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Abbreviations

CAPI	Computer-Assisted Personal Interview
EFSA	European Food Safety Authority
EMCDDA	European Monitoring Centre for Drugs and Drug Addiction
FAO	Food and Agriculture Organization of the United Nations
FCS	Food Consumption Survey
FFQ	Food frequency questionnaire
FPQ	Food propensity questionnaire
LPA	Low physical activity
NCDs	Non-communicable diseases
MVPA	Moderate-to-vigorous physical activity
PA	Physical activity
RIVM	Dutch National Institute for Public Health and the Environment
SB	Sedentary behaviour
TTP	Trusted third party
VPA	Vigorous physical activity
WHO	World Health Organization

1 GENERAL INFORMATION

1.1 Coordinates of sponsors

The Food Consumption Survey (FCS) is commissioned and co-financed by different Belgian authorities competent in the field of public health. The assignment to carry out the FCS in 2022 was determined in the framework of an Inter-ministerial Agreement between the Belgian Federal State and the Authorities (Regions and Communities) defined by the articles 128, 130 and 135 of the Constitution. The Inter-ministerial Agreement Protocol was concluded on November 5th, 2018. The signatories are:

For the Federal Government:

Maggie De Block
Minister of Social Affairs and Public Health

For the Flemish Community and Region:

Jo Vandeurzen
Flemish Minister of Well-being, Public Health and Family

For the Walloon Region:

Alda Gréoli
Minister of Social Action, Health, Equal Opportunities, Public Function and Administrative Simplification

For the Joint Community Commission of Brussels-Capital:

Didier Gosuin and Guy Vanhengel
Ministers responsible for Health Policy, Finances, Budget, Public Function, Heritage and External Relations

For the Joint Community Commission of Brussels-Capital:

Cécile Jodoigne
Minister responsible for Public Function and Health Policy

For the German Community:

Antonios Antoniadis
Minister of Family, Health and Social Affairs

All cabinets and administrations of the Ministries inclined in the organisation of the FCS 2022 are represented in a formal “Commission of Commissioners”. The Commission meets periodically – at least once a year or upon request – with the FCS project leader and coordinator to monitor the progression of the survey.

1.2 Team members

Project leader

Dr Nicolas Berger

Project coordinator

Dr Isabelle Moyersoen

Dieticians

Eline Le Dieu
Elien Van Campenhout

Scientific members (alphabetic)

Dr Karin De Ridder (Head of Service, MD PhD)
Dr Thérésa Lebacq
Dr Stefanie Vandevijvere

1.3 Subcontractors

A contract will be defined between Sciensano and a trusted third party (TTP). This TTP will be in charge of managing the data of the National Registry, i.e. drawing the samples and transferring the contact details of the selected individuals to the entity responsible for sending invitations, managing the interviewers, and the substitution process. This later process will either be performed by an administrative team of Sciensano (i.e. separated from the project team), or by an additional subcontractor, depending on the type of authorization received from the National Registry.

2 OBJECTIVE OF THE STUDY

2.1 Description of overall objective

The main objective of the Belgian Food Consumption Survey 2022 is to collect data on food consumption of the general Belgian population aged three years and older to gain insights into the consumption of food groups, the intake of energy and nutrients, the percentage of the population that meets the dietary recommendations, as well as associated social inequalities. Information collected will be useful at national and regional level, as well as for international instances such as the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO) and the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). In addition, because food consumption data were gathered in 2004 and 2014, the Food Consumption Survey (FCS) 2022 will also allow to monitor changes in dietary habits, and to assess the effectiveness of food policies and interventions. Collecting information on nutritional intake and dietary habits will support public and health policy makers in developing food recommendations and introducing effective policies to change dietary habits. Such information can also be used by the scientific community for in depth research activities.

2.2 Description of specific objectives

More specifically, the FCS 2022 will pursue the following **primary objectives**:

- To estimate the consumption of food groups, the intake of energy and nutrients (including supplements), and the percentage of the population meeting the dietary recommendations;
- To provide high-quality data for estimating exposure and risk assessment to contaminants, additives and other chemicals in food;
- To analyse the differences in food consumption by subgroups of the population;
- To estimate the contribution of food groups to the intake of energy and nutrients;
- To describe general food habits such as time, place of consumption or purchase of food and drinks consumed;
- To gain insight into trends in food consumption and dietary habits;

In addition, **secondary objectives** of the FCS 2022 will consist in:

- Assessing physical activity (PA) levels and sedentary behaviours (SB) in Belgian adults, adolescents and children older than three years;
- Estimating the proportion of underweight, overweight and obesity in the general population and by subgroup;
- Providing information on food literacy, attitudes towards food policies and perception of the food environment;
- Providing data to study the sustainability of diets;
- Helping to understand the relationship between nutrition and health.

3 SCIENTIFIC RELEVANCE

3.1 Scientific background

A healthy diet helps to prevent non-communicable diseases (NCDs) such as cardiovascular diseases, some cancers, diabetes type 2, and other conditions linked to obesity. Evidence shows the benefits of a diet with high consumption of fruits, vegetables, legumes, nuts and grains, but low consumption of salt, free sugars and fats, particularly saturated and trans fats (1). Moreover, a healthy diet should also be sustainable and include foods having no adverse effects on health due to the presence of micro-organisms, residues or contaminants (2).

Through the regular collection of food consumption data, food consumption surveys provide insights into a population's consumption of foods and into dietary changes. Combining these data with information on foods allows the intake of macro and micronutrients, the exposure to potentially harmful chemical or microbiological substances, and the environmental impact of the diet to be established. Furthermore, food consumption surveys provide information that is needed for scientific research on associations between nutrition and health.

In Belgium, the first national food consumption survey was conducted in 2004. Information on dietary intake was obtained from 3245 individuals aged 15 years and older (3). Based on the

results of this survey, efforts have been taken to improve the Belgian food pattern with programs such as the Belgian National Food and Health Plan (2005–2010). In 2014-2015, a second national food consumption survey was conducted in the Belgian population aged between three and 64 years (4). New food-based dietary guidelines were defined in 2019 for the adult population based on the results of the survey (5). Indicators of the FCS 2014 serve as a baseline for the "Gezondheidsdoelstellingen 2025" in the Flanders Community. The results of the FCS 2014 also urged other nutritional policy measures, e.g. school vending machines policies and the introduction of the Nutriscore. Since food consumption patterns are subject to changes, regular monitoring of food consumption through food consumption surveys is needed, which is why the third Belgian food consumption survey will be carried out in 2022.

3.2 Public health relevance

To prevent and control NCDs, there is a need to develop and implement effective nutrition and health policies together with nutrition education programmes addressing these modifiable risk factors. In this context, food consumption data are essential because they allow nutrition and food safety policies to be evaluated and developed. In addition, food consumption surveys provide useful information for scientific research in the field of nutrition and health (2).

4 METHODS

4.1 Study design

4.1.1 Study type

The Food Consumption Survey is a cross-sectional epidemiologic study carried out in the general population of Belgium, aged 3 years and older.

4.1.2 Study period

The fieldwork will be carried out between the 2nd of January 2022 and the 31st of December 2022.

4.1.3 Target population

The target population includes "all people aged 3 years and older residing in Belgium, regardless their place of birth, nationality or any other characteristic".

4.2 Sampling methodology

4.2.1 Sampling frame

The sampling frame will consist of all individuals listed in the National Register. *A priori* exclusion criteria will include: (i) people who are listed in the National Register without any physical address (mostly people living abroad, hence even not included in the target population); and (ii) people who are not listed in the National Register, like homeless and illegal immigrants.

For practical reasons, *a posteriori* exclusion will also apply to:

- people living in an institution (e.g. psychiatric institutions, homes for the elderly, nursing homes, psychiatric nursing homes), a religious community or cloister that shelter more than 8 persons, or a prison;
- people who moved out of the selected municipality;
- people hospitalized during the period of the survey;
- people who do not speak Dutch nor French (except for the sample in the German-speaking Community);
- people who recently died;
- people who are not able to be interviewed because of a physical or mental disability.

This exclusion process will take place *a posteriori*, when the interviewer will have identified that the selected person belongs to one of these categories. Persons who are temporarily away from home (e.g. on vacation or temporarily hospitalized) will be eligible for participation either by participating when they return home or by following them to their temporary address when possible.

4.2.2 Sample size

For the FCS 2022, three samples will be selected.

- The **main national sample** will include 3020 effective participants, divided as follows: 1660 in Flanders (i.e. 380 children aged 3-9 years, 380 adolescents aged 10-17 years, 260 adults aged 18-39 years, 260 adults aged 40-64 years, 380 adults aged 65 years and more), 200 in the Brussels-Capital Region (i.e. 40 persons in each age group), and 1160 in Wallonia (i.e. i.e. 260 children aged 3-9 years, 260 adolescents aged 10-17 years, 190 adults aged 18-39 years, 190 adults aged 40-64 years, 260 adults aged 65 years and more). In this main sample, two 24-hour dietary recalls will be conducted, together with the completion of a Food Propensity Questionnaire, questionnaires on food-related topics and anthropometric measurements.

- An **"extra"-sample** will be selected **in the Brussels-Capital Region**: this sample will include 1240 effective participants, among which 260 children aged 3-9 years, 260 adolescents aged 10-17 years, 230 adults aged 18-39 years, 230 adults aged 40-64 years, and 260 adults aged 65 years and more. Participants of this "extra"-sample will be asked to complete a comprehensive Food Frequency Questionnaire, as well as questionnaires on food-related topics and anthropometric measurements.

- A **sample** of 160 effective participants will have to be reached **in the German-speaking Community**: this sample will include 80 adults aged 18-39 years and 80 adults aged 40-64 years. These participants will be asked to complete a comprehensive Food Frequency Questionnaire, as well as questionnaires on food-related topics and anthropometric measurements.

Sample sizes, and repartitions by age group, have been decided together with the Commissioners and are fixed in the Agreement Protocol. The size of the main national sample is based on the minimal requirements set by the European Food Safety Authority (EFSA) (i.e. at least 260 participants – 130 males and 130 females – in each age group) (6),

and takes into account specific budget constraints and available logistic means. To be able to provide estimates at the level of the Brussels-Capital Region, this region will be oversampled. Due to financial and logistic constraints, however, only one interview – focusing on a Food Frequency Questionnaire – will be conducted in this sample. Similarly, to be able to provide estimates at the level of the adult German-speaking Community, a specific sample will be selected in East Belgium; this sample will be interviewed once by means of a Food Frequency Questionnaire and restricted to the adult population (18-64 years).

4.2.3 Sampling procedure

The sampling scheme which will be used in the context of the Food Consumption Survey will combine several techniques, i.e. stratification, multistage sampling and clustering. The sampling procedure will consist of four main steps: (1) the stratification by region; (2) the stratification by province; (3) the random selection of the municipalities (i.e. the primary sampling units, PSU); and (4) the random selection of individuals (i.e. the secondary sampling units, SSU).

4.2.3.1 Stratification by region

The number of interviews to be carried out in each Belgian region has been predetermined: 1660 for Flanders, 1160 for Wallonia, and 1440 (200 in the main sample and 1240 in the "extra"-sample) for Brussels-Capital. This stratification will allow regional comparisons. In addition, the number of interviews to be conducted in the German-speaking Community has been set to 160 adults.

4.2.3.2 Stratification by province

In order to achieve a balanced geographical spread, the target number of participants in Flanders and Wallonia will be stratified by province, proportionally to the population size of the provinces (based on the population – of all ages – at the 1st January 2020[1]) within each region. Because the Brussels-Capital Region is considered as a province in the sampling strategy, no provincial stratification will be performed in that region. In the German-speaking Community, the number of participants will be stratified by geographical region, i.e. North and South, according to their population sizes.

4.2.3.3 Selection of the municipalities

The numbers of interviews to be carried out in each Flemish and Walloon province, and in Brussels, will be divided into 50 to define the numbers of municipalities to be selected in each of these entities. Indeed, to facilitate the fieldwork, groups (i.e. clusters) of 50 individuals will be sampled in the selected municipalities. Municipalities will be selected using a systematic sampling procedure with a selection probability proportional to their size: this approach will ensure the selection of big cities, as well as small municipalities. Due to the small size of the German-speaking geographical area, this step was not conducted for the German-speaking sample.

[1] Eventually 2021 if available at the time of the sampling.

4.2.3.4 Selection of the individuals

One group of 50 individuals will be randomly selected within each sampled municipality (more than one cluster may be selected if the municipality is selected several times). For each cluster, the 50 individuals will be distributed as follow in the different age-gender groups, based on the final allocation which has to be reached in each sample:

- in Flanders and Wallonia: 5 or 6 persons of each gender in the age groups 3-9 years, 10-17 years, and 65 years and more, as well as 4 persons of each gender in the age groups 18-39 years and 40-64 years;
- in the Brussels-Capital Region: 5 persons of each gender in each age group (i.e. 3-9 years, 10-17 years, 18-39 years, 40-64 years, and 65 years and more);

The procedure is different in the German-speaking Community. In East Belgium, 40 adults aged 18-39 years old and 40 adults aged 40-64 years old will be selected both in the South and in the North of the Region (i.e. equal distribution).

4.2.3.5 Representativeness over seasons

To account for seasonality in food consumption, data collection will be spread throughout the year. The sampling procedure will be carried out every quarter so that each quarter is comparable in terms of number of selected units. The quarters are defined as follows: Q1: January-March; Q2: April-June; Q3: July-September and Q4: October-December. Samples will be drawn from the National Registry four times during the fieldwork phase, during the month preceding the start of each quarter. Individuals who are selected in a given quarter will be excluded from the sampling frame of the following quarters.

4.2.3.6 Substitution method

The sample sizes specified in Section 4.2.2 correspond to the total numbers of successful interviews needed at the end of the survey. However, all selected individuals will not necessarily participate in the survey. On the one hand, because the FCS is not a compulsory survey, some persons may refuse to participate. On the other hand, some selected persons could be non-eligible or not contactable, which will also contribute to non-participation. Therefore, a substitution method will be followed to reach the target sample sizes despite a certain percentage of non-participation.

In that process, for each “primary” individual selected, seven replacement persons with similar characteristics (i.e. sex, age group and municipality of residence) will be selected simultaneously, using a systematic sampling procedure. These eight individuals will constitute a “cluster” and will be numbered from one to eight. During the fieldwork, the individual number 1 will be first activated and contacted. If this person refuses to participate or is not contactable, the next replacement person will be activated and contacted. This procedure continues until a person is successfully interviewed.

4.3 Data collection procedures

Distinct data collection procedures will be followed for: (i) the main national sample of 3020 participants; and (ii) the “extra”-sample of Brussels and the sample of the German-speaking Community (total of 1400 participants).

4.3.1 Procedure for the main national sample

Two home visits will be planned for the participants of the main national sample, with an interval of one to four weeks between both visits (Figures 1 and 2). Proxy interviews, i.e. the interviews of a parent or caretaker, will be conducted for to obtain information on the children participating into the survey.

- **During the first interview**, a first 24-hour dietary recall will be conducted using the GloboDiet® software in adults and adolescents. In addition, a computer-assisted personal interview (CAPI) will be performed in all age groups (i.e. adults, adolescents and children) through an offline survey tool.

- **Between both home visits**, participants from all age groups will be asked to complete self-reported questionnaires, including questions on health and a Food Propensity Questionnaire (FPQ), through an online survey tool or a paper questionnaire. In addition, adolescents and children will be asked to wear an accelerometer seven consecutive days and to complete a non-wear activity diary. Parents or caretakers of children participating in the survey will also have to complete two non-consecutive one-day food diaries which will be followed by a GloboDiet® completion interview, by telephone for the first one.

- **During the second interview**, the second 24-hour dietary recall (in children: the GloboDiet® completion interview based on the second one-day food diary) and the second computer-assisted personal interview (CAPI) will be conducted. In addition, the weight, the height, the waist circumference, and the temperature of the fridge of the participants will be measured by the interviewer.

The interviewers collecting data for the main national sample of the FCS 2022 will have an extensive nutritional background (i.e., graduate dieticians or nutritionists). They will have to follow a three-day training about the recruitment and interviewing techniques, survey tools (GloboDiet® and LimeSurvey®), use of accelerometers, and measurement procedures for anthropometry and fridge temperature.

Figure 1 | Interview procedure in adolescents (10-17 years) and adults (18 + years), FCS 2022
* In adolescents only. CAPI: Computer-assisted personal interview. FPQ: Food propensity questionnaire. PA: Physical activity.

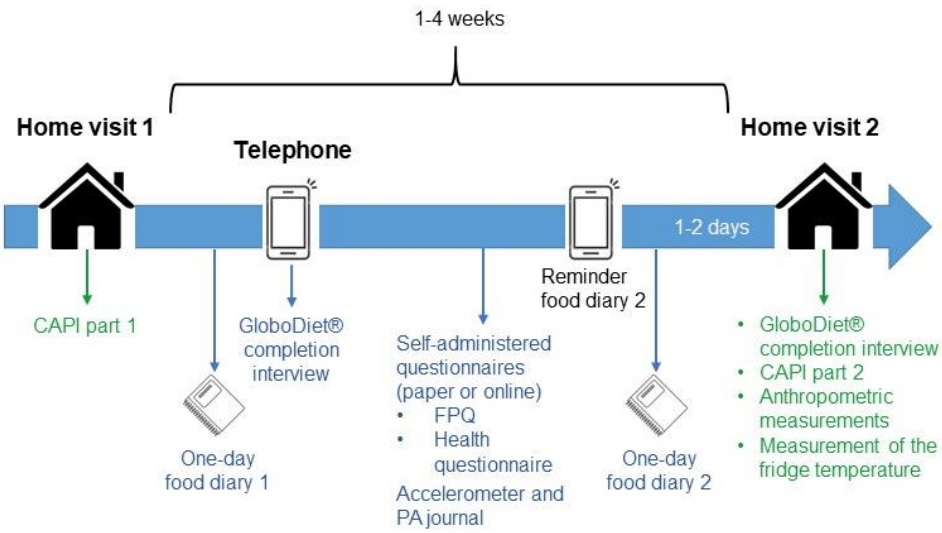

Figure 2 | Interview procedure in children (3-9 years), FCS 2022
CAPI: Computer-assisted personal interview. FPQ: Food propensity questionnaire. PA: Physical activity.

4.3.2 Procedure for the "extra"-sample of Brussels and the sample of the German-speaking Community

Only one interview will be performed in the "extra"-sample of Brussels and the sample of the German-speaking Community. During this unique home visit, the interviewer will perform a part of the CAPI, measure the height, weight and waist circumference, and ask the participant to complete a comprehensive Food Frequency Questionnaire (FFQ) (Figure 3). The interviewer will also ask the participant to complete, within two weeks, a self-administered questionnaire including some of the other questions asked in the CAPI to the main sample and the questions on health, on paper or using an online LimeSurvey® questionnaire. Participants opting for the paper questionnaires will be asked to send them by post to Sciensano using the stamped envelope which has been provided by the interviewer.

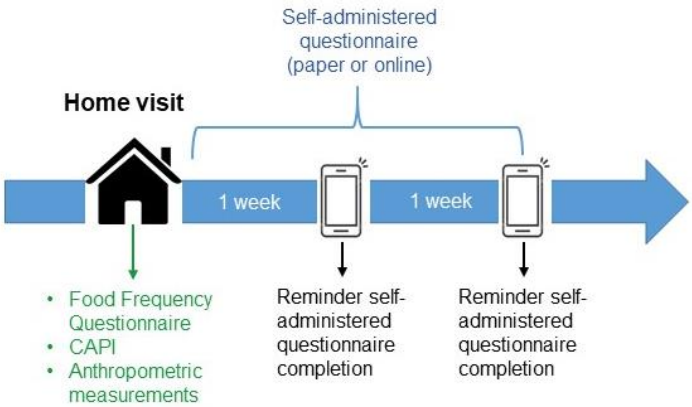

Figure 3 | Interview procedure in the "extra"-sample of Brussels and in the sample of the German-speaking Community, FCS 2022

The interviewers collecting data in these two samples will have to follow a one-day training about the recruitment and interviewing techniques (including the Food Frequency Questionnaire), survey tools (i.e. LimeSurvey®), and measurement procedures for anthropometry.

4.4 Instruments

Data collection in the FCS 2022 will take place using various standardized methods: (i) two non-consecutive 24-hour dietary recalls; (ii) a questionnaire administered in a face-to-face interview setting; (iii) a paper or online questionnaire handed out to participants for self-completion; (iv) the objective measurement of physical activity using accelerometers; (v) the anthropometric measurements; (vi) the measurement of the fridge temperature; and (vii) the sampling of non-invasive biological sample. Tables 1 and 2, at the end of this section, summarizes the topics examined within the FCS 2022, their modes of collection and the age groups concerned, for the main national sample and the "extra"-sample in Brussels and in the German Community respectively. All questionnaires are attached to the application.

4.4.1 24-hour dietary recalls

Food consumption data will be collected, in the main national sample, by performing two non-consecutive 24-hour dietary recalls using the GloboDiet® (previously EPIC-Soft) dietary assessment tool. The 24-hour dietary recall is a method widely used in national and international epidemiological and dietary monitoring surveys conducted in different target populations (children, adolescents and adults) (7). It consists of asking the participants to recall all food and drinks they have consumed in the last 24 hours. The use of this method, through strictly standardized procedures, is recommended in the EU MENU guidelines in order to provide comparable and reliable data at the European level (8).

GloboDiet® was developed by the International Agency for Research on Cancer (IARC) to conduct 24-hour recalls in the European Prospective Investigation into Cancer and Nutrition (EPIC) Study (9). This software is a menu-driven software enabling to conduct standardized interactive 24-hour recalls or to enter dietary records in a standardised way. It may be adapted to several languages and countries while keeping a high degree of standardization due to its structure including common files which are fixed across countries (except for the translation) and country-specific files which are adapted for each country according to a standardized structure (9).

The 24-hour recall interview performed with GloboDiet® is divided into five main steps: (1) the collection of general non-dietary information (i.e., name, ID-code, birthdate, gender, height and weight); (2) the creation of a chronological list of consumed foods and recipes (called "quick list"); (3) the description (e.g., cooking method, preservation method, packaging type, …) and quantification of consumed foods and recipes, including the use of a picture book, household measurements and food portions obtained from manufacturer's information; (4) a quality controls at the nutrient level; and (5) the collection of information on dietary supplement consumption.

While the above-described procedure will be used for the adults and the adolescents, food consumption data will be collected in children using two non-consecutive one-day food diaries administered by the parent / caretaker and followed by a GloboDiet® completion interview with the parent / caretaker: the first by telephone and the second face-to-face at the

respondent's home. The food diary is open-ended, i.e., without pre-coded food lists; it includes special pages for describing home-made recipes and supplement intake, examples on the way it has to be filled out and the telephone number of the responsible person of the survey. Food will be quantified with a picture book which was developed and validated in children of 0-10 years of age (10).

In addition, because 24-hour recalls inadequately measure the usual intake of episodically or periodically consumed foods, data on intake frequencies will also be collected in the main national sample, using a Food Propensity Questionnaire (FPQ) included in the self-administered questionnaire (see section 4.4.3). Such data will be used as covariate in supplementing 24-hour recalls when estimating usual intake of food groups (11,12).

4.4.2 Computer-assisted personal interviews (CAPI) with an offline survey tool

Several topics associated with food consumption will be investigated through computer-assisted personal interviews (CAPI) using an offline survey tool. The interviewers will read out the questions on screen to the respondent and enters the answers directly into the programme displayed on their laptop. For the children participating into the survey, the interviewers will call upon a "proxy interviewing" strategy: this means that the parent of caretaker of the child will respond on behalf of the selected participant. The topics examined using that method are specified in Tables 1 and 2.

Two CAPI interviews will be planned for each participant in the main national sample (Figures 1 and 2). In the "extra"-sample in Brussels and in the sample in the German-speaking Community, one CAPI interview will be conducted (Figure 3) and will mainly include a Food Frequency Questionnaire (FFQ) which has been developed within the FCS 2022 to collect food consumption data in those samples. It was constructed to capture the total dietary intake by asking the frequency of consumption, including portion sizes, of a finite list of food items. It will allow the food intake to be compared with dietary guidelines. The procedure of the questionnaire development is being documented in an internal report. The FFQ is being validated regarding its content (i.e., understanding of the questions and methods to estimate portion sizes) in a pre-test phase, and will be validated against 24-hour dietary recalls during the survey itself.

4.4.3 Self-administered questionnaire

Several topics will be investigated using a self-administered questionnaire, including the FPQ (Tables 1 and 2). Such a mode of data collection is used for two reasons: (i) to avoid social pressure and desirability which could occur when answering questions on sensitive topics, such as mental health, in a face-to-face context; and (ii) for practical reasons, to limit the duration of the face-to-face interviews while including all topics of interest in the study. The participants will have the choice between a paper or an online self-administered questionnaire. In the main national sample, paper questionnaires will be retrieved by the interviewer during the second visit (Figures 1 and 2), while they will be sent by post in the "extra"-sample in Brussels and in the German-speaking sample (Figure 3).

4.4.4 Objective measurement of physical activity using accelerometers

In order to promote physical activity in young people, it is crucial for governments and public health agencies to have a clear and up-to-date picture of the proportion of children and adolescents meeting guidelines for physical activity and sedentary behaviour. Therefore, as

in the previous FCS, the physical activity of children and adolescents will be measured objectively using accelerometers (13). Indeed, in younger populations, self-report questionnaires have shown poor reliability and validity due to recall bias and social desirability (14), and the absence of tool with both methodological quality and positive evidence ratings for reliability and validity (15).

In the main national sample, children and adolescents will be asked to wear a triaxial accelerometer GT3X+ Actigraph® **seven consecutive days including two weekend days during waking hours, except during water-based activities**. This accelerometer model (4.6 × 3.3 × 1.5 cm and 19 g) measures the accelerations caused by bodily movements in three axes: vertical, medio-lateral and anterior-posterior. The signal generated in response to movement is pre-processed to obtain activity counts, i.e. accelerations due to body movement. These activity counts are accumulated and stored over user-defined time intervals, called epoch lengths. Intensity thresholds may then be used to classify activity counts and assess the amount and intensity of daily physical activity (14).

In addition to wearing accelerometers, the participants will be instructed to fill in **non-wear activity diaries** to register all activities during which the accelerometer was removed (except for sleeping during the night), as well as their wake-up and bed- times. Online (LimeSurvey®) and paper versions will be available, up to the participant's (or parents for children) choice. These diaries will be used to associate the activities performed when the accelerometer was not worn to their corresponding energy expenditure in MET, to classify these activities according to their associated level of physical activity (sedentary, LPA, MPA, VPA), and to complete the accelerometer data with the time spent in these different levels.

4.4.5 Anthropometric measurements

Measured anthropometric data (i.e., height and weight) will be collected to calculate the Body Mass Index (BMI, i.e., weight in kilograms divided by the square of height in meters) of the participants, and assess the prevalence of underweight, overweight and obesity in Belgian adults, adolescents and children, using appropriate cut-off values. Further, waist circumference will be measured to provide an indicator of abdominal adiposity.

Overweight and obesity are major risk factors for the development of several chronic diseases (e.g., cardiovascular diseases, diabetes, musculoskeletal disorders and some cancers) (16), and reach high proportions in our country. In 2014, 29% of the 3-64 years-old population were overweight and 16% were obese (17). This is therefore crucial to monitor the prevalence of overweight and obesity in children, adolescents and adults. In addition, having such data available, together with information on food consumption, level of physical activity, health indicators and sociodemographic data, will allow associated factors and determinants to be identified.

Anthropometrics will be measured rather than self-reported. Indeed, under- and over-estimation may occur when such data are self-reported. Specifically, people tend to underestimate their weight and overestimate their height, thereby leading to an underestimation of the overweight and obesity prevalence (18–20). In addition, this self-report bias is greater in overweight and obese individuals than those of normal weight (20), and varies between countries, males and females, and age groups (19). With globally rising obesity rates, accurate and reliable estimation is essential for developing effective public health prevention policies (20).

Height, weight and waist circumference will be measured by trained interviewers using standardized procedures and devices. The measurement protocol is described in details in the interviewer manual. They will be measured to the nearest half centimetre or the nearest half kilogram. During the measures, the participants will wear light clothes, no shoes, jacket, nor outdoor garment. The height will be measured with a portable stadiometer including a bottom platform, a vertical backboard and a moveable headboard; the weight with an electronic weighing scale; and the waist circumference using a non-stretchable measuring tape. These measures will be introduced in the offline survey tool used for the CAPI.

4.4.6 Measurement of the fridge temperature

Because the temperature of the refrigerator is an indicator of potential risk of food toxi-infection, it will be measured by the interviewer in each participant household using a thermometer type TFA Digital Indoor-Outdoor – Dorstman.

4.4.7 Measurement of biomarkers

Biomarkers will be obtained in a subsample of the main national sample, selected on a voluntary basis, following the 1st home visit. Interviewers will give participants instructions on the procedure to follow to self-collect non-invasive biological samples (saliva, faeces, drop blood). Participants will send the samples to Sciensano or a partner laboratory by post, using pre-stamped envelopes. Biomarker data collection procedure will be part of an additional project which will require additional consent from the participants. It will provide an objective measurement of the intake of some nutrients, such as vitamins B1 and D. The full list of samples and elements which will be analysed is, however, not yet definite at this stage.

Table 1 | Topics included in the questionnaire addressed to <u>the main national sample</u>, with modes of data collection and age groups concerned

Modules	Mode of collection			Age group			
	CAPI*	Self-administered	Measure	Children	Adolescents	Adults	Older adults
Background information							
Information on the participant and his/her household	X			X[1]	X	X	X
Occupation	X			X[1]	X[1]	X	X
Education	X			X[1]	X[1]	X	X
Income	X			X[1]	X	X	X
Food security	X			X[1]	X	X	X
Breastfeeding/pregnancy	X			X[1]	X	X	
Smoking		X		X[1]	X	X	X
Tooth decay	X						X
Food consumption							
24h dietary recalls	X[2]			X	X	X	X
FPQ**		X		X	X	X	X

*CAPI = Computer-assisted personal interview. **FPQ = Food Propensity Questionnaire (the questions on food supplements will be in the CAPI). [1] Parental. [2] With the GloboDiet® software.

Table 1 (continued) |Topics included in the questionnaire addressed to the main national sample, with modes of data collection and age groups concerned

Modules	Mode of collection			Age group			
	CAPI*	Self-administered	Measure	Children	Adolescents	Adults	Older adults
Eating habits and food environment							
Regularity of meals	X			X	X	X	X
Involvement in meal preparation	X			X	X		
Screen watching while eating	X			X	X	X	X
Family meals	X			X	X	X	X
Home environment	X			X			
Food litteracy	X					X	X
Perceived food environment	X					X	X
Use of apps for food shopping	X					X	X
Influence of labels and Nutriscore	X					X	X
Marketing to children	X			X			
Diet and weight management							
Attitude towards weight		X			X	X	X
Means of weight management		X			X	X	X
Weight management motivations		X			X	X	X
Eating disorders and under-nutrition							
SCOFF		X			X	X	
Eating attitude test 7		X			X		
Mini Nutritional Assessment Short form		X					X
Attitudes towards food policies							
Actions expected from the government	X					X	X

*CAPI = Computer-assisted personal interview. **FPQ = Food Propensity Questionnaire (the questions on food supplements will be in the CAPI). [1] Parental. [2] With the GloboDiet® software.

Table 1 (continued) |Topics included in the questionnaire addressed to <u>the main national sample</u>, with modes of data collection and age groups concerned

Modules	Mode of collection			Age group			
	CAPI*	Self-administered	Measure	Children	Adolescents	Adults	Older adults
Physical activity (PA) and sedentary behaviors (SB)							
Accelerometers			X	X	X		
Self-reported PA	X			X	X	X	X
Context around the practice of PA	X			X	X	X	X
Self-reported SB	X			X	X	X	X
Context around the practice of SB	X			X	X	X	X
Anthropometry							
Height	X[2]		X	X	X	X	X
Weight	X[2]		X	X	X	X	X
Waist circumference			X	X	X	X	X
Health status							
Minimum European Health Module		X		X	X	X	X
Diagnosed with a condition (e.g. diabetes, allergy)		X		X	X	X	X
Mental Health: Hopkins Symptom Checklist-5		X			X	X	X
Special diet	X[2]			X	X	X	X
Food safety							
Home cooking practices	X			Person responsible for food preparation in the household			
Food safety behaviours	X			Person responsible for food preparation in the household			
Fridge temperature			X	X	X	X	X
Biomarkers			X	X	X	X	X

*CAPI = Computer-assisted personal interview. **FPQ = Food Propensity Questionnaire (the questions on food supplements will be in the CAPI). [1] Parental. [2] With the GloboDiet® software.

Table 2 | Topics included in the questionnaire addressed to the "extra"-sample in Brussels and the sample in the German-speaking Community, with modes of data collection and age groups concerned

Modules	Mode of collection			Age group			
	CAPI*	Self-administered	Measure	Children	Adolescents	Adults	Older adults
Background information							
Information on the participant and his/her household	X			X[1]	X	X	X
Occupation	X			X[1]	X[1]	X	X
Education	X			X[1]	X[1]	X	X
Income	X			X[1]	X	X	X
Food security	X			X[1]	X	X	X
Breastfeeding/pregnancy	X			X[1]	X	X	
Smoking		X		X[1]	X	X	X
Tooth decay	X						X
Food consumption							
FFQ**	X			X	X	X	X
Eating habits and food environment							
Regularity of meals	X			X	X	X	X
Involvement in meal preparation	X			X	X		
Screen watching while eating	X			X	X	X	X
Family meals	X			X	X	X	X
Home environment	X			X			
Food litteracy	X					X	X
Perceived food environment	X					X	X
Use of apps for food shopping	X					X	X
Influence of labels and Nutriscore	X					X	X
Marketing to children	X			X			
Diet and weight management							
Attitude towards weight		X			X	X	X
Means of weight management		X			X	X	X
Weight management motivations		X			X	X	X

*CAPI = Computer-assisted personal interview. ** FFQ = Food Frequency Questionnaire. [1] Parental.

In the "extra"-sample of Brussels and in the German-speaking sample, the list of the topics investigated and associated modes of collection are not yet finally determined; some of the topics listed here could be dropped.

Table 2 (continued) | Topics included in the questionnaire addressed to the "extra"-sample in Brussels and the sample in the German-speaking Community, with modes of data collection and age groups concerned

Modules	Mode of collection			Age group			
	CAPI*	Self-administered	Measure	Children	Adolescents	Adults	Older adults
Eating disorders and under-nutrition							
SCOFF		X			X	X	
Eating attitude test 7		X			X		
Mini Nutritional Assessment Short form		X					X
Attitudes towards food policies							
Actions expected from the government		X				X	X
Physical activity (PA) and sedentary behaviors (SB)							
Self-reported PA		X		X	X	X	X
Context around the practice of PA		X		X	X	X	X
Self-reported SB		X		X	X	X	X
Context around the practice of SB		X		X	X	X	X
Anthropometry							
Height			X	X	X	X	X
Weight			X	X	X	X	X
Waist circumference			X	X	X	X	X
Health status							
Minimum European Health Module		X		X	X	X	X
Diagnosed with a condition (e.g. diabetes, allergy)		X		X	X	X	X
Mental Health: Hopkins Symptom Checklist-5		X			X	X	X
Special diet		X		X	X	X	X

*CAPI = Computer-assisted personal interview. ** FFQ = Food Frequency Questionnaire. [1] Parental.

In the "extra"-sample of Brussels and in the German-speaking sample, the list of the topics investigated and associated modes of collection are not yet finally determined; some of the topics listed here could be dropped.

The FCS 2022 database will be linked, in the context of future projects, to collateral health and administrative data sources (e.g. the AIM/IMA records and the National Register). Such linkage projects will have protocols of their own. In addition, participants who have agreed could be recontacted later, after the survey, for some follow-up studies.

4.5 Data flow

An overview of the data flow within the FCS 2022 is provided in Figure 4. It includes several steps: (i) the flow of personal data from the National Registry to the interviewers; (ii) the fieldwork procedures and monitoring; (iii) the transfer of the data collected from the interviewers to Sciensano; (iv) the creation and cleaning of the working databases. These four steps are further described in the following sections.

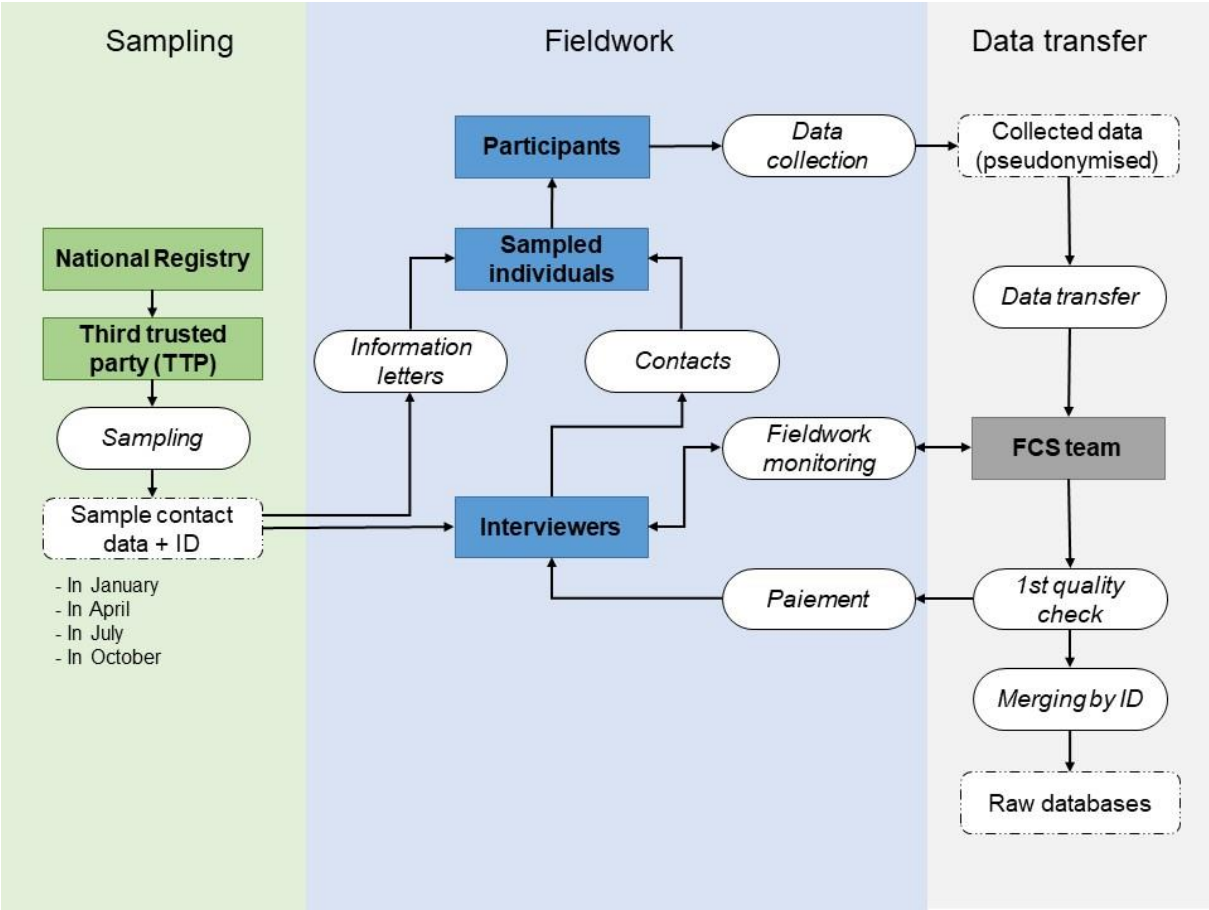

Figure 4 | Data flow within the FCS 2022

4.5.1 Personal data from the National Registry

The National Registry will provide the trusted third party (TTP) the data needed for the sampling. The sampling itself will be performed by the TTP based on the SAS codes provided by the FCS team. The output file will include the personal data of the selected persons, i.e., their National Registry number, name, first name, address, gender and birthdate. An nine-digit identifier (ID-code) will be assigned to each selected individual (Figure 5). The “key dataset” comprising both the ID-code and the individual National Registry number will be kept by the TTP.

In the first step of data collection, invitation letters and brochures will be sent monthly by post by the TTP to the selected individuals (or the parent / caretaker for the children). The letter will include a link to an online form in which the selected persons will be able to provide his/her contact details. Interviewers will then have access, through a secured Internet connection, to the personal data from the National Registry to contact the selected individuals and carry out the interviews. If selected individuals are not eligible, not

contactable or refused to participate in the survey, the contact information of the next replacement individuals will be sent to the interviewer by the TTP.

During the fieldwork and data entry, only the ID-codes will be used; no personal identifiers will be included in the FCS databases. These processes of sampling and participant recruitment will be repeated four times during the year of the survey (in December 2021-Mars 2022, Mars 2022-June 2022, June 2022-September 2022, September 2022-December 2022) to have interviews spread over the four seasons.

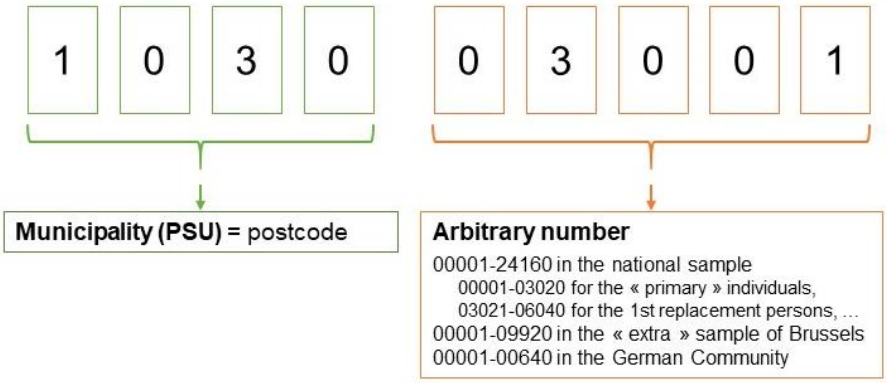

Figure 5 | Creation of the ID-code

4.5.2 Fieldwork monitoring

As mentioned above, the TTP will communicate the contact details and ID-codes of the selected persons to the interviewers. Interviewers will then contact these people (preferably by performing a house visit) and, if they agree to participate in the survey, make an appointment for a first home visit and start the data collection.

The FCS team will monitor the fieldwork through a secured Internet-based application. The interviewers will be instructed to register, using an online form, every contact attempt with each individual (date, time of the day, mode of contact and result) using participant ID-codes. Based on this information, the status of the participants will be determined. Possible status are the following:

- not yet contacted (i.e. the starting point);
- in contact (i.e. once one contact attempt has been registered);
- refusal interview 1;
- refusal interview 2;
- not contactable (i.e. when three unsuccessful contact attempts fulfilling the criteria – see below – have been registered);
- not eligible (i.e. the selected individual does not speak national languages nor English, lives in an institution, elderly home, nursing home, prison, or community, resides abroad or moved out the municipality, has a physical or mental disability, is hospitalized or died);
- first appointment planned;

- first home visit done (including details on the questionnaires and measures completed);
- second appointment planned;
- second visit home done (including details on the questionnaires and measures completed).

A person is considered as not contactable after he or she has been contacted three times, with at least one house visit, two contact attempts during the weekend, and two contact attempts during the week outside the working hours. If a selected individual is not eligible, not contactable or refused to participate in the survey, the contact information of the next replacement individual will be sent to the interviewer by the TTP.

Summary tables and figures of the interviews conducted by region, province, season and interviewer will be available in the application to see the progress of the fieldwork, the participation rates, the distribution of the interviews between days of the week, … In case of problems (e.g., slow progress), the interviewers will be contacted by the FCS team to try finding a solution. Feedbacks about the progress of the fieldwork will be provided to the interviewers about once a month through a newsletter with the main advances.

4.5.3 Transfer of the data collected to Sciensano

Different methods will be used to transfer the data collected during the fieldwork to Sciensano These are specified separately for the main national sample (Figure 6), and the "extra"-sample of the Brussels-Capital Region and in the German-speaking community (Figure 7).

In the national sample (Figure 6):

- The food consumption data collected using GloboDiet® (in format *.bak* and *.xml*) will be exported from the interviewer's devices to the secured server of Sciensano via a software developed by the ICT department of Sciensano and using a secured Internet connection. This transfer will be performed every fieldwork day.
- The data collected using CAPI with OfflineSurvey® will be saved automatically – once the interviewers have access to an Internet connection – on the secured server of Sciensano.
- The data collected through self-questionnaires using LimeSurvey® (LimeSurvey Community Edition) will be saved automatically on the secured server of Sciensano.
- The paper self-questionnaires, completed by the participants between the two home visits, will be retrieved by the interviewers at the second home visit. The interviewers will send by post those questionnaires at least once a month to Sciensano. The questionnaires will be stored in the FCS office in a locked cupboard until they are scanned or entered manually.
- The data registered by the accelerometers in children and adolescents will be downloaded by the interviewers on the laptop provided by Sciensano (in format *.agd*) and exported to the secured server of Sciensano via a secured software (File Transfer Protocol, FTP) developed by the ICT department of Sciensano. This transfer will be performed after each seven-day registration period.

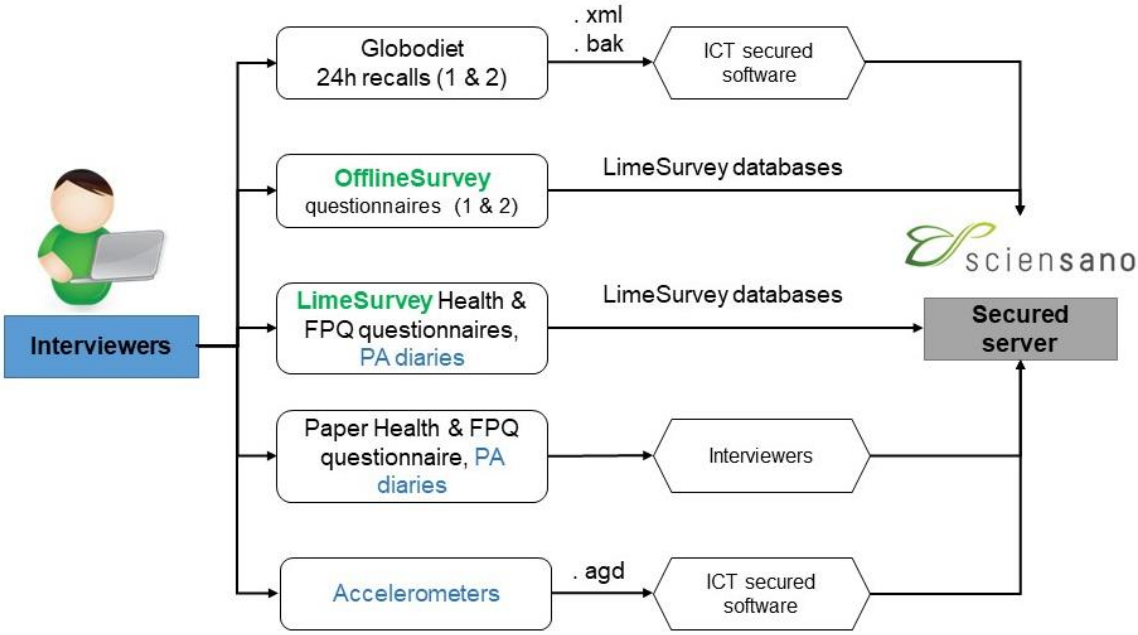

Figure 6 | Transfer of the data collected within the FCS 2022 to Sciensano
Accelerometers and physical activity (PA) diaries will be used in children and adolescents only.

In the "extra"-sample of the Brussels-Capital Region and in the German-speaking community, the data collected using CAPI with OfflineSurvey® and using self-administered questionnaires with LimeSurvey® will be saved automatically on the secured server of Sciensano. Given than only one interview per participant will be conducted in both regions, the paper self-administered questionnaires will be returned by post by the participants to Sciensano using pre-stamped envelopes provided during the interview (Figure 7).

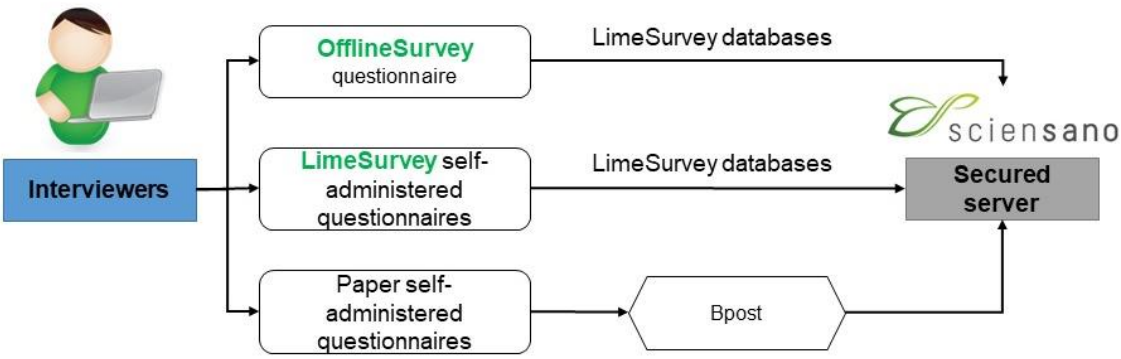

Figure 7 | Transfer of the data collected in the Brussels-Capital Region and the German-speaking Community within the FCS 2022 to Sciensano

4.5.4 Creation and cleaning of the databases

4.5.4.1 Food consumption database

Food consumption data exported from GloboDiet® and saved on the secured server of Sciensano are *.bak* and *.xml* files. The first are back-up files, while the second contain the data of the 24-hour dietary recalls which will be used to create the food consumption database. The management of these .xml files will include several steps, summarized in Figure 8.

Interviewers will export the 24-hour recall data in *.xml* format once every fieldwork day. As the *.xml* files are exported, they will be automatically appended and grouped by month, separately for the Dutch and French interviews. These "monthly" *.xml* files will then be reimported in GloboDiet® by the FCS team who will implement an extensive cleaning process. After the cleaning of all the Dutch and French "monthly" *.xml* files, these files will be appended using SAS® to provide the global database with all the 24-hour recall data (Figure 8).

The next step will consist in linking, in SAS®, this database with the food composition tables to provide data on energy, macro- and micronutrient intake. Finally, the database will be merged with the data of consumption frequency, originated from the FPQ, by means of the ID-codes (Figure 8).

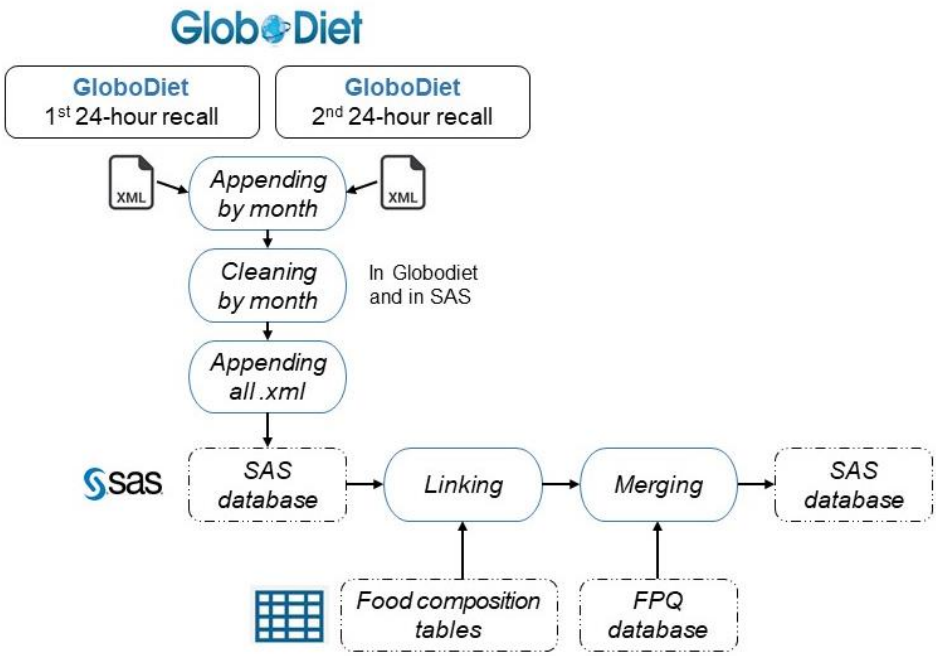

Figure 8 | Management of 24-hour recall data and creation of the food consumption database.

4.5.4.2 Accelerometer database

The database will be composed of accelerometer data and self-completed activity diaries. Accelerometer data will be downloaded and transferred, processed using the ActiLife® software to calculate activity counts, converted in *.csv* files, exported in SAS®, appended and finally processed (i.e. identification of non-wear time and data scoring) to provide a first

database (Figure 9). Because non-wear activity diaries might be completed using either LimeSurvey® or a paper-form, two types of data management will occur in parallel. Data collected using online diaries will be directly exported from LimeSurvey® as *.csv* databases and exported in SAS®, while data collected using paper diaries will need to be entered manually before being exported in SAS® and appended with the online data (Figure 9). Both kind of data will be appended before to be merged with the accelerometer data based on the ID-codes (Figure 9). This final database will be linked to the fieldwork monitoring database through the ID-code to perform vertical (e.g., presence of duplicates, errors in ID-codes, …) and horizontal consistency checks (e.g., inconsistencies between variables, …).

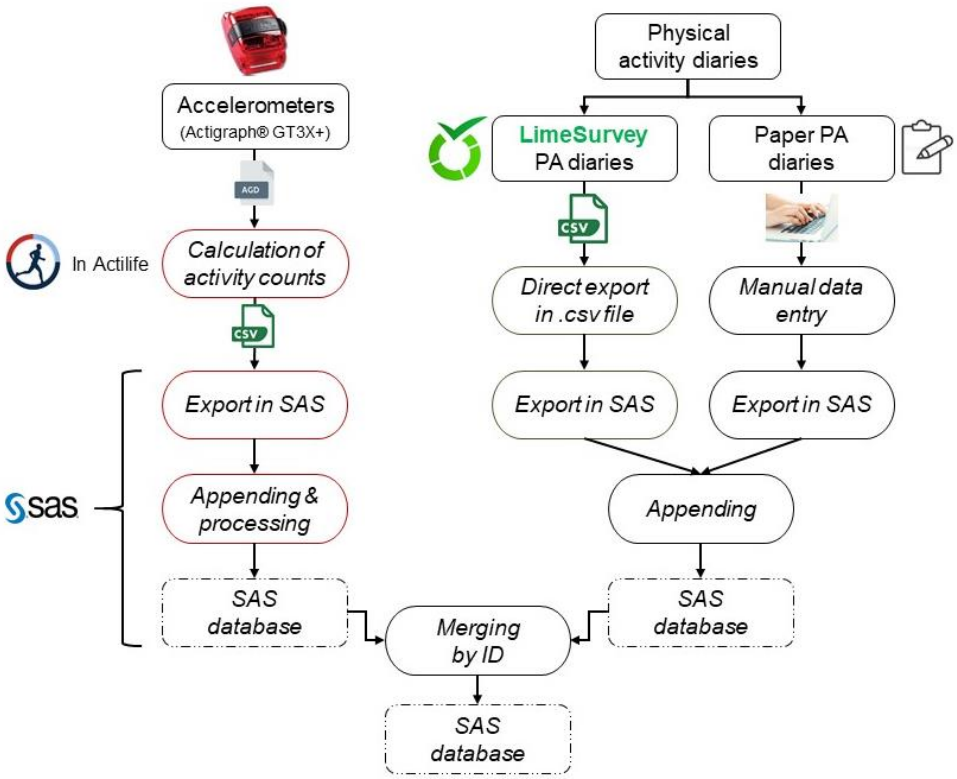

Figure 9 | Management of data collected using accelerometers and non-wear activity diaries.

4.5.4.3 Database including data collected using CAPI or self-reported questionnaires

Data collected using CAPI (1st or 2nd interview) or online self-administered questionnaire (such as Health questionnaire or FPQ) will be directly exported, from LimeSurvey® and OfflineSurvey® respectively, as *.csv* databases (Figure 10). Paper self-administered questionnaires will be scanned and automatically encoded to provide *.csv* databases (Figure 10).

In the main national sample, a database called "CAPI database" will be obtained by merging the two databases containing data from the 1st and 2nd interview days, through the ID-codes (Figure 10). A second database called "Health database" will be obtained by appending the health data collected with paper questionnaires and those collected with online questionnaires. A third "FPQ database" will be created by appending the data of consumption frequency collected with paper questionnaires and those collected with online questionnaires (Figure 10).

These three (CAPI, Health and FPQ) final databases will be linked to the fieldwork monitoring database through the ID-codes to perform vertical (e.g., presence of duplicates, errors in ID-codes, …) and horizontal consistency checks (e.g., inconsistencies between variables, …). At the end of this process, accelerometer, CAPI and Health databases will be merged based on the ID-codes to provide the "general database" with all the data except those collected with GloboDiet® and the FPQ. The latter data will constitute the food consumption database, which will be kept separate to follow a specific analysis process.

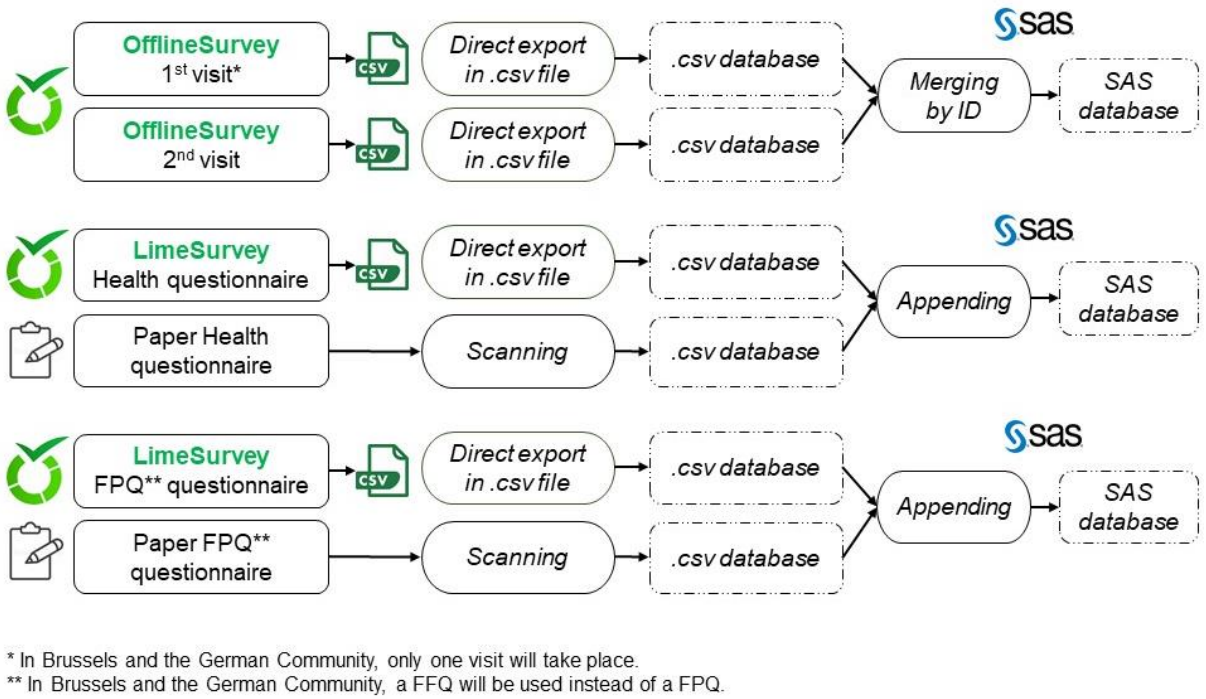

Figure 9 | Management of data collected using CAPI or self-reported questionnaires in the main national sample

In the "extra"-sample of Brussels and in the German-speaking Community, this process will be simplified given that only one home visit will be conducted (Figure 10). Databases from CAPI and self-administered questionnaires will be merged afterwards based on the ID-codes to provide the final database.

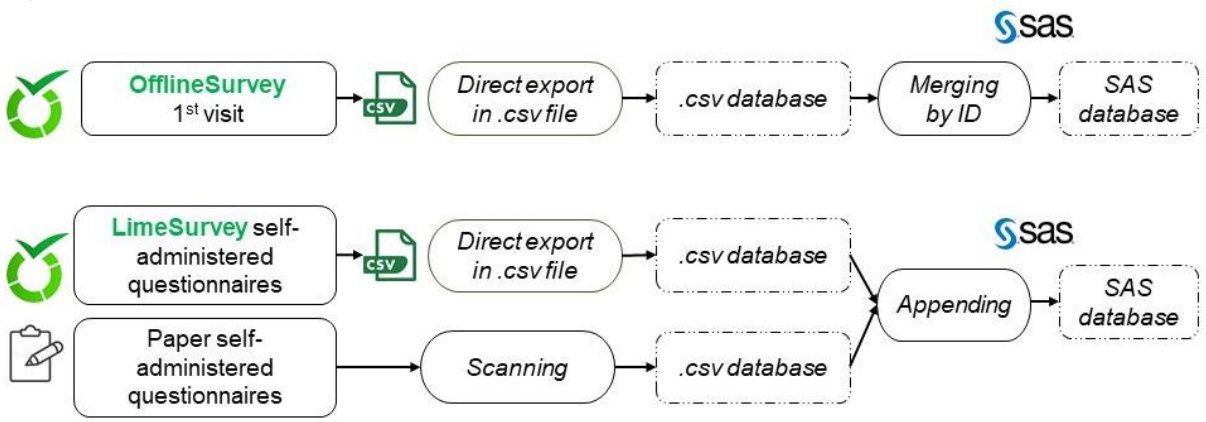

Figure 10 | Management of data collected using CAPI or self-administered questionnaires in the "extra"-sample of the Brussels-Capital Region and in the sample of the German-speaking Community

4.6 Data analysis

This section describes how the data collected will be analyzed, i.e., the preparatory steps, indicators developed, analyses conducted, software used, and methods used for the treatment of missing values.

4.6.1 Preparatory steps

Several preparatory steps are needed before analysing the data. Firstly, individual weighting factors will be computed for each participant in order to provide results that are representative of the Belgian population aged three years old and more. These weighting factors will be computed by taking into account the distribution of the sample according to the province, sex, and age, in comparison with the distribution of the Belgian population (the reference population) in these strata. The computation method will also take into account the daily and seasonal allocation of the interviews to eliminate the influence of daily and seasonal variations. The individual weighting factors will be integrated in the databases to conduct weighted analyses and provide representative results. Secondly, socio-demographic indicators (e.g., gender, age group, region, education level, household size and type) will be developed to provide background information. They will be integrated in the databases to allow stratified analyses.

4.6.2 Analysis of the food consumption data

The objectives of analysing food consumption data are: (1) to estimate the usual intake (i.e., the long-term average daily intake) of foods and nutrients within the Belgian population aged three years old and more; (2) to estimate the percentage of the population respecting the national food-based dietary guidelines; (3) to study the contribution of the different food groups to the intake of energy, macro- and micronutrients.

4.6.2.1 In the main national sample

In the main national sample, food consumption data will aim to: (1) estimate the usual intake (i.e., the long-term average daily intake) of foods and nutrients within the Belgian population aged three years old and more; (2) estimate the percentage of the population respecting the national food-based dietary guidelines; (3) study the contribution of the different food groups to the intake of energy, macro- and micronutrients. To this end, data from the 24-hour recall will be analysed together with those from the FPQ using statistical modelling methods implemented with the R package SPADE® (« Statistical Program to Assess Dietary Exposure »), developed by the RIVM ***(21)***. Detailed information on SPADE may be found on the RIVM website https://www.rivm.nl/en/spade. For each food groups (e.g., the vegetables), macro- and micronutrients, the usual intake will be estimated in the most relevant unit, based on the data originated from the two non-consecutive 24-hour recall and the FPQ (for the food groups). These habitual intake distributions will then be compared to the dietary guidelines defined by the "Active food triangle" (https://www.gezondleven.be) and the Superior Health Council (5).

4.6.2.2 In Brussels ("extra"-sample) and the German-speaking Community

The main purpose of the FFQ – which will be used in the "extra"-sample of Brussels and the German-speaking community – is to evaluate the dietary patterns of these populations against the food-based dietary guidelines. Therefore, the FFQ data, frequencies and portions

sizes – will be used to compute individual intake for the main food groups and compare these against the dietary guidelines defined by the "Active food triangle" (https://www.gezondleven.be) and the Superior Health Council (5).

4.6.3 Analysis of the general database

Data analysis will start with data cleaning and the construction of derived variables called "indicators". In some cases, indicators are just copies of initial variables (after cleaning) while in other cases, they result from the recoding and/or combination of several variables. For each module (i.e., each topic), the cleaning and creation of the indicators will be performed in separate SAS® programmes and resulting data will be saved in separate specific SAS® datasets.

SAS® macros will be used to analyse automatically the indicators included in these datasets and compute:

- for categorical or binary indicators, crude and adjusted percentages, at the level of the global population as well as by sex, age group, socioeconomic level, region, and year of the survey;
- for continuous indicators, crude means, medians and quartiles, and adjusted means, at the level of the global population as well as by gender, age group, socioeconomic level, region, and year of the survey.

When relevant, multivariable regression models will be used to analyse associations between the variables of interest and other variables (e.g., the socioeconomic status) while taking confounders into account.

4.7 Quality assurance

Quality assurance measures have been put into place with respect to the material and procedure used for data collection (software, scales, stadiometers, …) (see section 4.4), the monitoring of the fieldwork (see section 4.5.2), the qualification and training of the interviewers (section 4.7.1) and the correct implementation of the procedures (section 4.7.2).

4.7.1 Recruitment and training of the interviewers

Interviewers collecting data with the 24-hour recall tool GloboDiet® (i..e. in the main national sample) will need to have an extensive nutritional background (i.e., graduate dieticians or nutritionists). They will in particular be recruited by contacting both regional dietetic associations ("Vlaamse Beroepsvereniging van Diëtisten" VBVD, and "Union professionnelle des Diététiciens de Langue française" UPDLF) and schools of dietetics. In addition to their education in dietetics, they will need an independent status and be available in the evening and during the week-end.

All interviewers involved in the fieldwork will have to follow a collective training organised by Sciensano. This training will cover: (1) the use of the GloboDiet® software (or FFQ principles) and offline survey tools; (2) the outlines of the survey, i.e., the content of the questionnaires, the procedures to contact the selected persons, conduct the interviews, and transfer the collected data, and the importance of compliance; (3) the collection of objective

measurements[2] (anthropometric measurements, physical activity, and temperature of the fridge). The interviewers will receive a manual which describes their tasks in regard to the different parts of the survey.

4.7.2 Monitoring of the interviewers

To ensure quality of the data collected, the fieldwork will be monitored using a secured internet-based application. This will allow to monitor day by day the number of interviews conducted, to identify the interviewers for which the work is not progressing as expected and to monitor the participation rate. In addition, the correct implementation of the procedures will be verified via random controls taking place once a trimester based on semi-structured questionnaires addressed to the participants.

5 COMMUNICATION OF THE RESULTS

5.1 Reporting mechanism and website

The main results of the FCS 2022 will be communicated to the commissioners, the stakeholders and the public via several descriptive reports, among which the first ones will be published in 2023. All reports will be published by July 2024. In addition, the current website of the FCS will be rearranged by updating the information provided and modifying the design, layout and structure. Interactive options will be added to the website, e.g. by emphasising graphical visualisation and allowing the users to specify and export the results needed. Metadata and procedures to access the data will also be detailed on the website.

5.2 Publication plan

Results of additional analyses will be presented during scientific conferences, symposiums, national and international meetings, and may serve to answer parliamentary questions. They will also be published in peer-reviewed scientific journals or in medical journals. An up-to-date list of publications will be found on the website.

6 LEGAL AND ETHICAL FRAMEWORK

6.1 Risk and benefits for the participants

The ethical conduct of public health surveillance requires an evaluation of both the benefits and risks for the participants. In terms of benefits, participants having completed the two interviews will receive a financial compensation of 10€ but will not have other direct personal benefit. In recognition of their participation, they should thus be treated with respect and informed with professional knowledge. Respect for individuals in research entails informing them correctly about the research purpose and subject, obtaining their consent to participate or accepting their right to refuse to participate.

[2] In addition, biomarkers will be collected in a subsample of the main national sample during the second home visit. That procedure will be part of an additional project which will require its own protocol and demand to the ethical committee.

The FCS includes both questionnaire completion and health examination (i.e., anthropometric measures). The risk of a health hazard due to the health examinations can be ignored, given their very basic and simple character. In the context of the FCS, the main risk for the participants could be caused by the disclosure of their personal data. Special attention is therefore devoted to the protection of the information collected, both on the short term (encrypted data on interviewers' laptop, forbidden disclosure, pseudonymization,…) and on the long term (secured data transfers and storage, limited access, recoded data,…). Regarding the personal contact data, only the person responsible for sending the invitation letters to the participants and dispatching the sampled individuals among interviewers, as well as the interviewers themselves, may have access to these data, during a limited period of time. In the framework of the FCS, all data will be collected judiciously and managed (i.e. handling, storage, dissemination) according to both legal and ethical requirements.

6.2 Legislation

The FCS will demonstrate compliance with the General Data Protection Regulation (GDPR), mandatory in the European Union since the 25th of May 2018. The project and associated processing activities have been recorded in an internal register at Sciensano. This record will be kept up-to-date and revised at least once a year. In addition, since personal data will be collected at large scale, a risk assessment will be performed by completing a Data Protection Impact Assessment (DPIA), using the internal template of Sciensano.

According to the GDPR, the participants will be informed about their rights through the information form provided and signed, together with the consent form, during the first home visit (see section 6.4). During the fieldwork, technical and organizational measures will be taken to ensure the security of the personal contact details and collected data measures, and to certify that participants cannot be identified and that their responses remain confidential.

- Data will be pseudonymised: during the sampling, an ID-code will be assigned to each selected individual. Only this code will be introduced by the interviewers in the questionnaires. It will be used to ensure the merging of the different databases resulting of the interviews.
- Interviewers sign a confidentiality clause that is inserted in their contract. Interviewers are forbidden to disclose any information gathered during the interview to a third party.
- Data will be transferred between entities using secured internet connections and stored on secured server, with limited access.
- Only the FCS researchers will have access to the collected data (protected network emplacement). These researchers will however not have access to the name, address or any personal information of the participants.

Technical and organizational measures are also routinely taken at Sciensano. All working contracts include a confidentiality clause covering among others the management of personal data. Moreover, physical access to the buildings are controlled using personalized badges and a visitor registration system, and the access to sensitive (IT) infrastructure is restricted. A standard notification procedure is also defined in case of any incidents relating to personal data.

6.3 Ethical Committee

The FCS research protocol is submitted to the Ethical Committee of the University Hospital of Ghent University. The survey takes place under the condition that Sciensano is granted permission to proceed. The Committee gives an approval if all aspects of the study are ethically sound and meet the best practice guidelines. Separate requests to the same Ethical Committee will be make for the data collection of biomarkers.

6.4 Informed consent

Before performing any kind of research involving humans, an informed consent needs to be obtained from the participants. The objective of an informed consent is to allow a person to make a truly informed decision as to whether or not to participate in the survey. Its goal is to ensure that the individual fully understands the scopes of the study, the methods adopted, and how the data will be used. The first step therefore consists in providing the participant candidate complete and clear information about the study using an information form that the interviewer read with the participant. If the participant agrees to participate, it is then asked him to complete and sign the consent form. This form also includes the possibility to allow to be recontacted for follow-up studies in the field of public health, and to link the data to other databases.

6.5 Communication of results

All results will be divulged in an aggregated format (i.e., tables of statistics and graphs) that impedes any recognition of individuals (see the reports of the previous FCS in 2014: https://fcs.wiv-isp.be/fr/SitePages/R%c3%a9sultats.aspx).

6.6 What in case of violation of data security measures

Disclosing any given information that is used or collected during the fieldwork would constitute an infringement to the Law of July 4, 1962 (Art. 18 – 22) relative to public statistics and would be penalized according to the disciplinary proceedings established in the article 458 of the Penal Code.

If unauthorized individuals force access to the FCS data, there is no chance these could be used to harm participants. Indeed, the data are kept in an pseudonymised format and the logical key matching the ID-codes with the national numbers is not available at the Sciensano site.

Incidents concerning personal data have to be immediately notified to the Data Protection Officer of Sciensano, who will address the problem as soon as possible and inform the Data Protection Authority.

7 ORGANISATION OF THE RESEARCH PROJECT

7.1 Starting and completion date

The project will consist of three different phases described hereafter, starting in 2019 and ending in June 2024.

- The **preparation phase** (including the writing of conceptual papers, selection of measurements, protocol development, questionnaire development, writing of the invitation letters, information leaflets, preparation of manuals and training for the interviewers, request to the National Registry and the Ethical Committee, etc.) started in 2019 and will continue until the 31st December 2021.
- The **fieldwork phase** (including data collection, fieldwork monitoring, feedbacks and supply of information to interviewers, etc.) which is scheduled to start at the beginning of January 2022 and continue until the 31st December 2022.
- The **data management phase** which is scheduled to start in January 2023 and end in December 2023;
- The **data analysis and reporting phase** (i.e., the data cleaning and management, data analysis and reporting, and dissemination of results) which is scheduled to start in 2023 and continue until the end of June 2024.

7.2 Subcontracting

At this stage, no contract has been established between Sciensano and other parts. Such a contract will be made available as soon as a subcontractor has been defined (a.o. for the TTP).

7.3 Resources

7.3.1 Team

The FCS team, in charge of organizing and conducting the FCS 2022, is part of the "Nutrition and health" Unit of the Service "Lifestyle and chronic diseases" at Sciensano. The Table below shows the different members of the team, their qualifications, functions and full-time equivalent. The training of the team members is foreseen in Sciensano evaluation schemes on a long-lasting basis.

Table 1 | Team members

First name	Last name	Qualification	Function	Full-time equivalent
Karin	De Ridder	MD, PhD	Head of unit	0.05
Nicolas	Berger	Scientist, PhD	Project leader	0.7
Isabelle	Moyersoen	Scientist, PhD	Project coordinator	1
Stefanie	Vandevijvere	Scientist, PhD	Senior scientist	0.3
Eline	Le Dieu	Dietician	Dietician	1
Elien	Van Campenhout	Dietician	Dietician	1
Thérésa	Lebacq	Scientist, PhD	Data management and statistics	0.8

7.3.2 Availability of space, fund and material

7.3.2.1 Space

The FCS team works in one office on the Eurostation site of Sciensano. Storing space for the survey documents (information sheets, photobooks, logbooks, informed consents, etc.) and material is available in the office. Storing space for the anthropometric instruments (scales, stadiometers and tapes), accelerometers and interviewer laptops is foreseen in another adjacent office.

7.3.2.2 Funding

The FCS 2022 is funded by the Federal Government, the Flemish Community, the Walloon Region, the French Community Commission, the Common Community Commission and the German Community, according to the Agreement Protocol published the 5th November 2018. This funding of a total of 2.582.042 € will cover the whole period of the survey: 15% will be paid each year between 2019 and 2024, and the remaining balance will be paid before August 2025.

7.3.2.3 Material

In the framework of the FCS, data are collected using the GloboDiet® software and computer-assisted face-to-face interviews. It is therefore necessary to provide portable computers to each interviewer. The portable scales, stadiometers and non-stretchable measuring tapes (for the anthropometric measurements), as well as the accelerometers (for the objective measurement of physical activity) from the previous FCS will be used in the FCS 2022. An inventory of the devices will be carried out to identify if new devices need to be purchased.

7.3.2.4 Software development

GloboDiet®, the software used to collect 24-hour recall data, will be updated by the dieticians of the FCS team to take into account Belgian specificities and new items (foods, brandnames, …). LimeSurvey® and Offlinesurveys® questionnaires will be developed by the FCS team to collect the information during the home visit. Also, a module enabling to transfer the data from the laptops of the interviewers to Sciensano in a secured way will be developed by the ICT department of Sciensano.

7.4 Scientific review

7.4.1 Advisory Scientific Committee

In the context of the FCS 2022, an Advisory Scientific Committee has been established to assure the scientific and technical follow-up of the study. It consists of a set of experts from universities and other organizations concerned by the survey, as well as commissioners representatives. If necessary, the Advisory Scientific Committee can consult external experts. The role and tasks of this Committee are detailed in the Agreement Protocol signed by the Commissioners of the FCS. Its main task is to advice the Commission of Commissioners on scientific issues related to the survey. The Advisory Scientific Committee is meeting at least once a year and make decisions by majority vote of the persons present.

7.4.2 Expert consultation

In defining the content and the procedures of the FCS, other experts have been consulted to learn from previous experiences in conducting large-scale studies (e.g., from the HIS team) or about specific topic (e.g. objective measure of physical activity with accelerometers). Scientific and technical advices have also been obtained from the RIVM ("Rijksinstituut voor Volksgezondheid en Milieu"), the Public Health Institute of the Netherlands.

7.5 Propriety rights of study material and results

All data collected in the FCS 2022 are the property of the Commission of Commissioners. According to the Agreement Protocol published the 5th November 2018, all the variables and indicators of the final database will be made available free-of-charge, upon request, to the Commissioners and international public organisations, public health or statistical organisations. They will also be made available to university research teams for 1750€ per university if the request is introduced before the end of 2026. Requests introduced from 2027 will no longer involve payment.

All uses of pseudonomized data will require authorisation from the "*Chambre sécurité sociale et santé du comité de sécurité de l'information / Kamer sociale zekerheid en gezondheid van het informatieveiligheidscomité*" to have access to the FCS database. An anonymous dataset including a limited set of variables will also be available to external users. A simplified data request procedure will be made available for the anonymous dataset and data requests will be directly assessed by Sciensano.

7.6 Client satisfaction

7.6.1 Definition of the client

The Food Consumption Survey has two types of clients: the Commission of Commissioners and the future users of the FCS data.

7.6.1.1 Commission of Commissioners

The Commission of Commissioners is the sponsor of the FCS. The tasks of the Commission are described in the Agreement Protocol. All aspects of the survey (methodology, content, analysis, report) are discussed and approved by the Commission.

7.6.1.2 Future users of the FCS data

Once the Commissioners have received the results of the FCS, the external database is prepared, together with users' guidelines and a codebook, so that external researchers (i.e. federal, regional and community authorities, and university researchers) can exploit the data in accordance to their own domain of interest. The pseudonomized data are transferred following approval from the "*Chambre sécurité sociale et santé du comité de sécurité de l'information / Kamer sociale zekerheid en gezondheid van het informatieveiligheidscomité*" and payment .

7.6.2 Contacts with the client

7.6.2.1 Commission of Commissioners

Contacts with the Commissioners are made through meetings, at least once a year. In-between meetings, the members of the Commission will receive via e-mail the necessary information allowing them to have an updated insight of all aspects related to the FCS. If necessary, any member of the Commission can ask for supplementary information. In addition, progress and financial reports are provided to the Commission once a year.

The Commission of Commissioners monitors and assesses the progress of the FCS. As described in the Agreement Protocol, the Commission decides the content (modules and questions) and the methodology of the survey, provides indications regarding the statistical analyses based on the advices from the Scientific Committee, and defines the content of the final reports and evaluation. They also approve external request for the use of FCS indicators or variables.

7.6.2.2 Future users of the FCS data

After the publication of the results, the FCS data will be made available for use and in depth analyses by administrative and academic instances. A specific anonymized database will be created to this end (by removing or aggregating some variables). The conditions to obtain the database are indicated in the Agreement Protocol and will be described on the FCS website.

7.6.3 Satisfaction inquiry of the client

Commissioners are in contact with the FCS team members during meetings, but also, through e-mails for specific requests. The external researchers and academics are represented in the Advisory Scientific Committee, where recommendations are given to meet the expectations of the commissioners. Feedback and assessment of satisfaction are thus on-going processes throughout the project duration. If needed, a survey could be developed for the commissioners and – possibly – for the data users to ensure that the clients are satisfied, and if not, to identify what could be improved.

7.6.4 Treatment of complaints

The complaints will be treated In accordance with the procedure: SOP I/03/22/NF.

7.7 Archiving process

7.7.1 Data management

Archiving of all the files will be done as described in the SOP 31/E/007, via the general archiving process of the department of Epidemiology and Public Health of Sciensano (i.e. a daily backup on a separate Blade Server).

All documents will be stored in the subdirectory “FCS2022”, which can be found in: \\sciensano.be\FS\1140_DATA\FCS\FCS\FCS2022. The structure of the storage system of the computer files used for the FCS 2022 will be documented in the SOP “Management of electronic documents”.

7.7.2 Documents

The original contracts with the Commissioners are stored in the appropriate directories. The completed paper questionnaires will be kept in files at Sciensano (Service “Lifestyle and chronic diseases”) for at least 5 years, together with the consent forms, contracts with the interviewers and contracts with the external users.

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