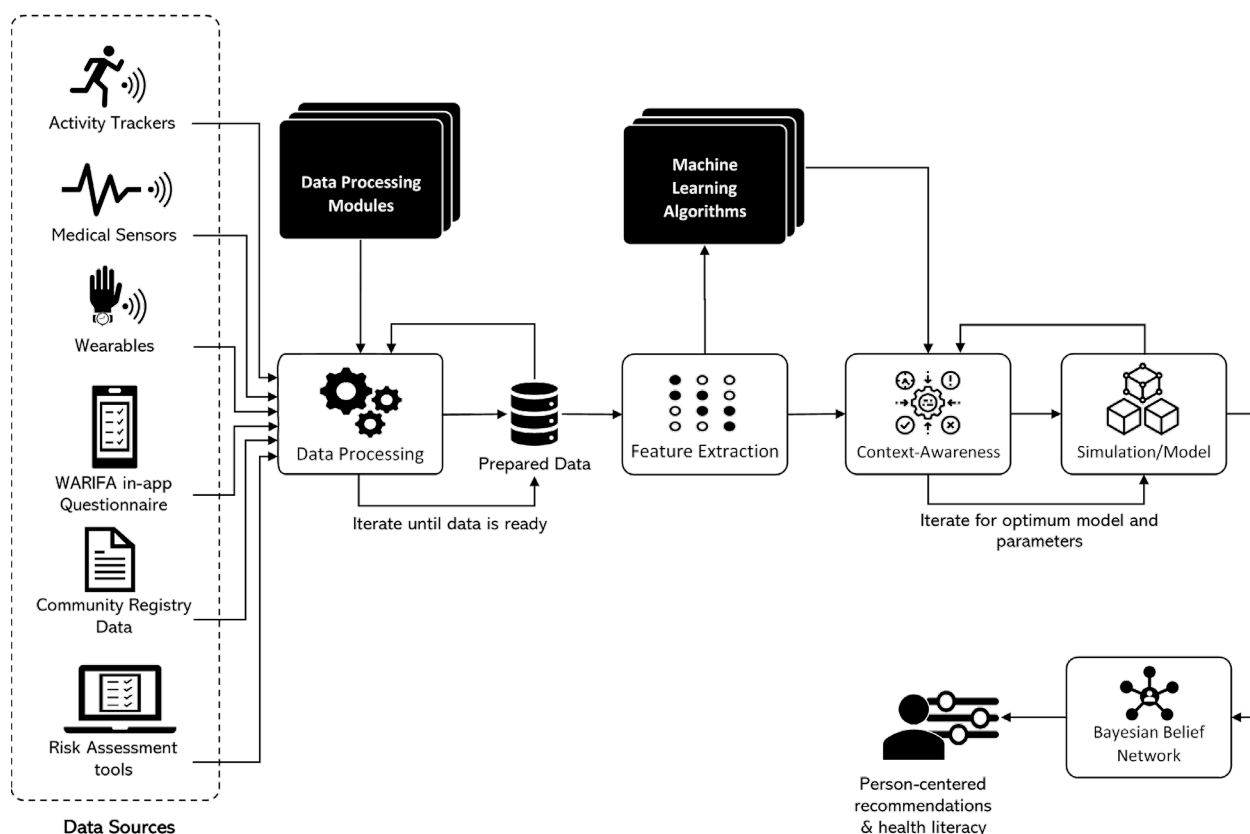
Figure 1. WARIFA architecture

3   INPUT VARIABLES FOR THE AI TOOL

The input variables for WARIFA reflect the information that should be collected about the user in order for the WARIFA system to fulfil its main functions:

1. Provide an estimation of the risk of developing the NCDs that are the focus of WARIFA (cardiovascular diseases, diabetes, COPD and skin cancer). This will materialize through an innovative WARIFA risk score, across multiple diseases (this function contributes to primary prevention)
2. Provide personalized recommendations for behavior change towards risk reduction and healthy lifestyle (contributes to primary prevention)
3. For people with type 1 diabetes - dedicated functionality: to better manage disease and treatment (this function contributes to tertiary prevention)
4. Advance research- identify potential new risk factors or statistical correlations among the different values collected through the WARIFA app by using AI-based algorithms, targeting potential new discoveries of disease risk determinants, beyond the current state of knowledge of epidemiology about the WARIFA focus diseases.

More specifically, the role of the Input Variables towards the WARIFA Architecture consists in providing the information regarding the user in order to:

1. Apply AI-based algorithms: identify, among the set of the collected variables, the variables with highest relevance for predicting the risk of the targeted diseases; study also the possible findings of new statistical correlations and patterns of co-variance between all collected variables; provide the sub-set of variables that is most relevant for each individual when assessing the combined risk for the NCDs studied in WARIFA. For more details, see *Deliverable D4.2,* specifically section 5 *"Proposed AI-based risk calculator pipeline for NCD prevention".*

2. Context analysis: the results from the Machine Learning algorithm will be processed by the Context-Awareness module to identify the relevant context data, and use this data to analyse and understand the context of the user. This will enrich, and personalise the data from the machine learning algorithm before it will be processed by the Bayesian Belief Network.

3. Build the scenario to be analysed by the Bayesian Belief Network (BBN), that should include the original set of input variables enriched with both the Machine Learning and Context-Aware outputs, to assess the risk score and select a personalized set of recommendations for behavior change towards risk reduction for the NCDs studied in WARIFA (primary prevention). For Diabetes patients, the BBN will additionally provide recommendations to better manage disease and treatment (tertiary prevention)

3.1 IDENTIFICATION OF THE INPUT VARIABLES FOR WARIFA

For the selection of the input variables the principles used for WARIFA were:

- Clinically/scientifically supported by the epidemiological knowledge so far, regarding their impact on risk for at least one of the NCDs studied (Diabetes Mellitus, Cardiovascular Diseases, COPD, Skin cancer) in European population (see Deliverables D.7.1, D.2.1, D.2.3)

Further aspects were also taken into consideration for selection, in regard to the feasibility of real-life implementation of WARIFA:

- "Minimum necessary"
- Feasible collection
- Available databases containing the respective variables
- Respecting the right of the user to opt out of providing some information
- Protection of user's personal data confidentiality and security

The selection of the input variables built on the available scientific evidence existing up to date, and involved intensive exchange between the Consortium experts in clinical and preventive medicine, epidemiology, sociology and behavioral sciences, computer science, artificial intelligence technologies development, applied mathematics.

The analysis of scientific evidence followed a step-wise approach (Figure 2)

1. **Analysis of the thorough documentation** of deliverables D.2.1 and D.7.1 for the building of the list of the input variables related to established risk factors for the studied NCDs, currently used in public health, preventive medicine and clinical practice. Results **in Table 1**

2. **Exploration for new potentially relevant variables** that may modulate the risk for the studied NCDs, for which epidemiological evidence is not yet conclusive, but for which AI algorithms and machine learning may contribute to additional information about their possible impact on risk.

    For this we followed the steps:

    2.1. ***Performed a scoping review of the scientific literature*** on reports of variables associated with risk, at individual behavioral level and at community/environment level, for the studied NCDs, in the 3 study countries, excluding the already established risk factors.

    Details of methodology and results are presented in ***Deliverable D.2.3***. From this work, a list of potentially relevant risk variables has been selected to be proposed as input variables for WARIFA- and are listed in Table 2

    The criteria for selection: strength of the study, adult subjects, size of the population, variable with suggested association with risk of at least one of the studied NCDs, in at least one of the 3 studied countries (Norway, Spain, Romania), and variable outside the list of already established factors

    2.2. ***Analysed the variables included as health indicators in the Norway community public health profiles[1]***

    These indicators include both individual level and group level variables[1]. We selected the candidates most likely to have a potential relevance for the NCDs, for the adult population that are WARIFA's focus. We focused on variables that were not included already in the previous lists. Results in **Table 3**.
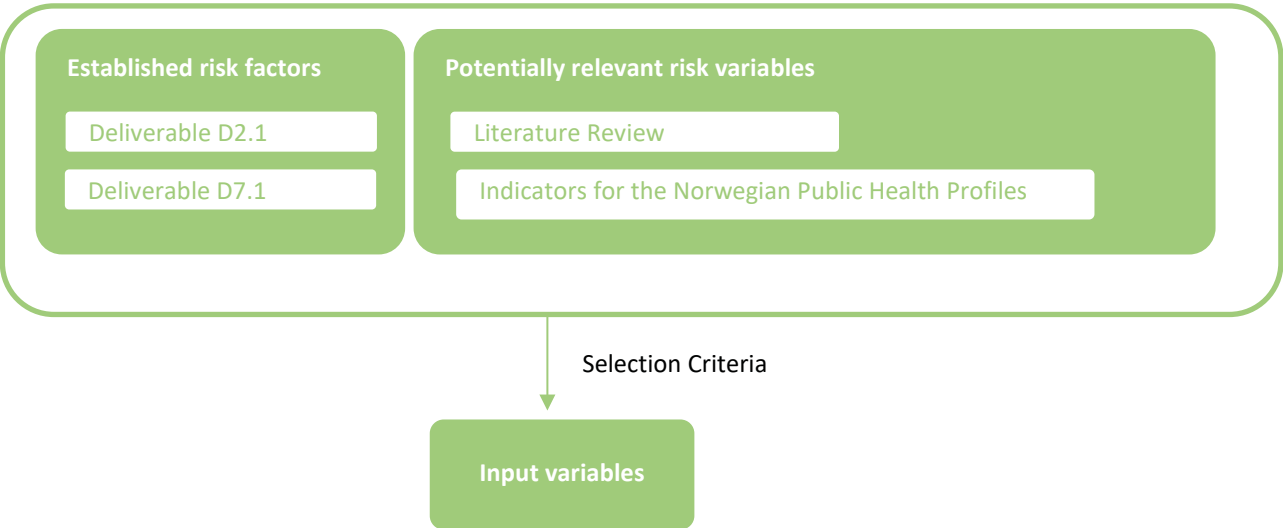

Figure 2. Workflow for identification of input variables for WARIFA

3.2 INPUT VARIABLES RELATED TO ESTABLISHED RISK FACTORS

Established risk factors for the studied NCDs are the ones solidly confirmed through decades of epidemiological research. They are detailed in Deliverables D.2.1 and D.7.1.

They are reflected through one or more variables. For example: overweight is a risk factor for CVD and T2DM, and the most used corresponding variable is BMI; photosensitive skin is a risk factor for melanoma- it is reflected through several variables: hair color, eye color, ability to tan, easiness of getting a sunburn.

Some of these risk variables have been included in clinically validated risk calculators – see D.2.1.

Some other of these risk variables have not been included in validated risk calculators, but their association with risk is well established, and to various extent, their impact on risk is quantified.

Some of these variables cannot be changed by the individual (e.g., age, skin color, familial predisposition for disease); Some variables are modifiable, related to behavior, and they are the focus of the WARIFA app, as the ultimate goal of WARIFA is to promote behavior change towards healthy lifestyle and prevention.

The list of input variables related to established risk factors, together with their impact on risk for the different NCDs studied are presented in the **Table 1**

Table 1. Input variables related to established risk factors

Variables associated with risk	Disease for which the risk variable is relevant (for risk prediction or risk reduction)							Modifiable through behavior yes/no
	CM	CVD	T1 DM	T2 DM	COPD	Mortality overall	Morbidity overall	
DEMOGRAPHICS								NO
Age	Yes	Yes		Yes		Yes	Yes	NO
Sex	Yes	Yes				Yes	Yes	NO
Ethnicity	Yes	Yes	Yes	Yes				NO
Education level						Yes	Yes	YES
Socio-economic level		yes		yes	yes	Yes	Yes	YES
Location								YES
PHENOTYPIC MARKERS								NO
Phototype (6 types of skin reaction to sun exposure	Yes							NO
Natural Hair color	Yes							NO
Presence of freckling	Yes							NO
Total Number of nevi on body	Yes							NO
Presence of atypical nevi	Yes							NO
MEDICAL SITUATION								NO
Personal medical history								NO
Diabetes		Yes				Yes	Yes	
CVD			Yes*	Yes		Yes	Yes	
Hypertension (HTA)		Yes	Yes*	Yes		Yes	Yes	
COPD		yes				Yes	Yes	
Cancer	Yes					Yes	Yes	

Variables associated with risk	Disease for which the risk variable is relevant (for risk prediction or risk reduction)							Modifiable through behavior yes/no
	CM	CVD	T1 DM	T2 DM	COPD	Mortality overall	Morbidity overall	
Immuno-suppressive treatment	Yes							
FAMILY HISTORY								NO
- of skin cancer	Yes							NO
- of cancer	Yes					Yes	Yes	NO
- of CVD (coronary heart disease, MI, stroke, hypertension)		Yes				Yes?	Yes?	
- of T1/T2 Diabetes		Yes		Yes				
LABORATORY PARAMETERS								YES
serum cholesterol total		Yes		Yes			Yes	YES
Serum cholesterol LDL HDL		Yes	Yes*	Yes			Yes	YES
Fasting plasma glucose		Yes	Yes	Yes				YES
VARIABLES for T1DM tertiary prevention								YES
HbA1c *			Yes*	Yes			Yes	
Kidney function (creatinine, estimated glomerular filtration rate, proteinuria) *			Yes*	Yes*			Yes	
Previous hypoglycemia (from sensor automatically) *		Yes*	Yes*					
Time in range (70-180mg/dl glucose) *			Yes*					
Hypoglycemia unawareness*			Yes*					
Average glucose concentration*			Yes*					
Time below glucose 70mg/dl*			Yes*					
Coefficient of variation in glucose (%) *			Yes*					
CURRENT BEHAVIOR/ Lifestyle								
BMI/OBESITY		Yes	Yes*	Yes		Yes	Yes	YES
DIET		Yes	Yes*	Yes		Yes	Yes	YES
1.-Diet low in fruits (frequency?)		Yes	Yes*	Yes		Yes	Yes	yes
2.-Diet Low in vegetables (frequency?)		Yes				Yes	Yes	yes
3.-Diet high in red meat		Yes		Yes		Yes	Yes	yes
4.-Diet high in processed meat		Yes		Yes		Yes	Yes	yes
5.-Diet high in sugar-sweetened beverages		Yes?		Yes		Yes?	Yes(?)	yes
6.Diet high in sodium		Yes		Yes?		Yes	Yes	yes
Carbohydrate (g in a meal)			Yes					yes
PHYSICAL ACTIVITY (lack of)		Yes	Yes*	Yes		Yes	Yes	YES
ALCOHOL CONSUMPTION		Yes	Yes*	Yes		Yes	Yes	YES
TOBACCO EXPOSURE		Yes	Yes*	Yes	Yes	Yes	Yes	YES
CURRENT SUN EXPOSURE	yes							YES

Variables associated with risk	Disease for which the risk variable is relevant (for risk prediction or risk reduction)							Modifiable through behavior yes/no
	CM	CVD	T1 DM	T2 DM	COPD	Mortality overall	Morbidity overall	
recreational	Yes							YES
professional	Yes							YES
tanning beds use	Yes							YES
Location UV index								NO
SLEEP PATTERNS		Yes		Yes				YES
AIR POLLUTION EXPOSURE		Yes	Yes*	Yes	Yes	Yes		YES
EXPOSURE HISTORY								NO
History of Sun exposure	Yes							NO
Sunburn history	Yes							NO
History of Indoor tanning sessions	Yes							NO
Past Exposure to carcinogens								NO
Past tobacco exposure		yes			YES	Yes	Yes	NO
∗ relevant for tertiary prevention, related to the risk of worse course/outcome of the disease								

3.3 INPUT VARIABLES RELATED TO POTENTIAL NEW RISK FACTORS

Certain characteristics, biological or behavioral of the individuals or characteristics of their social context or of their community and living environment may influence the risk for the studied NCDs, beyond the known and established risk factors.

For these characteristics some scientific evidence exists, suggesting that they may play a role in modulating (increasing or decreasing) the risk of at least one of the four studied NCDs, in at least one of the 3 populations studied (Norway, Spain, Romania). However, so far, they lack the solid evidence-basis of the large epidemiological studies and consequently their true impact on the disease risk in larger population is not known and cannot be quantified in present.

Including these as input variables into the WARIFA AI system may bring new light on their association (or lack thereof) with disease risk, and on their possible relationships with the established risk factors. Thus, WARIFA may help reveal interesting candidates for further studies looking for determinants for disease risk beyond the limits of current knowledge. This aligns with the aim of advancing edge research in AI-powered public health analysis by WARIFA

To identify the best candidates for this category of new emerging risk variables to be included in WARIFA, we followed 2 approaches: Literature review and analysis of Indicators for the Norway Public Health Profile

The results are presented below in the Tables 2 and 3.

3.3.1 Variables possibly associated with risk, identified through the scoping literature review

For these new variables, identified through the literature review performed in D.2.3 (see also methodology above), we do not know their true impact on risk (if any), we have only some

preliminary suggestions from limited studies that they might associate with disease risk in certain population subgroups.

Table 2. Input variables related to potential new risk factors identified from Literature review

(Based on results in D.2.3)

Variables	Type of variable (individual vs. Community level)	Association with risk reduction (+ = association with favourable impact/lower risk for disease) (- = association with unfavourable impact/ higher risk of disease)						Type of study	Country of the study
		COPD	CVD	DM	T1 DM	T2 DM	Skin cancer		
Access to small stores for buying healthy foods	Community		+					Exploratory study	SP
Accessibility to public green/open spaces	Community		+					Exploratory study	SP
Accessibility to walking areas for elderly	Community		+					Exploratory study	SP
Active travel (walking or cycling for travel) X Low Socioeconomic status (favourable)	Individual		+	+				Cross-sectional	NO
Antidepressant medication use	Individual						-	Cohort	NO
Antipsychotic drugs X male (vs. female)	Individual		-					Case control	NO
Anxiety	Individual		-					Cohort	NO
Anxiety (health anxiety)	Individual		-					Cohort	NO
Anxiety/depression (mixed symptoms)	Individual		-	-				Cohort, Cross-sectional	NO
Area of residence (adequate supply of healthcare resources/services)	Community		+					Cohort	SP
Area of residence (Bilbao, Gasteiz, and Goierri region (Gipuzkoa)	Community	-	-					Comparison of weather station data over time, Cross-sectional	SP
Area of residence (city size)	Community		-					Cross-sectional	SP
Area of residence (country)	Community					Country-specific		Cohort	SP
Area of residence (crowding)	Community			-				Cross-sectional	SP
Area of residence (crude divorce rate)	Community		-					Cohort	NO
Area of residence (greenness)	Community		-					Cohort	SP

Variable	Level						Study design	Country
Area of residence (higher altitude is favourable)	Community			+			Cohort	SP
Area of residence (less farming)	Community		+				Cohort	SP
Area of residence (less unemployment)	Community		+				Cohort	NO, SP
Area of residence (low population density is favourable)	Community		+				Cohort	SP
Area of residence (Neighbourhood)	Community		Different *				Cohort	NO
Area of residence (rural environment) X Low education level	Community			-			Cross-sectional	RO
Area of residence (urban greenness)	Community		+				Cohort	SP
Area of residence (urban vs. rural)	Community		-				Cross-sectional	RO
Area of residence (walkability)	Community		+				Cohort	SP
Attitudes (positive towards tanning)	Individual					-	Cross-sectional	SP
Availability of resources (absence of gender-exclusive gyms)	Community				+		Cohort	NO
Availability of resources (affordable training facilities)	Community				+		Cohort	NO
Availability of resources (available hospital beds)	Community		+				Cohort	NO
Availability of resources (lack of information about preventive health services)	Community				-		Cohort	NO
Beliefs ("Sunbathing is healthy for my body", "sunscreens are unattractive", etc.)	Individual					-	Cross-sectional	SP
Childhood environment (lower education)	Individual		-				Cross-sectional	NO
Childhood environment (parental practices, number of siblings)	Individual		-				Cohort	NO
Childhood environment (socioeconomic status of parents, lower)	Individual		-				Cohort	NO
Climatological factors (lower temperatures at hospital admission)	Community	-					Cross-sectional	SP
Climatological factors (ambient temperature, moderate exposure to cold temperatures)	Community			+			Cross-sectional	SP
Climatological factors (humidity, increase)	Community	-	-				Comparison of weather station data over time,	SP

Variable	Level							Study type	Country
								Cross-sectional	
Climatological factors (seasonality, colder) X Pollution/exposures (increasing concentrations of NO2, CO, PM10, and SO2 (but decreasing O3 concentrations) in the previous week)	Community	-	-					Comparison of weather station data over time, Cross-sectional	SP
Medication (combined oral contraceptives)	Community		-					Integrative review	SP
Depression	Individual		-					Cohort, Cross-sectional	NO, RO
Deprivation (Unemployment; Low educational level; Low educational level in young people; Manual workers; Temporary workers) X City size (larger)	Community			-				Cross-sectional	SP
Drinking as a socialization mechanism	Individual		+					Exploratory study	SP
Eating speed (fast)	Individual		-					Cross-sectional	SP
Ethnicity (Tunisian (compared to Canarian) X Women	Individual		-					Cross-sectional	SP
Social class (decrease in social class (education ICE model (including family income, household crowding and education level)) X Tunisian women	Individual		-					Cross-sectional	SP
Social class (increased social class (education ICE model (including family income, household crowding and education level))	Individual		+					Cross-sectional	SP
Employment status (unemployment or disability)	Individual		-					Cross-sectional	NO
Employment status (pensioner status)	Individual		-					Cross-sectional	RO
Ethnicity (South Asians living in Europe)	Individual		-					Cohort, Cross-sectional, Review	RO
Evening chronotypes	Individual			-				Cross-sectional	NO, SP
Habits (TV watching, increase)	Individual					-		Cohort	SP
Housing	Individual		Type-dependent*					Cohort	SP
Immigrant status (duration of stay in Norway, ≥10 years,	Individual					-		Cross-sectional	NO

Variable	Level						Study	Code
compared to those living <5 years) X Somali ethnicity X Women								
Immunomodulating drug use (immunosuppressants and corticosteroids)	Individual					-	Case control	SP
Income (higher)	Individual					-	Cross-sectional	SP
Intervention (Obese men on antihypertensive medications X advice/counselling and exercise sessions)	Individual	+					2X2 Factorial trial	NO
Intervention (Pharmacist-Dermatologist collaboration for screening awareness)	Community					+	Cross-sectional	NO
Knowledge	Individual					+	Cross-sectional	SP
Knowledge (high level of knowledge of sun exposure association w/ skin cancer) X High sun exposure (despite knowledge)	Individual					-	Cross-sectional	SP
Knowledge of disease (disease awareness) X Duration of disease	Individual	+					Cross-sectional	SP
Living alone X Women	Individual	-					Cohort	RO
Living alone X Lack of social support	Individual	-					Cohort	NO
Low Mediterranean diet adherence	Individual	-					Cross-sectional	SP
Marital status	Individual				Type-dependent*		Cohort	SP
Marital status (Widower vs. married)	Individual		-				Cross-sectional	SP
Marital status (single or divorced vs. married)	Individual		+					
Marital status (celibacy)	Individual		+					
Medical history (more sunburns) X students	Individual					-	Cross-sectional	RO
Mediterranean lifestyle (Rest (napping for 30mins or less) X Social habits X Conviviality)	Individual	+					Cohort	SP
Nap length during the day (<30mins favourable)	Individual				+		Cohort	SP
Occupation (<40 working hours per week favourable)	Individual				+		Cohort	SP
Occupation (manual)	Individual	+					Cross-sectional	SP
Occupation (physical activity level, higher)	Individual	+					Cohort	SP

Variable	Level							Study type	Country
Occupation as professional driver	Individual		-					Cross-sectional	NO
Olive oil consumption	Individual		+					Cross-sectional	SP
Oral tobacco use	Individual		-					Cross-sectional	SP
Pollution/exposure (air pollution)	Community		-					Cohort	NO
Pollution/exposure (black carbon, fine particulate matter)	Community		-					Cohort	SP
Pollution/exposure (CO)	Community	-						Cross-sectional	SP
Pollution/exposure (high concentrations of persistent organic pollutants)	Community					-		Cross-sectional	SP
Pollution/exposure (Indoor biomass smoke)	Community	-	-					Review	SP
Pollution/exposure (Indoor exposure)	Community	-	-					Review	SP
Pollution/exposure (inorganic arsenic)	Community					-		Cohort	SP
Pollution/exposure (higher level)	Community	-						Cross-sectional	SP
Pollution/exposure (long-term traffic pollution)	Community	-	-					Review	SP
Pollution/exposure (low exposure to persistent organic pollutants)	Community					-		Cross-sectional	SP
Pollution/exposure (NO2)	Community	-	-					Cohort, Cross-sectional	SP
Pollution/exposure (O3)	Community	-						Cross-sectional	SP
Pollution/exposure (outdoor light pollution)	Community		-					Review	SP
Pollution/exposure (particulate matter)	Community	-						Cross-sectional	SP
Pollution/exposure (traffic pollution)	Community	-	-					Case-crossover study, Review	SP
Poor adherence to the Mediterranean Diet X Little education, single, divorced or separated	Individual		-					Cross-sectional	SP
Previous hospital admission	Individual		-					Cohort	SP
Psychological stress (time pressure)	Individual					-		Cohort	SP
Psychological wellbeing (poor)	Individual		_					Cross-sectional	NO
Psychological wellbeing (emotional stress)	Individual		-					Cross-sectional	RO

Variable	Level							Study design	Country
Psychological wellbeing (increase in stress)	Individual	-						Cross-sectional	RO
Psychological wellbeing (lifestyle stress) X Psychoses	Individual		-					Cohort	RO
Psychological wellbeing (perceived stress)	Individual		-					Cross-sectional	SP
Psycho-physical stress	Individual	-						Case control	RO
Quality of life (high perceived quality)	Individual	+						Cohort	SP
Smoking (former smoker status)	Individual				-			Cohort	SP
Smoking practice X nonmanual occupation	Individual	-						Cross-sectional	SP
Social interaction (less frequency of seeing family/friends)	Individual	-						Cross-sectional	SP
Socio-cultural level (low)	Individual	-						Cross-sectional	SP
Socioeconomic status (higher)	Individual	+						Cohort, Cross-sectional	SP
Socioeconomic status (blue collar social status)	Individual				-			Cohort	SP
Socioeconomic status (civil status, employment, higher)	Individual	+						Case control	SP
Socioeconomic status (education and occupational activity, increase)	Individual	+						Cross-sectional	RO
Socioeconomic status (education, employment, i.e., not pensioner or disability status) X Rural living	Individual	-						Cross-sectional	NO, SP
Socioeconomic status (education, income, social class, low) X Area of residence (Asturias and Balearic Islands, as compared to Galicia, Navarra or Murcia)	Individual	-						Cohort	SP
Tele dermatology	Community					+		Transversal descriptive study	SP
Total number of negative symptoms of schizophrenia (blunted affect, emotional withdrawal, poor rapport, passive/apathetic social withdrawal, lack of spontaneity and conversation flow, motor retardation, and active social avoidance)	Individual	-	-					Cohort	SP

Psychological wellbeing (stress-prone personality or unfavourable coping styles, negative emotion, depression)	Individual				-	Case control	SP
Depression (not receiving adequate treatment)	Individual		-			Cross-sectional	SP
Traffic noise levels	Community		-			Review	SP
Traffic noise levels (daytime)	Community		-			Cohort	SP

 Different*/Type dependent* = categorical variables, for which different categories of values had different types of association (positive or negative) with the risk of disease

3.3.2 Input variables selected from the list of indicators for the Norwegian Public health Profile

The Norway Public Health Profiles[1] give a summary of health data for each Norwegian municipality to identify and measure areas for improvement. For the generation of these profiles a series of indicators are collected, reflecting health conditions and the factors that influence them in different communities. Data for these indicators are collected from the many good quality health registries available in Norway, from Statistics Norway and Norwegian health studies.

Some of these indicators represent established risk factors for the NCDs studied in WARIFA, already included in our list of input variables (Table 1), e.g., smoking, overweight or the lack of physical activity.

Other indicators have an established association with general health or morbidity/mortality, but so far not a confirmed direct one with the particular NCDs studied in WARIFA. This subset of indicators are interesting candidates as input variables for WARIFA AI system, as the WARIFA AI algorithms may reveal previously unknown associations between these indicators and the established risk factors for or the risk of developing the NCDs studied in WARIFA.

The complete list of indicators for Norway Public Health Profiles is given in Table 3. The ones that we consider the most interesting as input variables for WARIFA AI system are highlighted in green. This selection was based on criteria: variables related to adult population, not included in the previous list of established risk factors, and not referring specifically to unrelated diseases (e.g., injuries)

We underline that at this point this list is a proposal of potentially relevant risk variables. The feasibility of the collection of this list of variables for the other two countries studied- Spain and Romania is unknown and will be further explored in future work of the Consortium (D.2.6).

Also, the real-life relevance of the selected indicators for risk prediction for the scope of the studied NCDs will need further studies beyond WARIFA.

Table 3 Indicators of the Norwegian Public Health Profiles

Population

1 Proportion children, 0-17 years	
2 One-person households, 45 years +	
3 Proportion over 80 years, projected	
Childhood and living conditions	
4 Upper secondary school or higher education, 30-39 years	
5 Low income (household), 0-17 years (new def.)	
6 Income inequality, P90/P10	
7 Cramped housing, 0-17 years	
8 Child of single parents	
9 Social security, 20-29 years	
10 Enjoys school, 10th grade	
11 Is bullied, Ungdata. 2016	
12 Lowest level reading skills, 5th grade	
13 Lowest level numeracy skills, 5th grade	
14 Drop out from upper secondary school (UNgdata 2016) *	
15 Believe in a happy life, (Ungdata 2016) *	
Environment, injuries and accidents	
16 Satisfied with local environment, (Ungdata 2016) *	
17 Membership leisure organisation, (Ungdata. 2016)*	
18 Satisfactory venues to meet, (Ungdata 2016) *	
19 Loneliness, (Ungdata 2016) *	
20 Good drinking water supply (new def.)	
21 Drinking water supply	
22 Injuries, hospital treated	
Health-related behaviours	
23 Physically inactive, Ungdata	
24 Screen time over 4 hours, (Ungdata)*	
25 Smoking, women	
Health condition	
26 Life expectancy, male	
27 Life expectancy, female	
28 Educational difference life expectancy	
29 Satisfied own health, (Ungdata) *	
30 Mental symptoms/illness, 15-29 years	
31 Musculoskeletal disorders	
32 Overweight and obesity, 17 years	
33 Cardiovascular disease	
34 Antibiotics prescriptions	

- Highlighted in green: The indicators proposed as input variables for WARIFA;
- Highlight green with *: These indicators were produced based on the Ungdata 2016 study[2], which is a survey of youth and adolescents. Although WARIFA focuses on adults, some of these variables could provide interesting context information, so they might be taken into consideration for WARIFA input variables list.
- Highlighted in yellow: indicators related to established risk factors for the WARIFA NCDs, already included as input variables in table 1.

4 OUTPUT VARIABLES FOR THE AI TOOL

The WARIFA AI tool output for the user will fall into several categories (cf. Figure 1):

1. Combined risk score for the studied NCDs (the main innovation in WARIFA). As detailed in Section 5 of Deliverable D4.2, several research lines will be followed to achieve this combined risk score for the different diseases by using innovative AI-based algorithms.

2. Personalized set of recommendations for behavior change towards risk reduction for the studied NCDs (primary prevention). For Diabetes type 1 patients, the AI tool will additionally provide personalized recommendations to better manage disease and treatment (tertiary prevention)

3. Personalized set of health-related information tailored to the user in order to increase user's health literacy

The present deliverable focuses on point 2, the personalized recommendations for preventive behavior that will be provided to the user, according to his/her level of risk, calculated by the WARIFA AI tool combined across the diseases but also taking into account his/her particular configuration of risky behaviors.

The prevention recommendations will be selected for the user from the set of medically validated recommendations for prevention, included in the national or European guidelines. If the user location is known, the AI tool will provide recommendations according to the national relevant guidelines. If these specific national guidelines do not exist, or the user location is not known, the user will receive recommendations according to the European guidelines.

The various sets of recommendations available in Europe have been reviewed and presented n detail in Deliverable *D.7.1. Health outcomes.*

Here below we present a succinct overview of them, listed comparatively for the three studied countries, for each of the modifiable risk factors (Table 4)

Table 4 Recommendations for preventive behavior

Category	Modifi-able Risk factor	List of Prevention recommendations – European guidelines	List of Prevention recommendations – Norway guidelines	List of Prevention recommendations – Spain guidelines	List of Prevention recommendations – Romanian guidelines
Behavioral	Physical activity	**In adults**, physical activity confers benefits for the following health outcomes: all-cause mortality, cardiovascular disease mortality, incident hypertension, incident type 2 diabetes, incident site-specific cancers, mental health (reduced symptoms of anxiety and depression), cognitive health and sleep; measures of adiposity may also improve. It is recommended that:	New national guidelines were published in April 2022 [4] Adults should be moderately physically active 150-300 min./week, 75-150 min/week with high intensity or a combination. Reduce sedentary time.	Physical activity in the general population: The recommendations are specified as 60 minutes of physical activity of moderate intensity, or the equivalent of 10,000 steps a day, perhaps with some steps or specific periods of greater intensity Guías alimentarias para la población española (SENC,2020)[5]	1. It is recommended to evaluate the level of physical activity by GP, using the GPPAQ (General Practice Physical Activity Questionnaire). 1C 2. For the healthy development of children, it is recommended to encourage physical activity, especially supervised play on the floor in a safe environment. 2C 3. It is recommended to encourage physical activity in children aged 1-3 years and preschoolers 3-5 years, lasting

- All adults should undertake regular physical activity;
- Adults should do at least 150–300 min of moderate-intensity aerobic physical activity, or at least 75–150 min of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate-intensity and vigorous-intensity activity throughout the week for substantial health benefits;
- Adults should also do muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on 2 or more days a week, as these provide additional health benefits.

Adults may increase moderate-intensity aerobic physical activity to >300 min, or do >150 min of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate-intensity and vigorous-intensity activity throughout the week for additional health benefits (when not contraindicated for those with chronic conditions).

Older adults
(aged 65 years and older) including those with chronic conditions and those living with disability
Physical activity also helps prevent falls and falls-related injuries and declines in bone health and functional ability.
It is recommended that:
As for adults, plus

- As part of their weekly physical activity, older adults should do varied multicomponent physical activity that emphasises functional balance and strength training at moderate

at least 3 hours every day, per day. 1B
4. More physical activity provides greater benefits. 1
5. It is recommended to encourage moderate to intense physical activity in children and young people aged 5 to 17 years.
6. Healthy adults of any age should do 2.5-5 hours per week of physical activity or aerobic exercise at least moderate intensity or 1-2.5 hours per week of intense physical activity. Sedentary people should be strongly encouraged to start a light exercise program. 1
7. Physical activity or aerobic exercise should be performed in several installments lasting ≥10 minutes, spread evenly over weekly weeks, for example 4-5 days a week. Second
8. Muscle strengthening activities are recommended for at least 2 days of each week. 1B
9. Healthy pregnant women and girls who are not active or not used to doing intense physical activity should do at least 150 minutes (2.5 hours) of moderate-intensity aerobic physical activity per week during pregnancy and postpartum period. Physical activity would preferably be spread throughout the week. 2C
10 It is recommended to use short advice to increase the level of physical activity in adults who are not active. 2B
11. For overweight or obese adults with additional cardiovascular risk factors, it is recommended to offer or refer to intensive behavioral counseling to promote a healthy diet and activity. Adequate physical therapy in order to prevent cardiovascular disease. 1B
12. Monitoring of patients advised for movement is recommended. 2C [6]

		or greater intensity on 3 or more days a week, to enhance functional capacity and to prevent falls. Pregnant and post-partum women n women, physical activity during pregnancy and the postpartum period confers benefits for the following maternal and foetal health outcomes: reduced risk of pre-eclampsia, gestational hypertension, gestational diabetes, excessive gestational weight gain, delivery complications and postpartum depression and no increase in risk of stillbirth, new-born complications or adverse effects on birth weight. It is recommended that all pregnant and postpartum women without contraindication should: • undertake regular physical activity throughout pregnancy and post partum; • do at least 150 min of moderate-intensity aerobic physical activity throughout the week for substantial health benefits; • incorporate a variety of aerobic and muscle-strengthening activities. Adding gentle stretching may also be beneficial. In addition: Women who, before pregnancy, habitually engaged in vigorous-intensity aerobic activity or who were physically active can continue these activities during pregnancy and the postpartum period. *World Health Organization 2020 guidelines on physical activity and sedentary behaviour.* [3]			
	Alcohol	Recommendations If you drink alcohol of any type, limit your intake. Not drinking alcohol is better for cancer prevention [7] (European Code Against Cancer)	Children and teenagers < 18 and pregnant women should not drink alcohol. Women: Do not drink more than 10. grams of alcohol per day.		If alcohol is consumed, it should be consumed in moderation, up to one standard drink per day for women and up to two for men, and only by adults[6].

		Moderate alcohol consumption [up to 20 g/day (2 units) for men and 10 g/day (1 unit) for women] is acceptable for those who drink alcoholic beverages, provided that triglyceride levels are not elevated[8]	Men: Do not drink more than 20 grams of alcohol per day. Think about which situations where you consume alcohol. Limit your alcohol consumption. Avoid getting drunk Do not drink for health reasons It is recommended to limit alcohol intake. Intake should not exceed 10g per day for women and 20g per day for men. Alcohol consumption should not exceed 5 % of the energy intake in adults. Pregnant women, children and adolescents are recommended to abstain from alcohol. Lactating women are recommended to limit alcohol intake. Source Nordic Nutrition Recommendations 2012[9]		

	Smoking	Implement WHO Framework Convention on Tobacco Control (2003, 2005)[10]	Do not start smoking If you smoke, try to quit smoking.
			Recommendations for health personnel
			    Minimal intervention should be conducted at all appropriate consultations.
			    Anyone who wants to quit smoking should be offered structured help to quit.
			    Anyone wishing to quit smoking should be considered with regard to the use of smoking cessation drugs.[11]
				Continue to implement WHO report on the global tobacco epidemic: the MPOWER package. Geneva: World Health Organization, 2008. https://www.euro.who.int/en/health-topics/noncommunicable-diseases/pages/who-european-office-for-the-prevention-and-control-of-noncommunicable-diseases-ncd-office/data-publications-and-tools/data,-publications-and-tools-policy/publications-and-tools-supported-by-the-ncd-office/ncdprime-modelling-the-impact-of-national-policies-on-noncommunicable-disease-ncd-mortality-using-prime-a-policy-scenario-modelling-tool-2019	1.All patients should be evaluated for tobacco use: at each consultation if they are daily smokers, every 5 years if they have never smoked or given up for more than 5 years; annually if they have quit smoking for less than 5 years or are under 25 years of age. 1B
					2 Smoker / ex-smoker / non-smoker status must be recorded in patient record 1A
					3 After identifying and advising the smoker, a physician should assess his / her current desire / intention to quit smoking.3C
					4 It is recommended to provide smoking cessation support in the form of individual, group and telephone consultations, all of which are effective. 1
					5 It is recommended that the family doctor routinely offer smoking cessation advice to all smokers at all times. 1A
					6 Smoking cessation interventions should include: a) counselling for the development of risk management skills for smoking cessation; b) support and encouragement throughout the process. 1B
					7 TSN (Smoking Cessation Therapy) may be recommended for nicotine addicted smokers.

					There are no significant differences in the effectiveness of various forms of presentation, which is why the selection will be made according to the patient's preferences. 1A 8 Bupropion is effective for smokers with nicotine addiction and who want to quit smoking if there are no contraindications. 1A 9 Varenicline is effective for smokers with nicotine addiction and who want to quit smoking if there are no contraindications. 1A 10 It is recommended to combine counselling with medication for the treatment of nicotine addiction whenever possible and indicated, as the combination is more effective than if any of the methods were applied individually. 1A 11 All smokers who are in the process of quitting should be monitored. 1A[6]
	Diet	No common guidelines (https://www.fao.org/nutritio n/e education/food-dietary-guidelines/regions/europe/en/)	THE NORWEGIAN DIETARY GUIDELINES 1. Enjoy a varied diet with lots of vegetables, fruit and berries, whole-grain foods and fish, and limited amounts of processed meat, red meat, salt and sugar. 2. Maintain a good balance between the amount of energy you obtain through food and drink and the amount of energy you expend through physical activity. 3. Eat at least five portions of vegetables, fruit and berries every day. 4. Eat whole grain foods every day. 5. Eat fish two to three times a week. You can also use fish as a spread on bread. 6. Choose lean meat and lean meat products. Limit the amount of processed meat and red meat. 7. Include low-fat dairy foods in your daily diet. 8. Choose edible oils, liquid margarine and soft margarine spreads instead of hard margarines and butter.	The recommendations promote a balanced, varied and moderate diet that includes whole grains, fruits, vegetables, legumes, varying amounts of dairy and alternating consumption of fish, eggs and lean meats, along with the preferential use of extra virgin olive oil for cooking and seasoning. Reinforce the interest in a healthy, sympathetic, supportive, sustainable diet, based on seasonal and local products, axis for conviviality, devoting adequate time and encourage the use of nutrition labelling information. Guías alimentarias para la población española[5]	It is recommended to balance the calories in food and beverages with the energy consumed. Caloric intake should be limited to the energy needed to maintain (or gain) a healthy weight in adults and for adequate weight gain in children and adolescents.8 1A It is recommended to maintain an adequate caloric balance at every stage of life: childhood, adolescence, maturity, pregnancy, lactation, old age. 2B A healthy diet is based on vegetables, fruits, whole grains, grains and nuts, semi- / skimmed dairy products, chicken, fish, eggs, non-tropical vegetable oils, while limiting sodium, saturated fats, refined cereals, foods and sweetened beverages, red meat and processed meat.1, 8, 18, 19 1A In order to have a healthy diet, it is recommended to consume foods from all groups, in forms with a high nutritional content and in the recommended quantities; it is not necessary to eliminate food groups or follow a single diet; various food combinations can be made in a flexible way according to health needs, culinary preferences and cultural traditions.8, 18, 19 1A It is recommended to limit the consumption of foods containing refined cereals, especially refined cereals containing added solid fats, sugar and salt. 2B

| | | | 9. Choose foods that are low in salt and limit the use of
salt when preparing food and at the table.
10. Avoid foods and drinks that are high in sugar.
11. Choose water as a thirst-quencher.
12. Be physically active for at least 30 minutes each day
Look for the Keyhole when shopping for food.
Norwegian dietary guidelines. The Norwegian Directorate of Health.[11] | | It is recommended to replace refined cereals with whole grains so that at least half of the grains consumed are whole grains. 2B
In adults, 6 servings of cereal per 2000 calorie / day diet is recommended, of which at least half should be whole grains. In children and adolescents, it is recommended between 4 servings / day at 2-8 years and 7 servings per day in older adolescents. PP
It is recommended to eat a variety ("a rainbow") of fruits and vegetables daily, especially dark green and red / orange vegetables, as well as beans and peas. Second
In adults, it is recommended to consume every day at least 3 standard servings of vegetables and 2 fruits (optimally 5 standard servings of vegetables and 4 fruits). CONSENSUS
It is recommended to eat whole fruits, preferably raw; if 100% natural fruit juices are consumed, without added sugar, they will not exceed 100 mL / day. 2B
It is recommended to increase the consumption of skimmed or partially skimmed milk or dairy products (yogurt, cheese). 2B
In the population over 2 years of age, it is recommended to replace whole milk with skimmed or semi-skimmed milk (1%). 1It is recommended to eat a variety of protein foods: fish and seafood, eggs, peas, beans, lentils, soy, nuts and unsalted seeds, lean meat, chicken. PP
It is recommended to replace protein foods that contain solid fats with others that are low in fat and calories and / or that are sources of oils (fish and seafood, vegetables, grains, seeds and nuts). 1A
Fish is recommended at least 2 times a week, of which at least once fatty fish. 1B
It is recommended to limit the consumption of red and processed meat. 2B
It is recommended that most of the liquids consumed be water. PP
In children from the age of 2, the main drink is recommended to be skim milk. 1It is recommended to reduce the consumption of saturated fats in the diet by replacing them with unsaturated fats, respectively MUFA or especially PUFA. 1It is |

					recommended that saturated fats not exceed 10% of the caloric intake. 1A It is recommended to balance the calories in food and beverages with the energy consumed. Caloric intake should be limited to the energy required to maintain (or achieve) a healthy adult weight (BMI up to 25 kg / m2) and for adequate weight gain in children and adolescents. 1AI t is recommended to consume as little trans fat as possible, preferably not at all, from processed foods, and trans fats of natural origin to represent <1% of the daily caloric intake. 1,5,8,18,19,61,62 1A It is recommended to use non-tropical vegetable oils to replace solid fats. second It is recommended to reduce sodium intake in adults who would benefit from a reduction in blood pressure. 1It is recommended to reduce sodium intake below 2300 mg sodium / day (5 g salt). 2B It is recommended to reduce sugar consumption throughout life. WHO It is recommended that in adults and children, sugar consumption does not exceed 10% of energy intake. It is recommended to reduce or eliminate sugary drinks or caloric sweeteners.60 2B It is recommended to reduce the intake of calories from solid fats and added sugars.[6]
	UV exposure	Avoid excessive sun exposure • Seek shade • Avoid direct sun exposure in summer at midday • Use protective clothing outdoors (tops covering shoulders, bottoms covering knee, wide brim hats) • Wear sunglasses with UVB+UVA filter • Use sunscreen for uncovered skin areas • Correct use of sunscreen: use SPF>30, broad filter UVB+UVA, apply before sun exposure,	SunSmart guidelines Sun and solarium increase the risk of skin cancer, also when you do not get a sunburn. For best sun protection, combine the items below, and plan outdoor activities when the sun is not on its strongest. 1. Limit time in strong sun. The sun is strongest in the summer and in the middle of the day 2. Seek shade. Reflection from water, sand and snow make solar irradiance more intense, even in the shadow. 3. Use clothes, something on	Consult the local UV index via the media or using specific applications (e.g., UV-Derma, which is the app of the AEDV). • Gradual exposure to sunlight in order to facilitate adaptation of the skin and favour natural defence mechanisms (melanogenesis, epidermal thickening). Above all, exposure should be avoided during the middle of the day. • Taking advantage of shade. Staying in the shade can minimize direct exposure to sunlight. In fact, using one's own shadow as an	No different recommendations from European ones.

		reapply every 2 h or more often if bathing, transpiration, towelling; apply sufficient amount (2mg/cm2), do not use sunscreen to prolong time in the sun * Need to add advice for outdoors sports activities: e.g., plan outdoor activities outside the hours of strongest sun; seek shade; wear protective clothing and sunscreen etc. advice for swimming - apply sunscreen before swimming? advice for skiing; snow reflects UV and you can get sunburned on sunny winter days, especially at high altitudes. Use protective eyeglasses, sunscreen on uncovered areas of face, lips[7]	the head and sunglasses The clothes should cover as much skin as possible. A wide brimmed hat protects the face, ears and neck 4. Use generous amounts of sunscreen, SPF 30 or higher. Sunscreen alone does not give enough protection, it should be used with, and not instead of, shadow and clothes. Do not use sunscreen to extend time in the sun. Apply before going out, reapply every second hour and after bathing and sweating 5. Do not use solariums There is no safe lower limit.[12] https://kreftforeningen.no/forebygging/sol-solarium-og-hudkreft/	indicator of the incidence of solar radiation is easy: if the shadow is shorter than one's height, then it is time to look for shade. • Physical measures. Use materials that minimize the ''hole'' effect, such as knitted fabrics, and dark colors, technical sports fabrics, and products labelled with a high UV protection factor that cover most of the body surface. Use wide-brimmed caps and hats Use approved sunglasses (UV > 400 and categories 2, 3, and 4) Use beach umbrellas • Topical sunscreens whose SPF is high (SPF 30-50) or very high (SPF 50+). These should be applied generously some minutes before exposure and renewed as necessary. It is important not to forget to apply photoprotection on cloudy days.	
		Avoid sunbeds use	Do not use sunbeds/solariums. There is no safe lower limit		
		If consistent photoprotection supplement vit D through diet	A group of Norwegian experts have made a statement regarding sunbeds being carcinogenic and that sunbeds should not not be used as a source of vitamin D (in Norwegian): https://kreftforeningen.no/content/uploads/2022/01/solarium-er-kreftfremkallende-og-en-uegnet-kilde-til-vitamin-d.pdf		
Metabolic	Over-weight (High BMI)	Normal weight for adults aged 20 years and older: body mass index 18.5-24.9 kg/m^2 No common guidelines Many EU Member States have in place strategies and national guidelines for the primary prevention of	If you have overweight, but are in general good health, you don't need to lose weight, but you can avoid further weight gain by following the dietary advice and advice for physical activity. If you have at least one risk factor for cardiovascular disease in addition to overweight, e.g., diabetes type 2,	N/A	In order to detect overweight and obesity, it is recommended to determine the body mass index and the abdominal circumference of the waist. (Good Practice) Overweight and obese patients should be informed that cardiovascular risk and diabetes risk, as well as overall mortality, increase in proportion to the increase in BMI. 1It is recommended that the assessment of the cardiovascular risk of overweight and obese

		pre-obesity and obesity (EC 2018). Such strategies and guidelines include national dietary guidelines, physical activity guidelines, provision of information to the population through food and menu labelling, public awareness campaigns, and mobile apps, that empower the population to make healthier choices (EC 2018 , GBD 2015 , WHO 2007) (53). https://knowledge4policy.ec.europa.eu/health-promotion-knowledge-gateway/obesity_en	increased waist circumference, high cholesterol, high blood pressure, or sleep apnea, you should reduce your weight with 3-5%. A reduction of 5-10% will give even larger health improvements. Persons with obesity degree 2-3 (BMI of 35 or more) may need a larger weight reduction than 10-15% in order to achieve good health and increased quality of life https://www.helsenorge.no/kosthold-og-ernaring/overvekt/unnga-overvekt/		patients be considered to increase the risk estimated with the SCORE instrument. Newly diagnosed patients with overweight or obesity will be further addressed in the case management of people with CVD. In order to prevent CVD, according to the WHO, people with abdominal obesity will receive the following types of interventions:• for those with a waist ≥94 cm in men (but under 102 cm) and ≥80 cm (but under 88 cm) in women - support interventions to maintain weight;• for those with a waist ≥102 cm in men and ≥88 cm in women - support interventions for weight loss.[6] https://insp.gov.ro/download/cnepss/metodologii_ghirduri_recomandrari_si_evidente_stintifice/ghiduri_si_recomandari/Ghid-Volumul-3-web.pdf
	High Blood pressure	Williams B et al.; ESC Scientific Document Group. 2018 ESC/ESH Guidelines for the management of arterial hypertension. Eur Heart J. 2018 Sep 1;39(33):3021-3104. doi: 10.1093/eurheartj/ehy339. Erratum in: Eur Heart J. 2019 Feb 1;40(5):475. PMID: 30165516.	https://www.helsedirektoratet.no/retningslinjer/forebygging-av-hjerte-og-karsykdom Subjects with repeated blood pressure measurements > 140/90 mmHg should be investigated for precise blood pressure, other risk factors, and organ damage to decide need for treatment. Mild hypertension can be investigated over months, while serious hypertension >160/100 should be treated earlier		In all adults over 18 years of age, with no history of cardiovascular risk factors, at least one measurement of BP at 2 years is recommended. 1For the diagnosis of hypertension it is recommended at least two measurements of blood pressure in the office at a visit and confirmation in at least two other meetings. 1C.For the diagnosis of hypertension, it is recommended to measure blood pressure in the office. 1B. https://insp.gov.ro/download/cnepss/metodologii_ghirduri_recomandrari_si_evidente_stintifice/ghiduri_si_recomandari/Ghid-Volumul-3-web.pdf Romanian Ministry of Health and Romanian Society of Cardiology adopted ESC 2019 Guidelines for dyslipidemia
	High Plasma glucose		https://www.helsedirektoratet.no/retningslinjer/diabetes Diagnosis of diabetes: HbA1c ≥48 mmol/mol (≥6,5 %), or fasting glucose in plasma ≥7,0 mmol/L	The lifestyle and especially the diet, constitutes the substantive basis of treatment to improve glycemic and lipid control blood pressure and reduce high cardiovascular morbidity and mortality appears in people with DM2 https://www.fesemi.org/sites/default/files/documentos/varios/fin	. HbA1c ≥6.5% (48 mmol / mol) Or 2. Fasting blood glucose ≥126 mg / dl (7 mmol / l) or 3. Blood glucose at 2 hours (during TTGO) ≥200 mg / dl (11.1 mmol / l) Or 4. Occasional glycemia (in a patient with characteristic symptoms * of hyperglycaemia or hyperglycaemic crisis) ≥200 mg / dl (11.1 mmol / l) https://societate-diabet.ro/publicatii/ghid-de-management-al-diabetului-zaharat-editia-2021/

				al_trat_diet_diabetes_interactivo_v25_compressed.pdf	
	High blood cholesterol	Mach F et al; ESC Scientific Document Group. 2019 ESC/EAS Guidelines for the management of dyslipidaemias: lipid modification to reduce cardiovascular risk. Eur Heart J. 2020 Jan 1;41(1):111-188. doi: 10.1093/eurheartj/ehz455. Erratum in: Eur Heart J. 2020 Nov 21;41(44):4255. PMID: 31504418.	https://www.helsedirektoratet.no/retningslinjer/forebygging-av-hjerte-og-karsykdom	N/A	
Environme nt-al	UV index		The UV index is not yet implemented in the Norwegian guidelines for sun safety. It has been discussed but the consensus was that the UV index is still not easy to find and well known to the public. However, on the webpage for the guidelines, UV index is explained with relevant links. https://kreftforeningen.no/forebygging/sol-solarium-og-hudkreft/ Yr.no is likely the most used website in Norway for UV index	N/A	
	Particulate air matter		On this website, https://luftkvalitet.miljodirektoratet.no/, the pollution can find the current quality of the air at their location. The value for the individual's chosen location is given together with general advice to the population in general, for those with asthma/respiratory problems, coronary heart disease, older people and pregnant and children Maybe not relevant here, but I (MBV) also add this: Norway is among the European countries with the lowest risk of death	N/A	

			due to air pollution. https://www.regjeringen.no/no/tema/klima-og-miljo/forurensning/innsiktsartikler-forurensning/lokal-luftkvalitet/id2344384/ Airborne dust and NO2 are the most important factors, yearly concentrations in different geographic locations are found here https://miljostatus.miljodirektoratet.no/tema/forurensning/lokal-luftforurensning/ https://www.fhi.no/nettpub/hin/miljo/luftforureining--i-noreg/		
High risk of melanoma		UV protection recommendations as above **PLUS**: Check your own skin 1x/month Consult a dermatologist Have a complete skin check by your PCP or dermatologist at least 1x/year		

5 CONCLUSIONS

The current deliverable provides the proposal for the initial set of input and output variables for the development of WARIFA AI tool, in order for this to fulfil its aim of innovative personalized risk prediction and support for preventive behavior change in regard with the major, morbidity and mortality-causing chronic diseases and lifestyle-related risks.

It includes both variables whose connection with risk of disease is strongly confirmed through epidemiological studies, and emerging variables, for which the research in WARIFA could bring valuable new information regarding their role as potential additional risk factors, and their value as interesting candidates for further ample clinical and epidemiological studies of validation.

This information will be refined and supplemented in the next phases of research within WARIFA

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