Pilot of Intake24 in the Scottish Health Survey

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1.1 Introduction

In 2018, Intake24, an online dietary recall system designed to collect detailed nutritional information over a 24-hour period, was piloted in the Scottish Health Survey (SHeS) with a view to including it in SHeS in the future. This pilot was commissioned by Food Standards Scotland, in collaboration with the Scottish Government and delivered by ScotCen Social Research in partnership with Newcastle University's Human Nutrition Research Centre and Open Lab who have developed and tested Intake24.

Diet is a key factor affecting population health. A poor, energy dense diet high in processed foods and free sugars, and low in fruit and vegetables is associated with obesity, dental caries and many other related health consequences [1] [2]. Since 2003, when data were first collected in SHeS, less than a quarter of adults have met the recommended five-a-day fruit and vegetable consumption and in 2018, 65% of adults living in Scotland were overweight including 28% who were obese; a trend that has remained stable since 2008 [3]. Monitoring the population's dietary intake can identify and highlight potential excesses and deficiencies in the diet and provides important evidence to contribute to the development of public health policies and interventions, including dietary guidelines. However, effective dietary monitoring is challenging.

Currently, the dietary information that is collected in Scotland in SHeS, is through the Fruit and Vegetable Consumption (asked of all adults aged 16 and over, participating in the survey since 2003 and of children aged 2-15 since 2008) and Eating Habits (asked of all children aged 2-15 annually, and a sub-sample of adults biennially since 2008) modules [3]. Whilst this provides useful information on diet and the consumption of specific food types, Intake24 allows collection of data on the whole diet so that nutrient intakes can be derived thus allowing monitoring against the Scottish Dietary Goals (SDGs) [16].

Prior to this pilot, Intake24 had undergone significant validation in 11-24 year olds in North East England [4] and was field-tested in SHeS in 2015 [5]. Learning from the SHeS 2015 field-test has been incorporated into this pilot of Intake24 including:

- using a face-to-face interview to explain and encourage participation
- tailored reminders to prompt respondents to complete their recalls
- reminders for those not completing their recall
- an optional add-on for personalised dietary feedback for respondents who complete two recalls

[5] A total of 1056 participants completed 2 Intake24 recalls in the pilot study. However response data was only available for 1053 participants at the time of reporting due to a pilot study programming error. This error does not impact the key findings.

- an option for a telephone interview for those who cannot or prefer not to complete online

Information about the development of the tool, reports and publications and a demo can be found on the website (Intake24.co.uk).

1.2 Pilot Objectives

The aim of the Pilot of Intake24 was to deliver a robust study to meet the following key objectives:

- Measure response to Intake24 and examine the impact of response to the main survey
- Collect and assess feedback on Intake24 and its integration in SHeS from respondents and interviewers
- Determine the optimum approach for integrating Intake24 in SHeS and collecting two recalls from respondents
- Provide baseline dietary data for the Scottish population including analysis by health parameters (such as BMI) collected in SHeS allowing for comparison to the SDGs
- Allow comparison of dietary data from Intake24 and SHeS

1.3 Methodology

1.3.1 Data Collection

All SHeS participants aged 11 years or over in all households in the core sample that was allocated across July to December 2018, were eligible to take part in the Intake24 pilot. Eligible respondents were invited to take part by their SHeS interviewer after completing the SHeS core interview. All respondents who completed two (or more) dietary recalls were sent a shopping voucher loaded with £20 of credit.

The main method for accessing Intake24 was by clicking a URL link sent to them in an email or text message immediately after they consented to take part and provided necessary contact details. All Intake24 interviewers were given a 3G dongle prior to fieldwork, which was plugged into the interviewers' Computer-Assisted Personal Interview (CAPI) devices to create a localised internet connection. The CAPI questionnaire was programmed to send the collected details to a pre-prepared sample template stored in an automated message software managed by Pure360. This software was programmed to deliver an email and or text with a predefined content, including personalised mail merge fields, to the respondent. The email and/or text message arrived with the respondent after around five minutes, and contained a unique URL link which respondents could click to access Intake24. Respondents' unique identifiers were also used to facilitate linkage of Intake24 data to the individuals' SHeS responses. Each household was given an Access Sheet with a generic access link to Intake24, unique access codes and second dietary recall completion dates for each respondent; this was

an alternative means of access for those who did not provide email or mobile phone details and as a contingency for those who did. Just under 60% of participants accessed Intake24 via their laptop or desktop, others used mobile phones or tablets.

Respondents were asked to complete their first dietary recall on the day of their SHeS interview, covering the preceding day's intake, and then another on a specified day based on the aim of collecting dietary behaviour data from one weekday and one weekend day to enable a balanced reflection of weekly eating habits. Respondents who provided an email address and or mobile phone number were sent reminder messages to chase their first dietary recall, and to remind them of and chase their second dietary recall.

Respondents who indicated at the consent stage that they were unable to complete their Intake24 dietary recall without support were taken through their first recall with their interviewer on the CAPI device, and their second dietary recall on the phone with a member of the research team at Newcastle University.

On completion of two dietary recalls, respondents were invited to complete a feedback questionnaire on their experience of Intake24 and sent a thank you email or letter with their £20 vouchers enclosed. Interviewers were also asked to provide feedback on the Intake24 experience through an online questionnaire.

1.3.2 Analysis

The analysis for this pilot comprised four main strands:

- Assessment of response rates for those completing the pilot and any impact on the main survey
- Analysis of feedback from respondents and interviewers on using Intake24
- Provision of baseline dietary intake data, including comparisons with the SDGs and comparing dietary intake across a range of health, demographic and socio-economic parameters collected from SHeS
- Comparison of Intake24 data with data from the SHeS eating habits and fruit and vegetable consumption modules

The following analyses were completed;

- consent
- demographics of respondents
- completion rates and patterns (such as the proportion of recalls completed on the scheduled date)
- attrition rates
- geographic coverage
- reasons given for not taking part
- usability and user experience problems
- modes of access

- number and demographic profile of respondents requiring interviewer-led recalls were reported

Response rates were also analysed by age, gender, SIMD and BMI.

In addition to respondent feedback, analysis of the interaction analytics of the system was conducted to show where users had issues with different aspects of the system. Analysis of the types of device (and types and versions of operating systems of these devices) that people access the system through was carried out. Time taken to complete Intake24 was also reported.

Full reconciliation and quality checks were undertaken on the Intake24 responses prior to linkage of Intake24 and SHeS responses to create the analysis dataset. The dietary analysis focused on the food groups and nutrients detailed in the SDGs (with the exception of salt)[6]. Analysis included a comparison of dietary intakes with SDGs for the study group as a whole and stratified by age, gender, BMI and SIMD. In addition, concordance between intakes measured using Intake24 and selected food groups from the SHeS Eating Habits and Fruit and Vegetable Consumption Modules was assessed using Bland-Altman analysis and Kappa analysis.

Prior to analysis, the Intake24 data was weighted to help to minimise any bias due to differential non-response at the household level (using auxiliary data from census and interviewers' observations) and ensure that the age and gender distribution of the achieved sample matched the population distribution. The Intake24 weight incorporated the main SHeS survey weight, which is developed by the Scottish Government.

1.3.3 Approvals

Ethical approval for the pilot study was gained from an NHS Research Ethics Committee (REC reference 17_WA_0371). Approval for the linkage of Intake24 and SHeS data was gained from the Public Benefits Privacy Panel (ref 2019-0005).

1.4 Response

A total of 1053 respondents completed two or more dietary recalls (2+ recalls). The mean response rate was 44.1% of the eligible SHeS sample. Less than 3 in 4 (72.3%) of the eligible SHeS sample consented to take part in Intake24. Of these, around 1 in 5 (20.9%) failed to complete one recall, and after completing one recall, less than 1 in 4 (22.7%) did not complete their second recall.

Demographic factors that influenced response included age and gender. Adults aged over 64 were significantly less likely than younger respondents to consent to take part, with particularly low levels of participation among those aged over 74. There was little difference in response rates between adults (16+ years) and children (11-15 years). However, after consenting, those aged between 65 and 74 were most likely to go on to complete two or more recalls. There were no statistically significant differences in participation by deprivation or BMI category groups.

[6] Salt intake is most appropriately measured using a urinary sodium survey.

There were 33 requests for help using Intake24, and nearly all of these related to logging on and were easily resolved by the provision of an alternative Intake24 link. The process of carrying out telephone interviews ran smoothly, with only a small number of respondents who could not be contacted.

Respondents completed Intake24 in less than 16 minutes on average, which is comparatively faster than the time taken to complete other interviewer-led 24 hour recalls (usually taking around 20-30 minutes) [6], and also comparable or quicker than other online 24 hour recall tools which took between 16 and 41 minutes [7] [8]. Respondents agreed through the feedback questionnaire that they were able to complete a recall through Intake24 in a 'reasonable amount of time' and 42% would have been happy to complete a further two recalls using Intake24, suggesting the time required to complete a recall was acceptable.

Respondent answers to the feedback questionnaire were generally very positive. Intake24 was considered a tool that; accurately captured their diets, provided useful feedback and looked acceptable. In addition, Intake24 scored well through the System Usability Scale with a classification of 71.5 and 'good', comparing favourably to other online 24-hour recall tools [9] [10].

Feedback also highlighted the need to minimise the number of foods that could not be found by ensuring the Intake24 food database is kept up to date with new products and missing products, and by the inclusion of a question asking the respondent if the day they are reporting their diet for is 'normal' and also if they are following a particular diet.

The objective of minimising the impact of Intake24 on overall SHeS response rates was a consideration in every aspect of the data collection design. Most interviewers felt the pilot had a positive (41%) or no impact (37%) on delivering SHeS and offered no evidence that Intake24 impacted negatively on SHeS response rates. However, a minority of interviewers (15%) felt that the time required to administer and set up the pilot with respondents had a negative impact on SHeS and there was some indication from interviewers that it may have reduced participation in the biological module[7].

There was a slight difference (-2.4%) in the household response rate in the second half the SHeS 2018 field year when Intake24 was being piloted; response rates for SHeS are usually lower in the second part of the field year. More biological modules were achieved against target during the Intake24 pilot period. However, these figures are not easily attributable to Intake24 as there is no clear pattern for biological module achievement against target in the first and second halves of SHeS field years.

1.5 Dietary Intake and Food Group Agreement

Reported average energy intake for male and female adults (16+ years) was 1862 and 1500 kcals/day respectively. Male's average intakes of fat and saturated fat as a percentage of total food energy (%total food E) were 34.2% and 13.0% respectively, and female's intakes were 33.3% and 12.7%. Non-milk extrinsic sugars (NMES) as a

[7] The SHeS biological module is the part of the interview where additional biological measurements and samples (e.g. blood pressure, waist measurement and saliva samples) are taken from a sub-sample of respondents.

percentage of total energy (%total E) were above the 5% SDG recommendations for free sugar, with average male reported intakes at 12.9% and females at 11.1%. Average fibre intake (using estimated AOAC fibre) was 16 and 15.8g/day for males and females respectively, which is only half of the amount recommended by the SDGs (30g/day) (Table 1).

Table 1. Summary of weighted reported two-day average dietary intakes for adults (16+ years) by gender

	Males (16+ years)	**Females (16+ years)**
Average energy intake (kcals/day)	1862	1500
Average total fat intake (%total food E/day)	34.2	33.3
Average saturated fat intake (%total food E/day)	13.0	12.7
Average NMES intake (%total E/day)	12.9	11.1
Average estimated AOAC fibre intake (g/day)	16.0	15.8

Analysis of dietary intakes within different demographic groups in the pilot survey showed that NMES intake as a %total E was highest in the 16-24 years' age group at 14.8%, three times the recommended intake (5%), and lowest in the 65-74 years' age group at 9.0%. Fibre intakes were lower than recommended in all age groups ranging from 14.1g/day in the 16-24 years group to 16.8g/day in the 35-44 years group. The most deprived group (SIMD 1) had the lowest reported energy intake of 1563 kcal and the highest NMES intakes as a %total E at 13.3%. SIMD 1 also had the second lowest fibre intake at 15.0g/day. The least deprived group (SIMD 5) had the second lowest NMES intake as a %total E and the highest fibre intake at 16.8g/day. These comparisons between demographic groups are observational only.

When directly comparing the fruit and vegetable intakes of respondents who completed Intake24 for the same day as the SHeS Fruit and Vegetable Consumption Module (*n*=671), reported average intakes were similar with 3.0 portions/day reported through Intake24 and 3.1 portions/day through SHeS, showing a good agreement between the two methods at a population level. In addition to comparing the mean reported intakes of fruit and vegetable portions, the agreement between the two methods was examined using the method of Bland and Altman. The ratio of the geometric mean at 0.88 showed that at a population level, Intake24 reported intakes of fruit and vegetable portions just 12% lower than the FVM. There were however wide limits of agreement between the two methods indicating that there was poor agreement at the individual level. These individual differences are likely due to, at least in part, differences in what the two

methods are actually measuring. For example, Intake24 includes all fruits and vegetables in composite dishes whereas the Fruit and Vegetable Consumption Module is a less comprehensive measure. In addition, there may be differences in reporting between methods when respondents are face to face with interviewers in SHeS due to social desirability bias. When comparing with the recommendation of 'five a day' and those who reportedly consumed less than one, or five or more portions of fruit and vegetables through Intake24, 22% of the study population consumed less than one portion of fruit and vegetables compared to 16.3% through the Fruit and Vegetable Consumption Module. For those who reportedly consumed five or more portions, there were 16.3% respondents through Intake24 and 20.8% through the Fruit and Vegetable Module.

1.6 Discussion

1.6.1 Integration of Intake24 in SHeS

A key objective of this pilot was to determine the optimum approach for integrating Intake24 in SHeS and collecting two recalls from participants. The approach taken to integrate Intake24 in SHeS in this pilot was broadly successful. The pilot achieved close to the estimated response rate and the number of respondents completing two dietary recalls was within the target range with very few help requests received and those were easily resolved. Also, there is no evidence to suggest that the Intake24 pilot had a detrimental effect on SHeS response rates, except possibly biological module response according to some interviewers.

Fewer than 1 in 25 (3.6%) of respondents who consented to take part used the option of a telephone call for the completion of their second dietary recall. As this is a relatively time consuming and costly part of the exercise it could be removed, although this would potentially bias the sample further as the mean age of those completing by telephone was 71, compared to 51 among those consenting to take part.

The average lengths of time currently required for the Fruit and Vegetable Consumption and Eating Habits Modules in the SHeS interview are 2.5 and 4.7 minutes. Introducing Intake24 would free up around five minutes currently in the main SHeS interview, as the time taken for interviewers to introduce Intake24 cannot be discounted, although there are ways that this could be reduced by streamlining the process.

Most interviewers suggested that the £20 incentive encouraged respondents "a great deal" (46%) or "quite a lot" (28%) to agree to take part in Intake24. If Intake24 was to be run on the full SHeS sample at the current rates there would be an additional incentive cost of around £40,000.

It is important to consider that SHeS is a highly accessible resource for academics, policy makers, health and social care practitioners, service providers, journalists and the general public. Whilst some key areas are easily transferrable such as reporting on five a day, it will be important to develop new, accessible formats for the reporting of more complex data such as weights of foods or energy intakes. These will however allow monitoring of dietary intake against the SDGs that is not currently possible through SHeS and provide an opportunity to raise wider public awareness of the SDGs.

1.6.2 Nutritional data: Advantages and Limitations of Intake24

Intake24 can provide quantifiable outcomes in terms of nutrients and food groups which can be directly compared to dietary recommendations such as the SDGs including the percentage energy contributions of total fats, saturated fats, trans fatty acids, total carbohydrates and free sugars, grams of fibre, portions of fruits and vegetables and grams of red and processed meats and of oily fish.

A limitation to this pilot was that comparing the recommended energy density SDG with the data collected through Intake24 was not possible due to difficulty distinguishing 'foods and milk' from 'drinks'. Once developments have been made to identify 'food' vs 'drinks' input into Intake24, data collected can also be compared to the energy density SDG to enable measurement of progress towards meeting the goals at a population level.

There are also methodological differences between the Eating Habits Module and the Fruit and Vegetable Consumption Module with Intake24. Although Intake24 does provide more detailed data, the methods will likely give slightly different results, albeit the feedback from respondents suggest that Intake24 data is a more accurate reflection of respondent's actual consumption. Among those participating in the pilot 50% agreed felt that they were able to give the most accurate information about their diet when using Intake24 compared to 18% who felt they were able to give the most accurate information about their diet through the questions they answered in the SHeS interview.

The pilot has highlighted a number of ways in which Intake24 could be further developed and improved, including:

- Researchers needing to update foods in the database to ensure there are minimal problems with finding foods. This can be resolved by using the more up to date NDNS food database, which includes more foods and also includes free sugars rather than only NMES
- Requesting more information about the day that the recall has been completed for by adding 'usual day' and 'special diet' questions
- Adding a flag to items so that the energy density can be easily calculated

1.7 Conclusions

Intake24 is a way to collect considerably more detailed data from the SHeS sample than the Fruit and Vegetable Consumption Module and Eating Habits Module methods currently included and is a more effective way to measure population dietary intakes against the SDGs and differences between population groups. However, the pilot raises a number of key areas that would require careful consideration prior to introducing Intake24 to SHeS.

Although introducing Intake24 to SHeS is unlikely to have a detrimental impact on the overall SHeS response rate, the Intake24 sample will be around 44% of the overall SHeS sample, which will limit analysis of population intakes at a local level. Currently the

intention is that SHeS data can be analysed at a Local Authority level using combined data on a four-year basis. Intake24 provided very similar population estimates of average daily fruit and vegetable portion consumption but gave a higher estimate of those eating less than one portion of fruit and vegetables/day and a lower estimate of those eating five or more portions. The timeseries for SHeS is likely to be impacted, albeit with potentially more accurate nutritional intake data. It will be important that the Scottish Government and FSS jointly weigh up the advantages of having more detailed food and nutrient data that can better inform how the Scottish population's diet is comparing with the SDGs and freeing up vital SHeS interview time for new topics, against the disadvantages of a smaller sample of dietary data, less frequent Local Authority level analysis, changes in time series, and additional costs.

Based on the findings from this pilot, a number of key considerations for the possible integration of Intake24 into SHeS are made including:

- Finding ways to encourage more older adults to participate, this is a key challenge for interviewers. Introducing some "practice questions" for respondents to complete and get a feel for the usability of the programme, if they're reluctant due to technical concerns, may be of some benefit. This approach is used on the CASI self-complete data collection (where the interviewer provides the respondent with a tablet, mobile phone or a computer to self-record their answers directly into the device) section of the Scottish Crime and Justice Survey. Relatedly, the Survey of Health, Ageing and Retirement in Europe (SHARE) has previously trialled an interviewer bonus for achieving interviews with respondents aged 80+ years
- Finding ways to maximise the number of children (aged 11-15) and those adults aged 16-24 years who consent to take part to then go on to complete as this group was least likely to complete two dietary recalls.
- Finding ways to encourage more males to complete the dietary recalls, in particular the first recall
- Considering a staggered incentive strategy (for example £5 for completing the first recall and £15 for the second), as a means of increasing consent and reducing dropout after consent. Forty three percent of eligible respondents did not complete any recalls, whereas 77.3% of respondents who completed one recall went on to complete a second. An incentive strategy that focusses more on encouraging respondents to complete their first recall may lead to greater numbers completing two recalls. This being said, a staggered incentive strategy may lead to an increase in the dropout rate after one recall
- Minimising time required for interviewers to administer Intake24 at the end of the SHeS interview
- Considering placing Intake24 introduction after the biological module to minimise any negative impact on biological module response
- Maximising the number of respondents who give email as a contact detail and minimising the number of respondents who give a text number only
- Developing some aspects of Intake24 categorisation of foods, drinks and milk to facilitate better analysis of dietary data against the SDG's (such as the energy density calculation). These adaptations are recommended to be put in place prior to the introduction of Intake24 to SHeS

- Exploring the possibility of including a food frequency diary for key foods that may not be consumed daily, such as oily and white fish, fruit juice and soft drinks
- Considering moving to web only as few used the telephone recall option, however this could further reduce the response from adults aged over 74
- Ensuring that Intake24 and SDGs data are presented in SHeS in a highly accessible way to facilitate access by the large and wide ranging SHeS audience
- Collecting four instead of two dietary recalls per person, although this may affect response rate

1.8 Exec Summary Reference list

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1.9 Acronyms List

Abbreviation	*Definition*
AOAC	American Association of Analytical Chemists
BMI	Body Mass Index
CAPI	Computer-Assisted Personal Interviews (a face-to-face data collection method in which the interviewer uses a tablet, mobile phone or a computer to record answers given during the interview).
CASI	Computer-Assisted Self Interviews (where, during a face to face interview, the interviewer provides the respondent with a tablet, mobile phone or a computer to self-record their answers directly into the device).
CHILDREN	Children are described as those aged between 2 and 15 years
DINE	Dietary Instrument of Nutrition Education
EHM	Eating Habits Module
FVM	Fruit and Vegetable Module
LCFS	Living Costs and Food Survey
NDNS	National Diet and Nutrition Survey
NMES	Non-milk Extrinsic sugars
NU	Newcastle University
PBPP	Public Benefits and Privacy Panel
SACN	Scientific Advisory Committee on Nutrition
SDGs	Scottish Dietary Goals
SHeS	Scottish Health Survey
SIMD	Scottish Index of Multiple Deprivation

SUS	System Usability Scale
TU	Telephone Unit
URL	Uniform Resource Locator; a website address
WHO	World Health Organization

2 Introduction

Intake24, an online dietary recall system designed to collect detailed nutritional information over a 24-hour period, was piloted on the Scottish Health Survey (SHeS) in July to December 2018 with a view to including it in SHeS in the future. This pilot was commissioned by Food Standards Scotland (FSS), in collaboration with the Scottish Government. It was delivered by ScotCen Social Research in partnership with Newcastle University's Human Nutrition Research Centre and Open Lab who have developed and tested Intake24.

Dietary information is currently collected in the SHeS via the Eating Habits (EHM) and the Fruit and Vegetable Consumption (FVM) survey modules. These provide useful information on diet and the consumption of specific food types, however Intake24 offers the potential to collect considerably more detailed data including food portion size and a large number and variety of food types. It also offers the potential to measure total daily dietary intake which is the level of detail needed to monitor dietary intakes against the Scottish Dietary Goals (SDGs) [16].

This report focusses on the findings of the Intake24 pilot in SHeS including response rates, feedback on usability from the perspective of respondents, feedback on the integration of Intake24 into the SHeS data collection systems from the perspective of interviewers and an analysis of the Intake24 nutritional data collected and comparison of this with SHeS dietary data.

2.1 Background

Diet is a key factor affecting population health. A poor, energy dense diet high in processed foods and free sugars, and low in fruit and vegetables is associated with obesity, dental caries and many other related health consequences [1] [2]. Whereas a diet high in fibre, wholegrains, fruit and vegetables has been linked to a reduced risk of non-communicable diseases such as bowel cancer [11] [12]. Previous dietary surveys have found that on average, the majority of the UK population consumes too many free sugars, saturated fat and salt and not enough fibre, fruit or vegetables [13]. In 2018, SHeS 2018 stated that less than a quarter (22%) of adults met the five-a-day recommendation for consumption of fruit and vegetables, a trend that has remained stable since 2003. Also in 2018, 65% of adults living in Scotland were overweight including 28% who were obese, with similar levels since 2008, and 29% of children were at risk of overweight including 16% at risk of obesity [3].

The World Health Organization (WHO) stated that dental caries can be prevented by avoiding the consumption of free sugars [14]. The amount of tooth decay in children in Scotland has been decreasing [15]. However, the free sugars intake in Scotland is still reported to be higher than the SDGs of less than 5 % of total energy [16] and there are oral health inequalities, whereby the most deprived children are more likely to have tooth decay [15].

Monitoring the population's dietary intake highlights potential excesses and deficiencies in the diet. It is of great importance in terms of influencing the development of public

health policies and interventions, and to develop dietary guidelines, however this monitoring can be extremely challenging. There are many methods of dietary data collection commonly used including; weighed food diaries, non-weighed food diaries, food frequency questionnaires and interviewer led, 24 hour recalls. Many of these methods, whilst able to capture detailed dietary information place a high burden on respondents and can be both time consuming and make large-scale surveys expensive to run. In some cases, there has been a change in methodology to reduce cost and respondent burden. A key example is the National Diet and Nutrition Survey (NDNS) which in 2008, shifted from using a data collection method of a 7-day weighed food diary (self-reported) to a less burdensome 4-day food diary with estimated quantities (also self-reported) [17]. More recently, in October 2019, the NDNS began using an updated version of Intake24 as the main dietary assessment method, supplemented with a brief food frequency questionnaire assessing a few foods of interest for non-nutrient reasons.

Methods of dietary assessment reliant on the memory of respondents to report their dietary intake have problems associated, particularly with under-reporting of intake. It has been shown in validation studies that under-reporting dietary intake is common [18]. Under-reporting is not solely related to dietary recall methods and other factors such as gender and socio-economic status increase the likelihood of under-reporting dietary intake [19]. Despite under-reporting, methodologies such as 24-hour recalls do enable detailed dietary information to be obtained, whereas other methods (such as solely using food frequency questionnaires) cannot, and these allow comparisons to be made with dietary goals and the observation of dietary trends and changes over time.

2.1.1 SHeS Eating Habits Module and Fruit and Vegetable Module Overview

The SHeS module of questions on Fruit and Vegetable Consumption (FVM) was designed with the aim of providing sufficient detail to monitor population-level adherence to the five-a-day recommendation. These questions have been asked of all adults (aged 16 and over) participating in the survey since 2003 and of children (aged 2 to 15) since 2008.

The module includes questions on consumption of the following food types in the 24 hours to midnight preceding the interview:

- vegetables (fresh, frozen or canned)
- salads
- pulses
- vegetables in composites (e.g. vegetable chilli)
- fruit (fresh, frozen or canned)
- dried fruit
- fruit in composites (e.g. apple pie)
- fresh fruit juice

A portion is defined as the conventional 80g of a fruit or vegetable. Since 80g is difficult to visualise, survey respondents are asked to describe the amount of each fruit or vegetable category they consumed using more everyday terms, such as tablespoons, cereal bowls and slices. These everyday measures are subsequently converted to 80g portions prior to analysis. Examples are given in the questionnaire to aid the recall process, for instance, tablespoons of vegetables, cereal bowls full of salad, pieces of medium sized fruit (e.g. apples) or handfuls of small fruits (e.g. raspberries). Table 2 shows the definitions of the portion sizes used for each food item included in the survey:

Table 2. Scottish Health Survey food portion size definitions

Food item	Portion size
Vegetables (fresh, frozen or canned)	3 tablespoons
Pulses (dried)	3 tablespoons
Salad	1 cereal bowlful
Vegetables in composites, such as vegetable chilli	3 tablespoons
Very large fruit, such as melon	1 average slice
Large fruit, such as grapefruit	Half a fruit
Medium fruit, such as apples	1 fruit
Small fruit, such as plums	2 fruits
Very small fruit, such as blackberries	2 average handfuls
Dried fruit	1 tablespoon
Fruit in composites, such as stewed fruit in apple pie	3 tablespoons
Frozen fruit/canned fruit	3 tablespoons
Fruit juice	1 small glass (150 ml)

Since the five-a-day recommendation stresses both volume and variety, the number of portions of fruit juice, pulses, and additionally in SHeS dried fruit, is capped so that no more than one portion of each can contribute to the total number of portions consumed. Interviewers record full or half portions, but nothing smaller. Additionally, in SHeS vegetable soups are not included as a dish made mainly of vegetables and pulses, even if they are home-made. This is due to the large variety of soups available which makes it difficult to determine their nutritional content. For example, the nutritional content of a cup-a-soup could be very different to a homemade soup.

The SHeS Eating Habits Module (EHM) was developed from the Dietary Instrument of Nutrition Education (DINE) questionnaire and is similar to that used in the Health Survey for England. The DINE questionnaire was developed by the Imperial Cancer Research Fund's General Practice Research Group to assess usual intake of a wide range of nutrients, including protein, starch, fat and fibre [20]. The module asks about frequency of consumption for categories of food but does not ask about either the amount consumed or specific types of food. It cannot be used to estimate daily nutrient intake but can reflect differences in consumption of the specified foods between population and sub-groups or within a population over time. In SHeS these questions are asked of all

children aged 2-15 years annually, and a sub-sample of adults (16+ years) biennially. Further details of the EHM and FVM are in Appendix A.

2.1.2 Online Dietary Assessment Overview

With developing technology, there is an increase in the use of online tools which enable large numbers of respondents to be reached, as well as consistently coding data, substantially decreasing the time needed for manual coding and data entry and reducing or eliminating the need for an interviewer to be present. The multiple pass method (MPM) is a method commonly used to administer 24 hour recalls, where respondents are guided through the previous 24 hours providing multiple opportunities to remember food intake and details of the items consumed [21]. This method allows comprehensive dietary data to be collected whilst reducing laborious tasks such as weighing and measuring all foods/drinks consumed [22]. There are many international online dietary assessment tools based on the MPM such as Intake24 and myfood24 (UK), ASA24 (USA) and YANA-C (Belgium) [23-25].

Intake24 is an online 24-hour dietary recall tool developed by researchers in Newcastle University. The tool has been developed in previous research commissioned by FSS [5, 26-28]. Intake24 allows the collection of self-reported food and drink intake data in large population groups, enabling quantifiable estimated intakes of food groups and nutrients in grams per day to be calculated. This enables direct comparisons with specific dietary targets, such as those in the SDGs.

2.1.3 Dietary Recommendations and Monitoring

In the United Kingdom (UK) there are population dietary recommendations, which are set by Government, and are underpinned by evidence from the Committee on Medical Aspects of Food and Nutrition Policy and its successor (from 2000), the Scientific Advisory Committee on Nutrition.

The Eatwell Guide was launched in March 2016 [29], replacing the previous eatwell plate [30], and illustrates the different types of foods and drinks, and the proportions in which they should be consumed to achieve a healthy balanced diet. The Eatwell Guide reflects the most up to date dietary recommendations on nutrients such as free sugars and fibre and is the main consumer-facing resource which illustrates a healthy balanced diet.

At a UK level, the NDNS [31] is used to measure population intakes against the dietary recommendations. The Scottish sample of the NDNS (year 1-4) was boosted to provide population level dietary intakes for Scotland and to compare the findings with the rest of the UK [32]. The data indicated similar patterns of intake across the UK. This data collection method has not been not repeated due to the high costs and long timeframe required to obtain this data for Scotland.

The Scottish diet is monitored against the SDGs. The SDGs describe, in nutritional terms, the type of diet that will improve and support the health of the Scottish population. The SDGs were updated in March 2016 to reflect the most up to date evidence base on free sugars and fibre and include both food and nutrient based goals. In Scotland, the current method used by FSS to monitor population intakes against the SDGs is

secondary analysis of the Living Costs and Food Survey (LCFS) data. Secondary analysis of the LCFS has monitored trends in population food and nutrient intakes in Scotland from 2001 to 2015. The FSS dietary surveillance programme also includes monitoring of retail food and drink purchase into the home in Scotland [33].

2.2 Pilot Objectives

The aim of the Pilot of Intake24 was to deliver a robust study to meet the following key objectives:

- Measure response to Intake24 and examine the impact of response to the main survey
- Collect and assess feedback on Intake24 and its integration in SHeS from respondents and interviewers
- Determine the optimum approach for integrating Intake24 in SHeS and collecting two recalls from respondents
- Provide baseline dietary data for the Scottish population including analysis by health parameters (such as BMI) collected in SHeS allowing for comparison to the SDGs
- Allow comparison of dietary data from Intake24 and SHeS

2.3 Intake24

Intake24 is an online 24-hour dietary recall tool, originally developed by researchers in Newcastle University for FSS Information about the development of the tool, reports and publications and a demo of the tool can be found on the website (Intake24.co.uk).

Users are able to log in online on their computer, laptop, tablet or smart phone via a URL and report foods and drinks consumed for the previous 24 hours. Intake24 uses a range of different methods to estimate the portion size of foods and drinks including food photographs, drinks scales and weight (g) for recipes (see Appendix B) for additional images). There are prompts to remind respondents about common foods and drinks that might have been forgotten (for example, milk and sugar in tea, or sauce on chips), built in checks to detect low reported energy intakes and low intake of drinks, checks for large time gaps between foods and drinks and a bespoke spelling correction system handling most cases of misspelled food names. The system has a prompt whereby if a respondent enters more than one food per line, they are asked if they would like to include these foods separately (Figure 1). Other features of the system include; a missing foods function to ensure foods that are not in the Intake24 database are not missed from the recall, a recipe function so that respondents can report the recipe for any homemade items they consumed, a video tutorial on how to complete a recall, contextual help buttons and a telephone help request function enabling a study researcher to call back respondents to talk them through issues they may be experiencing (*see* field testing report [34] for further information).

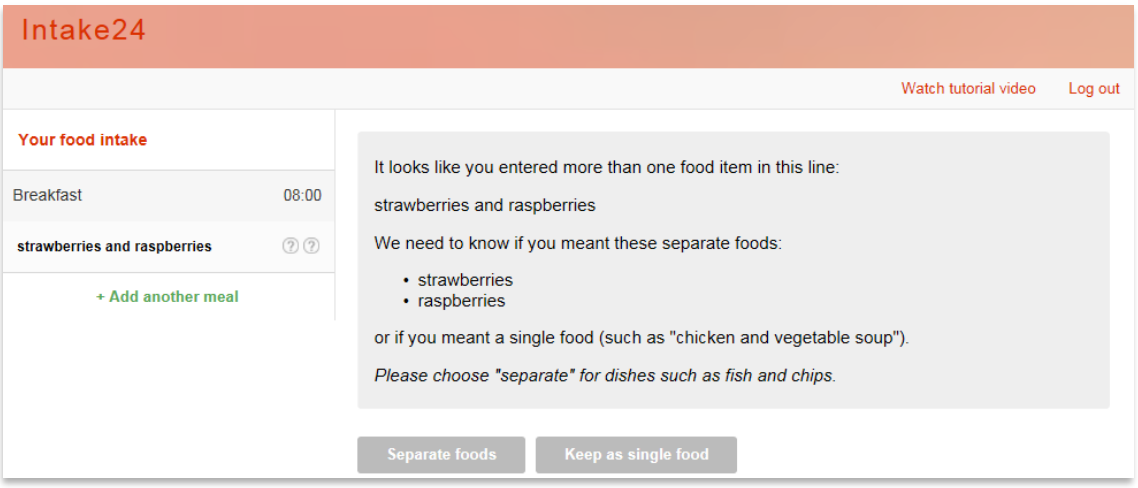


Figure 1. Prompt showing check for multiple foods entered on one line

Since October 2019, the NDNS have been using an updated version of Intake24 for dietary data collection, including linking to the newest UK food composition data.

2.3.1 Intake24 Validation Prior to Pilot

Intake24 has been validated against interviewer-led recalls in 11-24 year olds, which showed that intakes of energy and macronutrients estimated by Intake24 were within 1% of estimates by interviewer-led recalls on average [4]. Limits of agreement (within which 95% of estimates lie) for energy ranged from an under-estimate of 48% to an over-estimate of 82% for 11-16 year olds and an underestimate of 50% to an over-estimate of 97% for 17-24 year olds. The validity of energy intakes reported using Intake24 was also assessed against concurrent measurement of total energy expenditure using doubly-labelled water in 98 UK adults (40-65 years) [35]. Energy intake reported with Intake24 was moderately correlated with objectively measured total energy expenditure and underestimated on average to the same extent as seen with interviewer-led 24-hr recalls and estimated weight food diaries. There are over 2400 photographs of more than 100 foods for portion size estimation used in the Intake24 system. These have also been validated in a feeding study where estimations of portion sizes in food photographs were compared with estimations of known food quantities [36] For food consumed, food weight overestimated by 13% compared to 46% using the food models.

Prior to this 2018 pilot of Intake24 in SHeS, Intake24 was field tested in a sub-sample of the SHeS sample in 2015/16 to examine the feasibility of using it in the wider Scottish population [34]. One thousand people that had previously taken part in the Scottish Health Survey (SHeS) (aged 11 years and over) were invited to take part in testing. The sample was stratified by age, gender and SIMD with oversampling in sub-sets of the population in which digital technology adoption and frequency of use is known to be low (including older people and those living in the most deprived areas). Respondents were asked to complete four recalls using Intake24 and to provide feedback on the system. Of those who were considered eligible to take part in the field testing of Intake24, 57% agreed to take part; of these respondents who agreed, 29% completed the four recalls requested (*see* Figure 1 in Rowland *et al*, 2018). Key findings from respondent feedback showed that respondents found the system user friendly and enjoyable to use and over 80% agreed that the system was easy to follow and understand. Over 75% of

respondents agreed that Intake24 accurately captured their dietary intakes and 79% felt they could complete Intake24 in a reasonable time (see [5, 34] for further details). Whilst this feedback about Intake24 was encouraging, the completion rates were lower than hoped for. This was however considered to reflect the recruitment strategy and instruction methods used rather than the acceptability of Intake24. That is, no second reminder was sent to respondents if recalls were not completed and there was no face-to-face interviewer presence as respondents were sent emails/texts asking them to complete their recalls (*see* [34] pages 66-71 for more details).

The above field test allowed development of recommendations for future use of Intake24 in national surveys including; using a face-to-face interview to briefly explain and encourage participation (face-to-face interviewers already present in SHeS data collection), tailored reminders to prompt respondents to complete their recalls and reminders for those not completing their recall. These recommendations, as well as requesting two rather than four recalls are tested in this current pilot to examine the impact on response rates.

2.3.2 Intake24 Dietary Feedback

Findings from the above mentioned field-testing of Intake24 in SHeS 2015 noted that the majority (75%) of respondents wanted to receive feedback on their diet [5]. In response to this, a tool was developed for this 2018 pilot study to give individual dietary feedback to respondents based on the food and drink input into Intake24 (see Appendix C). The feedback for this pilot study was adapted to be specific to the Scottish population (e.g. showing links to the FSS Nutrition pages). This respondent feedback is an optional 'add on' to Intake24 surveys. The feedback is based on an average of all recalls submitted by an individual, therefore the more recalls completed by the respondent, the more accurate the feedback on the respondent's overall diet. After submitting the requested two recalls, the respondents in this pilot were able to view their dietary feedback.

3 Methodology

3.1 Recruitment

All SHeS participants aged 11 or over in all households in the core sample (including the biological module sample[8]) allocated across the six months from July to December 2018, were eligible to take part in the Intake24 pilot. Scottish Health Survey interviewers were issued with additional instructions for the pilot study and given training on the process and the use of dongles via telephone and sent additional materials in their usual monthly allocation packs prior to the implementation of the pilot. Eligible participants were invited to take part by their SHeS interviewer after completing the SHeS core interview. The invitation, read by interviewers from the screen of their interviewing device, was:

"We would like you to complete an online food diary called Intake24. It's easy to complete and should only take around 20 minutes. We'd like you to complete it today and then a second time in the next week or so. You'll be asked to give details about the food and drink you had the day before.

Everyone who completes the diary twice will get a £20 shopping voucher and you can get feedback on your diet if you like. We'll also ask you what you thought of the diary."

At this point respondents were also provided with an Intake24 information leaflet, including a specific version for children where applicable (Appendix D).

After being read the invitation text and provided with the information leaflet, all respondents were then asked if they would be happy to take part. Respondents had the option to:

1. Complete the online dietary recall without interviewer support
2. Complete the online dietary recall with interviewer support / has no internet
3. Refuse to complete the online dietary recall

Respondents who were willing but required interviewer support, or not willing, were asked why they had selected this response; Interviewers were also able to "autocode" the reason if it has been given unprompted or if it was evident without asking. When respondents were aged 11-15 years (child) their parent/guardian was asked if they were happy for the child to take part. If the parent/guardian provided consent, the child was then asked if they were willing to take part. If either the parent/guardian or the child was not willing, then the child was not eligible to take part.

[8] The SHeS biological module is the part of the interview where additional biological measurements and samples (e.g. blood pressure, waist measurement and saliva samples) are taken from a sub-sample of respondents.

3.1.1 Incentives

All respondents who completed two (or more) dietary recalls received a shopping voucher loaded with £20 of credit. Receipt of the shopping voucher was not conditional on completing without support, completing the dietary recalls on the dates set, or on completing the feedback questionnaire.

Respondents who provided an email address (including an email address of someone on their household which acted as a proxy) were sent an Amazon shopping voucher via email. Respondents who did not provide an email address were sent a Love2Shop shopping voucher in the post. Of respondents who completed two or more dietary recalls, around 90% of respondents provided an email address and therefore received an Amazon shopping voucher, via a 'thank you' email (Appendix F).

After completing their second dietary recall, respondents were also given the opportunity to view personal dietary feedback, based on the data they provided. This feedback was optional, but also served as an additional incentive for respondents to take part.

3.2 Access to Intake24

For respondents completing their first online dietary recall without interviewer support, the main method for accessing Intake24 was by clicking a URL link (access link) sent to them in an email or text message immediately after they consented to take part and had provided necessary contact details.

The requirements to process sending the instant message(s) were:

- An internet connection for the interviewer's Computer-Assisted Personal Interview (CAPI) machine[9]
- Respondent contact details
- A pre-assigned sample loaded into Pure360 software

3.2.1 Internet Connection

All Intake24 interviewers were given a 3G dongle prior to fieldwork, which was plugged into the CAPI devices to create a localised internet connection. The dongles were loaded with a sufficient amount of 3G data. Interviewers were also given instructions for using the dongles.

Interviewers plugged in their dongle when respondents were reading the information leaflet, after they had read out the invitation text. Connecting to the internet normally took around one minute after plugging in the dongle.

[9] A face-to-face data collection method in which the interviewer uses a tablet, mobile phone or a computer to record answers given during the interview.

3.2.2 Respondent Contact Details

Respondents were asked to provide an email address and/or a mobile phone number (if they possessed a mobile phone which could access the internet). Interviewers explained to respondents that this was being collected so that they could be sent an access link for their dietary recall. Providing these details was optional, and respondents were able to refuse, or provide a "proxy" email or phone number as an alternative. It was stipulated that a "proxy" email address or phone number must belong to another adult in the household.

Of respondents asked, 98% provided either an email address or mobile phone number, 90% gave an email address, 79% gave a mobile phone number, and 75% provided both. When an email address and phone number were provided the respondent received an email and a text message.

Interviewers recorded the contact details into their CAPI machines, and also recorded whether they were "direct" (belonging to the respondent) or "proxy". Direct messages were worded slightly differently to proxy messages, but both contained the same information.

3.2.3 Pre-assigned Sample Loaded into Pure360

Prior to fieldwork, a sample of all potential Intake24 respondents was created, this included a possible 12 respondents per household (the maximum number allowed in SHeS). Each potential respondent was given a unique identifier, and a unique access link. Additional, initially blank, sample fields were also included for information collected within the SHeS / Intake24 interview e.g. respondent name, title, email address, and phone number, which were then merged into the messages.

This sample file was then loaded into Pure360, a software package that can be used to send automated email and text messages, based on a specified template. For example, below is the template used for Intake24 instant text messages (direct), including merge fields ("XXX") for information derived from the pre-assigned sample and questionnaire responses:

Sender name: ScotCen Social Research

Send to: "XXX" (mobile phone number provided by respondent)

Message text: "Please complete your first Intake24 diary today at "XXX" (unique access link pre-assigned).

The template used to send instant emails, which contained more text and additional merge fields, can be seen in (Appendix E).

3.2.4 Sending the Instant Message

When an internet connection had been established and respondent contact details had been collected, the CAPI questionnaire was programmed to send the collected details to

the Pure360 sample and instruct for the email and or text message to be sent. Messages normally took around five minutes to arrive with the respondent (or proxy), depending on the strength of the 3G connectivity.

Respondents were then able to click on the unique link sent to them, which redirected to their Intake24 dietary recall, without the requirement for them to enter a username or password. Furthermore, the respondent's unique identifier was then linked to their Intake24 data, meaning data collected here could be easily linked to their SHeS responses.

3.2.5 Access Sheet

All households were also provided with a hard copy "Access sheet". This contained a generic access link to Intake24, and a unique access code for all respondents in the household who consented to take part. This therefore acted as a means of accessing an Intake24 dietary recall for respondents who were willing to take part but unable to do so without interviewer support and/or had no internet, and those who did not / were not able to provide an email address, and also as a contingency for those who did.

For every address they were assigned to visit, each interviewer was provided with:

- an access sheet, with instructions for respondents accessing their Intake24 dietary recall via the generic link and the unique access code, as well as a blank grid with column headers: "person number", "name", "Intake24 code", and "2nd diary day" see (Appendix G)

and

- an access code label sheet, which contained the pre-assigned unique access codes for each of the 12 potential respondents in the household, printed on to separate sticky labels

After the instant emails had been sent, the CAPI questionnaire was programmed to provide the interviewer with the information required to fill in the blank access sheet for the household. This included the person number, name, unique access code, and second dietary recall day for each respondent who had consented to take part.

The person number, name, and second dietary recall day (calculated by the CAPI programme, see section below where this is covered in more detail) were written onto the access sheet by the interviewer. The unique access code was peeled from the access code label sheet and stuck onto the access sheet. This decision was taken to ensure the unique access codes were clearly legible.

3.2.6 Allocation of Dates for Intake24 Recall Completion

All respondents were asked to complete their first Intake24 recall for the 24 hours of the day before their SHeS interview. They were also all automatically allocated a date to complete their second dietary recall (Diary 2) and notified of this date on their Access sheet (see section 2.3.1) and through text and email reminders. The aim was to facilitate

each respondent completing one dietary recall which recorded their dietary behaviours on a week day, and another on a weekend day. Intake24 recalls are completed in relation to dietary behaviours on the previous day. Therefore, recalls completed on a Sunday or Monday were classed as weekend recalls (as they recalled dietary behaviours on a Saturday and Sunday), and recalls completed on any day between Tuesday and Saturday were classed as weekday recalls (as they recalled dietary behaviours on a Monday - Friday).

Respondents whose first dietary recall day (the day of their SHeS interview) was a weekend recall day (Sunday or Monday) were then randomly assigned, by the questionnaire program, a Diary 2 date that was a weekday recall day (Tuesday – Saturday) within the next 10 days. Conversely, those whose first dietary recall day was a weekday recall day (Tuesday – Saturday), were randomly assigned a Diary 2 date that was a weekend recall day (Sunday or Monday) within the next 10 days. Of respondents who completed two dietary recalls, 75% completed one weekend recall and one weekday recall. The remaining 25% were included in the analysis and completed either two weekdays, or two weekend days.

3.2.7 Telephone Interviews

Respondents who were unable to complete their Intake24 dietary recall without support were taken through their first dietary recall with their interviewer on the CAPI device, and their second dietary recall on the phone with a member of the research team at Newcastle University (NU). Respondents completing their second dietary recall via telephone interviewer were left a food portion atlas [37] by the NatCen interviewer after the first dietary recall was completed. This contained food photographs with different portion size amounts.

Researchers at NU were sent a notification email when a request for a respondent telephone interview was sent via a secure data transfer platform (FTP) by ScotCen, which included details about the preferred day and time for the researcher to call. Respondents were called at the requested time where possible either to carry out the recall if the day type (e.g. weekday or weekend day) was appropriate, or to arrange an alternative suitable day and time for the phone call to obtain information about their food and drink intake. Respondents were asked to make sure they had the food portion atlas with them so that they could use this to estimate the amounts of foods and drinks they had.

During the interview, the NU researcher asked the respondent to list all foods and drinks consumed the previous day. After this ‘quick list’, the researcher asked for further information and details about the items, including the time consumed, cooking/preparation processes, brand information, and additional details (e.g. skimmed, semi skimmed or whole milk). Respondents were prompted for commonly missed items (such as milk and sugar in tea or coffee, butter on spread on toast etc.). To estimate portion sizes, respondents were asked to turn to the page in the atlas specific to the reported food and to choose the most similar portion size from the food photos that they consumed. All information was repeated back to the respondent and they were prompted again to ensure no foods/drinks were missed.

This method was designed to provide very similar answers to those that might have been given had the respondents completed an Intake24 dietary recall online. The interview sheets were entered into Intake24 under the respondent's access code and included in the dietary analysis (if appropriate).

3.3 Reminders and Thank-you Letters

Respondents who provided an email address and or mobile phone number were sent reminder messages, which were also processed using Pure360. The reminder messages included:

- **Diary 1 chase** - Text / email received on morning / afternoon of the day following the day scheduled for Diary 1 (day of SHeS interview) if Diary 1 was not completed on the scheduled day
- **Diary 2 reminder** - Text / email received on morning / afternoon of the day scheduled for Diary 2
- **Diary 2 chase** - Text / email received on morning / afternoon of the day following the day scheduled for Diary 2, if Diary 2 was not completed on the scheduled day

There was a direct and proxy version of each of the above automated messages, which contained slightly different text. All of the reminder and chase messages included the web link and log in details for the respondent to access their dietary recall (Appendix H) Respondents were able to "unsubscribe" to the messages at any time by clicking an "unsubscribe" link in the messages.

If a respondent (who provided an email address and phone number) completed their dietary recall after receiving the reminder / chase text in the morning, they would still receive the reminder / chase email in the afternoon as this was an automated process.

Finally, all respondents who completed two dietary recalls were sent a thank you letter with their incentive vouchers enclosed.

3.4 Respondent Feedback Questionnaire

After completing two Intake24 dietary recalls, respondents were invited to complete an online feedback questionnaire, which contained 22 closed questions. Ten of the 22 questions were part of an established usability scale, responses from which are covered in more detail in Section 3.4.1. If the respondent indicated that they had experienced an issue with: "logging in", "finding foods", "portion sizes" or "missing foods" they were asked to explain their issue in open text. This feedback was monitored throughout fieldwork and issues raised which required correction were acted upon wherever possible. Completing the feedback questionnaire was optional, and not a requirement of the conditional incentive. For full findings of the feedback questionnaire see Appendix J.

3.4.1 System Usability Scale

Within the respondent feedback questionnaire, ten questions based on the System Usability Scale (SUS) [38] were asked, which allows tools to be given a quantifiable score

of usability and enables comparisons to be made between Intake24 and other tools. The questions asked in this feedback were adapted from the original SUS questions by study researchers as it was thought the meaning of some of the original questions was not very clear for respondents, and that some respondents may find them difficult to answer. The original and amended questions are shown in

Table 3.

Table 3. Original and amended System Usability Scale questions

Q	Original SUS question[1]	Reworded SUS question
1	I think that I would like to use this system frequently.	I would like to use Intake24 often.
2	I found the system unnecessarily complex.	Intake24 was too complicated.
3	I thought the system was easy to use.	Intake24 was easy to use.
4	I think that I would need the support of a technical person to be able to use this system.	I would need help using Intake24.
5	I found the various functions in this system were well integrated.	The different parts of Intake24 worked well together.
6	I thought there was too much inconsistency in this system.	Intake24 was too inconsistent.
7	I would imagine that most people would learn to use this system very quickly.	Most people would learn to use Intake24 quickly.
8	I found the system very cumbersome to use.	Intake24 is awkward to use.
9	I felt very confident using the system.	I felt very confident using Intake24.
10	I needed to learn a lot of things before I could get going with this system.	I needed to learn a lot about Intake24 before I could use it.

[1] *[38]*

Respondents were given five options on a Likert-type scale to choose from 1 (strongly agree) to 5 (strongly disagree) to rate the statements. The individual respondent scores were re-coded in line with the SUS analysis protocol [38] and analysed using IBM SPSS Statistics version 25. SUS scores were analysed as a whole group and by age group. A

one-way ANOVA and Post Hoc tests were carried out to assess between age group differences.

3.5 Interviewer Feedback

Each of the 53 interviewers who worked on Intake24 were asked to complete a short online feedback questionnaire, after the finalisation of fieldwork. The Interviewer feedback questionnaire consisted of 15 open-text and closed questions which aimed to glean interviewers' insights into delivering Intake24 on a number of key elements, including: how the instruction, introduction, consent, and set up phases of delivering Intake24 could be improved, the role and effectiveness of the incentives in increasing response, the impact of Intake24 on delivering SHeS, and where interviewers felt Intake24 could best be incorporated into the current SHeS questionnaire.

3.6 Data Linkage

With permission from the Scottish Government Public Benefits and Privacy Panel (PBPP) (ref 2019-0005) on 2nd October 2019, the Intake24 dataset was linked with the 2018 SHeS data for respondents who completed two or more Intake24 dietary recalls. A data sharing agreement was drawn up between the Scottish Government, FSS, ScotCen and Newcastle University (NU) to facilitate the linkage. The SHeS data that was linked with the Intake24 data included the SHeS EHM and FVM, gender, age, BMI, SIMD and date of interview.

To maximise respondent confidentiality, the extent of sharing of personally identifiable data between ScotCen and NU was minimised. The linkage process involved NU first securely sharing the cleaned Intake24 dataset with ScotCen, then this was linked to the SHeS dataset by NatCen data managers using the Intake24 unique access codes and SHeS serial numbers and the linked dataset was then securely transferred back to NU with all personally identifiable information and non-relevant SHeS data removed. NU therefore only ever saw the Intake24 unique identifier.

3.7 Analysis

3.7.1 Response Analysis and Intake24 Weighting

Analysis of response to Intake24 focused on two key indicators; consent to take part in Intake24, and completion of two (or more) dietary recalls. Logistic regression analysis was carried out to measure any significant (to 95% confidence) impact of four (demographic) dependent variables on the two key indicators. The dependent variables were: age, SIMD, BMI, and gender. Comparisons and significance of differences were assessed between: the whole SHeS sample and the cohort who consented to take part in Intake24, the whole SHeS sample and the cohort who completed two or more Intake24 recalls, and the cohort who consented to take part in Intake24 and the cohort who completed two or more Intake24 recalls.

Prior to analysis, the Intake24 data was weighted to help to minimise any bias due to differential non-response at the household level (using auxiliary data from census and interviewers' observations) and ensure that the age and gender distribution of the achieved sample matches the population distribution. The Intake24 weight incorporated the main SHeS survey weight, which is developed by the Scottish Government. The SHeS weight addresses a number of sources of bias:

- **Differential selection probabilities (within addresses)** – Data are weighted to take account of the fact that respondents living in large households, or in households where there is more than one dwelling unit per address, have a lower chance of being included in the sample than people living in single adult households and addresses with only one dwelling unit
- **Non-response** – Certain population subgroups are more likely to participate in social surveys. For example, lower rates of survey cooperation have been found among those who are disadvantaged and higher rates among those households containing dependent children, carers and pensioners [39]. These groups can end up being either under-represented or over-represented, which can lead to bias in the survey estimates. Differences between responding and non-responding households are identified using postcode sector level information from the census and interviewer observations about addresses (covering, for example, the type of the property, condition of the property relative to other properties in the area and barriers to entry). The response behaviour of all sampled households can thus be modelled and non-response weights created to adjust for these differences and bring the profile of responding households into line with those that were issued

The final stage of the weighting (calibration) adjusts the weights to ensure that the weighted sample matches the Scottish population in terms of the distribution of age and gender, based on mid-year estimates from the National Records of Scotland. The various stages of weighting result in a single, user-friendly weighting factor, which ensures that the sample profile reflects that of the adult Scottish population as closely as possible.

The SHeS weight adjusts for bias in participation in the SHeS survey overall. The Intake24 weight added to this by correcting for bias in participation in this Intake24 pilot – an extension of the 'non-response' correction detailed above.

An Intake24 weight was calculated separately for adult (16+ years) and child (11-15 years) respondents, and then rescaled so that adult and child respondents could be analysed together.

The basis for the adult weight was the weight from the SHeS survey, which adjusts for the probability of selection into SHeS and non-response to the SHeS survey. This weight was rescaled to a mean of one for all adult SHeS respondents eligible for the Intake24 survey. Weights were then adjusted for non-response. To derive the non-response model, a list of possible independent predictors was developed from variables considered in non-response weighting of other SHeS subsamples. Forwards and backwards stepwise logistic regression models were then run for all eligible respondents with response to Intake24 as the dependent variable and the independent predictors described above weighted by the SHeS weight. Any variable with a significant association with response was included in the non-response model.

The final non-response model included: age and gender, number of adults in household, times in the last week people in the household ate a main meal together, economic activity of respondent, whether the respondent has a long standing illness, highest educational qualification, urban/rural classification, number of natural teeth, whether the respondent did any gardening/DIY/building work in the last four weeks, BMI category, whether there are persons smoking in the house, and health board code.

A non-response weight was calculated as the inverse of the predicted probabilities from the non-response model. These were trimmed at 99%. The final Intake24 adult weight was calculated by multiplying the SHeS weight by the Intake24 non-response weight. The final Intake24 adult weights were then rescaled to have a mean of one.

There were not enough children eligible for the Intake24 survey to run a non-response model. Therefore, a different strategy to adjust for non-response in child Intake24 respondents was used. First, an initial child weight from the SHeS survey (which accounts for probabilities of selection in SHeS and non-response to the SHeS survey) was rescaled to a mean of one. This weight was then calibrated to population totals of gender, times in the last week people in the household ate a main meal together, and SIMD quintile derived from the SHeS survey to create the final Intake24 child weights.

To combine the Intake24 adult weights and the Intake24 child weights into a final combined Intake24 weight, the adult and child weights were rescaled to ensure the ratio of adults to children in the survey matched the ratio in the 2018 Mid-year Population estimates in Scotland.

3.7.2 Nutrient Data Analysis

Data cleaning (*see* Section 7.4 in [34]) was carried out in Microsoft excel and statistical analysis was performed using IBM SPSS Statistics version 25. Analysis was carried out on cleaned data including only those respondents who had completed at least two days' recall using Intake24, regardless of the day type (i.e. weekdays or weekend days). For those that completed more than two recalls, the first two recalls were chosen to be included in the analysis due to the possibility of respondents receiving dietary feedback after this, which may have influenced subsequent dietary intake. Statistical analysis was carried out on weighted data unless stated.

3.7.3 Data Quality Checks and Underreporting

Food level data entered by the respondent was examined by a nutritionist for mistakes and missing foods – this is required for all recalls and is a time consuming process, however it is still much quicker than manual collection of dietary data (such as coding self-report food diaries). Items identified as needing amending were manually coded and the appropriate nutrient information added. Nutrient information was calculated using the VLOOKUP function with the appropriate food code from the NDNS food composition table [40] and food portion sizes were calculated either by duplicating the previously reported amount by the respondent if available (i.e. if the food had been reported by the respondent at a different time), or by using average portion sizes [41]. Foods that were added by respondents using the 'missing foods' function were coded and weights and nutritional information calculated as detailed above. The weight of foods and drinks were

checked using the 'Reasonable amount' flag inbuilt in Intake24 which highlights foods/drinks with particularly large weights. These foods were checked and amended if it was deemed to be very unlikely that this was the amount consumed. Histograms of macronutrients and daily energy calculations were carried out to check the distributions of nutrients to identify any extreme intakes which were then checked.

Recalls were also checked for very short completion times. Those completed in two minutes or less were examined and those recalls that had fewer than five food or drink items were checked and removed if deemed to be incomplete recalls. Those days with the sum of energy over 4000kcal (n=4) were examined and amendments to the food portion weights were made where likely errors in the entry of portion size were identified (e.g. 700g Smarties which would not have flagged as 'not a reasonable amount' in terms of weight of a food). Recalls with energy intake under 400kcal were also examined and case by case decisions were made as to whether the recall could be considered complete. These 'cut-off' values for total energy and recall time were arbitrary values determined by nutritionists working on Intake24 based on knowledge and experience of dietary recalls. To our knowledge there is no published guidance on how to determine cut off values. Food portion weights were determined by using a previous weight of the same food consumed by the individual, or if this was not available, and average food portion size.

3.7.4 Details of Amendments

There were 172 items reported as 'missing' through the missing foods function (<0.1% of all foods entered) (*see* Section 7.5 [34] for further information). In addition, there were 799 (<2%) foods that were not recorded, due to multiple foods being reported on one line, despite the prompt shown in Figure 1 asking that they be reported separately, these were therefore coded appropriately by a nutritionist and added. Forty-five foods were amended (<0.1% of all foods entered) due to incorrect recording by respondents e.g. respondent had entered 'broccoli soup' but then chosen 'broccoli, boiled' from the foods list. These food codes were amended and appropriate nutritional information added based on average portion sizes of the particular food/drink [41]. These amendments are carried out on all Intake24 surveys, and instructions are provided to those who use the tool.

3.7.5 Time Analysis

Analysis was carried out to examine how long respondents took to complete a recall using Intake24. Due to respondents being able to start a recall and then complete it later on, there were some recalls with very long times and therefore the data were heavily skewed. So that the analysis would give meaningful results, a pragmatic approach was taken to include those respondents who would had on average, completed, Intake24 recalls within one hour and within two hours. Analysis was also carried out on all data up to the 95th percentile. This data remained skewed and therefore the median and interquartile range (IQR) are presented. Analysis was carried out on the average recall time over the two days, for all respondents (adults and children) who completed Intake24.

3.7.6 Intake24 Nutritional Analysis

Dietary data are reported as a two-day average for adults (those aged 16 years and over). It must be noted that it was not possible in this analysis to separate white processed meat from red processed meat and therefore both are included in this food group. The SDG does not include white processed meat in the recommendation.

Table 4 describes how individual food groups and nutrients were calculated.

To accurately calculate foods contributing to food groups in Intake24 (such as fruit and vegetables, red and processed meats, oily fish etc.) in both whole foods and within composite dishes, a disaggregation process was used. This approach, ensured for example, carrot sticks eaten as a snack as well as the mixed vegetables in Bolognese sauce in an evening meal were counted towards the 'vegetables' food group. This food group disaggregation work had been previously carried out in collaboration with the MRC, Cambridge (unpublished). Briefly, the process involved calculating the percentages of food groups within a food and this percentage, along with the weights of the foods reported in Intake24, was used to calculate the grams of foods contributing to each food group for every food reported, for example, 100% of the weight of carrot sticks and 30% of the Bolognese sauce weight would count towards the vegetables food group.

Using this method allows fruit and vegetable components, as well as red and processed meat in dishes to be included in food group analysis and so count towards dietary goals. It must be noted that it was not possible in this analysis to separate white processed meat from red processed meat and therefore both are included in this food group. The SDG does not include white processed meat in the recommendation.

Table 4. Methodology used for calculation of food groups and nutrients in dietary analysis

Food Group/Nutrient	Method used
Fruit	Canned fruit (fruit only), Cooked fruit and Fresh fruit = the weight (g) of these were summed and divided by 80g. 80g is equal to one portion. There is no cap on the number of portions
	Dried fruit = the weight (g) of dried fruit were summed and divided by 30g. 30g is equal to one portion. There is no cap on number of portions.
	Pureed fruit, Pureed vegetables, Fruit juice and Vegetable juice = the weight of these were summed and divided by 150. 150 ml is equal to one portion. There is a cap at 1 portion.
Vegetables	Canned vegetables, Cooked vegetables, Dried vegetables and Fresh vegetables = the weight (g) of were summed and divided by 80g. 80g is equal to one portion. There is no cap on number of portions.

Food Group/Nutrient	Method used
	Beans and pulses = the weight (g) of these were summed and divided by 80g. 80g is equal to one portion. There is a cap at 1 portion.
Red and processed meats	Red and processed meat content was calculated through the disaggregation work as stated above. This method includes all red meat and all processed red and white meat (cooked). *Note:* this differs from the SDG where white processed meat is not included.
AOAC fibre (g) [2]	Englyst fibre (g) multiplied by 1.33 conversion factor
Carbohydrate % total energy	Calculations carried out on the sum nutrients/ day/ person. Total weight CHO (g) * 3.75[3]/total energy (Kcal) * 100
NMES % total energy	Calculations carried out on the sum nutrients/ day/ person. Total weight NMES (g) * 3.75[3]/total energy (Kcal) * 100
Total fat % food energy	Calculations carried out on the sum nutrients/ day/ person. Total weight fat (g) * 9/total energy (Kcal) (excluding energy from alcohol) * 100
Saturated fat % food energy	Calculations carried out on the sum nutrients/ day/ person. Total weight sat fat (g) * 9/total energy (Kcal) (excluding energy from alcohol) * 100
Protein % total energy	Calculations carried out on the sum nutrients/ day/ person. Total weight protein (g) * 4/total energy (Kcal) * 100

[2] [42] [3] [43]

3.7.7 Individual Level, Fruit and Vegetable Agreement Analysis

The agreement between the number of portions of fruit and vegetables reported in Intake24 and the number reported using the FVM (see section 2.1.1) was assessed by calculating the ratio of an individual's daily fruit and vegetable portions in Intake24 to the number reported in the FVM. This analysis was for those who completed the SHeS FVM for the same day as their first Intake24 recall was reported for. All values of zero were changed to 0.1 to avoid division by zero. Checks for normality were carried out and as the data was not normally distributed, analyses were performed on logged data and then back transformed. In order to minimise the effect of outliers, the geometric means are presented.

The method of Bland and Altman [44] was used to look at the mean agreement (indicating population level agreement) and limits of agreement of the two methods

(Intake24 and FVM). Limits of agreement were applied so that 95% of the individual differences lie between the limits, this is calculated by:

d±2s (where d=mean difference, s=standard deviation of the differences)

3.7.8 Food Group Comparisons

In addition to the direct comparisons that can be made between Intake24 and the FVM (i.e. comparing the fruit and vegetables reported for the same day using each method), some indirect comparisons can also be made in regards to food groups reported through Intake24 and the EHM (2.1.1) Both the FVM and Intake24 ask about what respondents have eaten 'yesterday' and therefore the answers are directly comparable; however, the questions in the EHM are about usual eating habits – hence, the comparison between the methods is indirect. Whilst not directly comparable, this analysis gives an indication of the similarities and differences of food groups reported through the SHeS dietary data collection methods and Intake24.

The food types examined in this analysis included respondent's 'usual type' of milk (e.g. semi/skimmed milk and whole milk) and bread (wholemeal/brown/granary bread and white bread). In addition, the reported amount of consumption of some food groups (non-diet soft drinks, sweets and chocolate, crisps, and biscuits) through EHM and the food reported using Intake24 was examined. In the EHM, respondents are also asked about how often food groups such as sugary drinks, sweets or chocolate, crisps and biscuits are consumed (e.g. x times a day/week/month, less often or never). For the 'usual type' questions in the EHM, the type of food was compared with the type reported in Intake24, and those reporting the same type were classed as a 'Match' (e.g. report skimmed milk as usual milk type consumed through EHM and reported consuming skimmed milk through Intake24). For the 'how often' questions, respondents consuming a food group 'once or more a day' were compared to the food and drinks reported using Intake24, if the answers were the same they were classed as a 'Match' (e.g. a respondent had reported they usually consume biscuits once or more a day and they reported consuming biscuits in Intake24).

3.8 Ethics and information security

3.8.1 Ethical Approval

Ethical approval was sought for the Intake24 pilot as a substantial amendment to the SHeS 2018 ethical approval (REC reference 17_WA_0371) and granted on 25th April 2018. The ethical approval covered the incorporation of Intake24 into the second half of SHeS 2018 fieldwork, sampling and recruitment processes, incentives, informed consent, data security and data analysis.

3.8.2 Data Security

Intake24 was deployed using secure HTTP (HTTPS) protocol to exclude any possibility of data interception. The system was accessed using a unique ID and no personally

identifiable data is collected. All Intake24 data was stored securely at NU for the duration of the pilot in accordance with the University's data protection policies. Electronic records were backed up on the University's shared filestore service which is hosted across two data centres and was equipped with fire detection, suppression equipment and secure audited access procedures.

Only members of the core ScotCen and NU research teams had access to the data. Data was anonymised with a unique access code. All results were presented in summarised tabulated form and no information is attributable to individuals. At the end of the pilot the anonymised dataset was lodged indefinitely and archived (in anonymous form) alongside the rest of 2018 SHeS data at the UK Data Archive, Economic and Social Data Service at Essex University. Web address: www.data-archive.ac.uk.

The online feedback survey, held on UI (Unicom Intelligence) was transmitted directly to a secure server hosted at NatCen, which has full IG Toolkit compliance. All data collected by the UI form were transmitted securely using SSL and were immediately encrypted using AES. Thus, the data during transmission and when stored on the secure server will be encrypted and secure. The server has full back-up facilities, security based on BS7799 and business continuity. NatCen is registered under the Data Protection Act and all systems and process complied with its obligations. NatCen holds certification to the Information Security Management standard ISO27001.

4 Intake24 Response[10]

4.1 Fieldwork Procedure Overview

Intake24 fieldwork took place from July 2018 – February 2019. Eligible respondents were introduced to the Intake24 study after completing the SHeS core questionnaire. Those who consented to take part in Intake24 were provided with the necessary access details and asked to complete a dietary recall on the day of their SHeS interview and another dietary recall on an allocated day within 10 days of their SHeS interview. Of respondents who were willing to complete Intake24, around 97% stated that they were willing and able to complete without interviewer support.

Respondents were sent an email and/or text message reminder on the day scheduled for their second dietary recall. For each recall an email and/or text message reminder was sent the day after the allocated day if they had not completed yet. A £20 conditional shopping voucher was offered at the recruitment stage and sent only to those who completed two dietary recalls.

Table 5 sets out the predicted participation rates at the design phase of the pilot and the final achieved fieldwork figures.

Table 5. Intake24 Pilot estimated participation rates

	Target	***Achieved***
	n= / %	**n= / %**
Estimated eligible adults (16+)	2500	2254
Estimated eligible children (11-15)	250	132
Total estimated eligible individuals	2750	2386
% who agree to participate	85%	72%
No. who agree to participate	2338	1724
% responding to first recall	60%	79%
No. responding to first recall	1403	1363
% responding to second recall (as % of those who complete first recall)	85%	77%
No. responding to second recall	1192	1053
% completing 2 recalls from all eligible SHeS participants	43%	44%
% completing 2 recalls from all who agree to participate	51%	61%

[10] A total of 1056 participants completed 2 Intake24 recalls in the pilot study. However response data was only available for 1053 participants at the time of reporting due to a pilot study programming error. This error does not impact the key findings.

4.2 Response

Table 6 below shows the rate of consent to take part in Intake24, and completion of two or more Intake24 dietary recalls. Slightly more than 7 in 10 (72.3%) of eligible SHeS respondents consented to take part in Intake24. Of these, 79.1% completed one or more recalls and just over 3 in 5 (61.1%) went on to complete two or more Intake24 dietary recalls. Overall, this meant that 44.1% of eligible SHeS respondents completed 2+ Intake24 dietary recalls. This is marginally higher than the estimated participation rate of 43% of the eligible SHeS sample completing two or more recalls. However due to there being fewer eligible participants overall than estimated (2386 in this pilot compared to a predicted 2500), whilst the final number of respondents completing two or more dietary recalls was within the target range of between 1000 and 1500 participants at 1053 it was 139 less than the originally estimated 1192. There was little difference in response when comparing adults (16+ years) and children (11-15 years).

Of those who consented to take part (n= 1724), 79.1% (n=1363) responded to the first recall, a higher proportion than estimated, and 77.3% (n=1053) of those completed the 1st recall responded to the second recall, a slightly lower proportion than was estimated (85%). Therefore, among those who consented to take part but did not complete two or more Intake24 dietary recalls (n= 671), slightly less than half (46.2%, n=310) completed one Intake24 dietary recall only, and slightly more than half (53.8%, n= 361) completed none.

Respondents were asked to complete their first dietary recall on the day of their SHeS interview and then another on a specified day based on the aim of collecting dietary behaviour data from a weekday and a weekend day (see section 3.2.6). Of respondents who completed two or more Intake24 dietary recalls, 63.4% completed their first dietary recall on the day of their SHeS interview, and 75.4% completed one weekend and one weekday recall (20.6% completed two weekday recalls and 4.1% completed two weekend recalls).

Table 6. Consent and response to the Intake24 study, split for adults and children

	Adults	Children (11-15)	Total
Total eligible SHeS respondents	*2254*	*132*	2386
Total respondents who consented to complete Intake24	1622	102	1724
Total respondents who completed 1 recall only	290	20	310
Total respondents who completed 2+ recalls	998	55	1053
% consented to complete Intake24	72.0	77.3	72.3
% of consenting respondents who completed no recalls	20.6	26.5	20.9
% of consenting respondents who completed 1 recall only	17.9	19.6	18.0

% of consenting respondents who completed 2+ recalls	61.5	53.9	61.1
% of eligible SHeS respondents who completed 2+ recalls	44.3	41.7	44.1

4.3 Demographic Profile of Intake24 Respondents

Among adults there was a clear association between age and likelihood of providing consent to take part in Intake24 (Table 7). Those aged 65 and over were statistically significantly less likely to consent to take part (p=<0.001) compared with those aged 16-64 years. There was no statistically significant difference (p=0.455) in the proportion of children (aged 11-15) consenting to take part, compared with adults aged 16-64.

In terms of consenting to take part and then going on to complete two or more dietary recalls, it was only the older age category (aged 75 and over) who were significantly less likely to do so (p=0.008). Completion among those consenting was also statistically significantly lower for those aged 11-24 compared with those aged 25-64 (p=0.007).

Among all eligible adults, the starkest association between age and completion was among those aged 75 and over, who were significantly less likely to complete two or more recalls compared with all other eligible respondents (p=<0.001). Less than one in five (19.5%) eligible SHeS respondents aged 75 and over completed two or more recalls. Nearly half (47.8%) of eligible SHeS adults aged 11-74 completed two or more recalls, meaning those aged 75 and over were less than half as likely to complete two recalls compared with other age groups.

Those aged 75 and over were also significantly more likely to complete no recalls, after consenting, compared with all other age groups (p=0.002). There was no statistically significant association between age and the likelihood of completing just one recall (p=0.519).

Table 7. Consent and response to the Intake24 study, by age

	11-15	16-24	25-34	35-44	45-54	55-64	65-74	75+	Total
Total eligible SHeS respondents	132	170	243	316	390	416	412	307	2386
Total Respondents who consented to complete Intake24	102	145	195	262	303	323	273	121	1724
Total respondents who completed 1 recall only	20	34	29	44	61	53	47	22	310
Total respondents who completed 2+ Intake24 recalls	55	79	116	167	188	207	181	60	1053
% consented to complete Intake24	77.3	85.3	80.2	82.9	77.7	77.6	66.3	39.4	72.3
% of consenting respondents who completed no recalls	26.5	22.1	25.6	19.5	17.8	19.5	16.5	32.2	20.9
% of consenting respondents who completed 1 recall only	19.6	23.4	14.9	16.8	20.1	16.4	17.2	18.2	18.0
% of consenting respondents who completed 2+ recalls	53.9	54.5	59.5	63.7	62.0	64.1	66.3	49.6	61.1
% of eligible SHeS respondents who completed 2+ recalls	41.7	46.5	47.7	52.8	48.2	49.8	43.9	19.5	44.1

No statistically significant difference was observed between deprivation quintile and likelihood of consenting to take part in Intake24 ($p=0.335$) (Table 8). Those in the most

deprived quintile were significantly more likely to consent to take part but then not complete two recalls, compared with others (p=0.002). However, due to the higher level of initial consent among this group, there was no significant difference in the proportion of respondents completing two or more recalls by deprivation within the sample of all eligible SHeS respondents (p=0.131).

The prevalence of completing no recalls after giving consent was higher among respondents living within the most deprived quintile, although this difference was not statistically significant (p=0.067). However, the respondents in the most deprived quintile were significantly more likely to complete only one recall, compared with the rest of the sample (p=0.024).

Table 8. Consent and response to the Intake24 study, by SIMD

	1 (most deprived)	2	3	4	**5 (least deprived)**	**Total***
Total eligible SHeS respondents	378	536	449	504	452	2319
Total Respondents who consented to complete Intake24	278	379	328	362	311	1658
Total respondents who completed 1 recall only	55	61	42	49	45	252
Total respondents who completed 2+ recalls	153	244	223	228	201	1049
% consented to complete Intake24	73.5	70.7	73.1	71.8	68.8	71.5
% of consenting respondents who completed no recalls	25.2	19.5	19.2	23.5	20.9	20.9
% of consenting respondents who completed 1 recall only	19.8	16.1	12.8	13.5	14.5	18.0
% of consenting respondents who completed 2+ recalls	55.0	64.4	68.0	63.0	64.6	63.3
% of eligible SHeS respondents who completed 2+ recalls	40.5	45.5	49.7	45.2	44.5	45.2

* 67 of the sampled addresses are not included in the SIMD database (https://www2.gov.scot/Topics/Statistics/SIMD). Therefore, these addresses are excluded from SIMD analysis.

Among respondents for whom BMI was recorded, there was no statistically significant difference in levels of consent to take part (p=0.808) or completion of two or more recalls

(p=0.415) (Table 9). This seems partly due to the small base sizes within the "Underweight" and "Very obese" categories.

Those with no BMI recorded were significantly less likely to consent to take part (p=<0.001) and complete two recalls (p=<0.001).

Among respondents who consented to take part in Intake24 and from whom a BMI measurement was taken, there was no significant difference between BMI classification and completion of no recalls (p=0.869) or completion of one recall only (p=0.417).

Table 9. Consent and response to the Intake24 study, by BMI

	Under-weight	Normal weight	Over-weight	Obese	Very obese	Not collected	Total
Total eligible SHeS respondents	51	549	642	455	74	615	2386
Total Respondents who consented to complete Intake24	38	411	495	342	59	379	1724
Total respondents who completed 1 recall only	8	53	79	48	6	116	310
Total respondents who completed 2+ recalls	22	276	314	230	44	167	1053
% consented to complete Intake24	74.5	74.9	77.1	75.2	79.7	61.6	72.3
% of consenting respondents who completed no recalls	21.1	20.0	20.6	18.7	15.3	25.3	20.9
% of consenting respondents who	21.1	12.9	16.0	14.0	10.2	30.6	18.0

	Under-weight	Normal weight	Over-weight	Obese	Very obese	Not collected	Total
completed 1 recall only							
% of consenting respondents who completed 2+ recalls	57.9	67.2	63.4	67.3	74.6	44.1	61.1
% of eligible SHeS respondents who completed 2+ recalls	43.1	50.3	48.9	50.5	59.5	27.2	44.1

There was no significant difference in the likelihood of males or females consenting to take part in Intake24 (p=0.094) (Table 10). However, among those who consented to take part (p=0.013), and within the total eligible SHeS sample (p=0.003), females were significantly more likely to go on to complete two recalls. Males were significantly more likely than females to complete no recalls after consenting to take part (p=0.032), yet, after completing one recall, there was no statistically significant difference in the likelihood of completing the second recall between males and females (p=0.146).

Table 10. Consent and response to the Intake24 study, by gender

	Female	Male	Total
Total eligible SHeS respondents	1330	1056	2386
Total Respondents who consented to complete Intake24	979	745	1724
Total respondents who completed 1 recall only	169	141	310
Total respondents who completed 2+ recalls	623	430	1053
% consented to complete Intake24	73.6	70.5	72.3
% of consenting respondents who completed no recalls	19.1	23.4	20.9
% of consenting respondents who completed 1 recall only	17.3	18.9	18.0
% of consenting respondents who completed 2+ recalls	63.6	57.7	61.1
% of eligible SHeS respondents who completed 2+ recalls	46.8	40.7	44.1

4.4 Analysis of How Respondents Accessed Intake24

4.4.1 Google Analytics

Google Analytics (GA) is a tool used to measure website traffic and generate reports based on custom variables making it easier to understand user engagement of the system. It is the most widely used analytics tool on the internet. GA is used for two purposes in Intake24. The event tracking feature of GA is used to collect statistics on how often specific features of the system are used, for instance what percentage of users report a missing food and which prompts cause the users to click the contextual help button most often. This is necessary to identify features that need further development (or, conversely, features that are not used very often and therefore should have lower development priority), and what parts of the system cause confusion.

Approximately 2600 recalls were submitted, and during the survey period the missing foods button was clicked on 4,616 times with a total of 189 missing dishes/foods reported. About 7% of all submissions reported missing foods.

The contextual help button was used 2043 times (it is not possible to count exactly how many of those were by the same participant, but we estimate that about 20% of users used it), and eight people requested human assistance through the help request tool within Intake24 (according to GA data). The help button on the guide prompt is still by far the most frequently used (second is the food search prompt and the third is the meal time confirmation prompt).

The other important feature of GA is to identify platforms (mobile vs. desktop), operating systems and browsers that are used by the target audience to ensure that browsers used by a significant portion of the user base are well supported. The most popular browsers by far are still Chrome and Safari, Internet Explorer (IE) 11 is the third most widely used. Only a small number of people used older versions of IE.

In relation to how Intake24 was accessed, 58% of participants used laptop or desktop PCs, 25% used mobile phones and 17% used tablets. Apple iPhone and iPad comprised about 54% of mobile devices while the rest were Android based. The percentage of mobile users has been steadily rising since the system was first introduced.

4.4.2 Server-side Logs

In addition to logging critical errors, the system now also logs normal events such as successful survey submissions and failed log in attempts. Recording failed log in attempts allows identification of users that are unable to access the system due to mistyped usernames and/or passwords. This feature was very useful in identifying common causes for un-recognised passwords which are now handled by the password verification system.

4.4.3 Client-side Logs

A very detailed log of client-side system behaviour is collected during the survey, such as exactly what sequence of prompts was shown to the user, why those specific prompts were selected (i.e. which prompt rules were applicable and which were not), which items from the food list where clicked by the user and so on. This log is stored in the database together with the survey data on survey submission, and this data is used to identify problems in the client-side system logic, such as, for instance, prompts not being triggered correctly or user actions not being handled properly by the system.

4.5 Reasons for Consent Refusal

A little over one third of respondents who declined to consent to participate in the pilot gave that they were not interested in taking part as the reasons; this was the most common reason given (Table 11). Of the remaining who did not consent to take part, around one in four respondents said they had "no time", and around one in ten refused due to: "Illness", "Not comfortable with information being entered online", and having "Already answered questions about diet" (as part of the main SHeS questionnaire).

Table 11. Reasons for refusing consent to take part in the Intake24 study

Reason	% of those who refused*
Not interested	35
No time	24
Other	12
Illness	10
Not comfortable with information being entered online	10
Already answered questions about diet	9
Does not wish to give reason	6
Not feeling well	5
Not comfortable sharing information about diet	3

*Respondents were able to give more than one reason – 87% gave one reason, 12% gave two reasons and 1% gave three or four reasons.

4.6 Details of Help Requests

Respondents were able to make a request for help using the help function within Intake24 itself, via the NU support Intake24 email address, the NU telephone help request or through the NatCen Telephone Unit (TU).

There were 33 help requests received by the NU team, the majority (*n*=28, 85%) of these came through the support Intake24 email address which respondents are directed to during a recall if they require help or if they were unable to log on (Table 12). Most of the issues this small number of respondents encountered were with logging into Intake24 (*n*=25, 76%). Although respondents were provided with a link, which allowed them to directly access their Intake24 recall without using their log in details, some respondents contacted NU to say they were unable to log in. The NU researcher provided respondents with the survey link (Intake24.co.uk/surveys/health) and asked them to try to log in again with their access code. If they had forgotten their access code, NU passed their details to ScotCen team so that they were able to remind respondents of their codes. It is not possible to give details on how many of these queries were resolved as many respondents did not reply to confirm their issue was resolved and did not provide their access code for researchers to check whether they went on to complete a recall.

Table 12. Details of how NU team were contacted for help requests

Help requests	*n=*	*%*
Through Intake24 support email/phone request	28	85
Through NatCen referral/ScotCen email	5	15

4.7 Telephone Interviews

Fifty respondents requested a telephone interview with a NU researcher to carry out their dietary recall (Table 13). In general, these respondents were older adults without internet access. The majority of these (76%, *n*=38) were carried out without issues. One respondent on contact said they no longer wanted to take part. Researchers were unable to carry out interviews with the remaining 11 respondents after multiple attempts to call, and after leaving voicemail messages and text messages to arrange the recall. Demographics of those requesting a telephone interview are shown below (Table 13, Table 14 and Table 15).

The mean age of respondents was 70.9, with a mean BMI of 26.9 (classed as overweight). There were 19 males and 31 females requesting a telephone recall. The oldest respondent was 91 years old.

Table 13. Mean age and BMI of telephone request group

	Mean	**SD (±)**	**Min**	**Max**
Age	70.9	11.0	38.0	91.0
BMI	26.9	5.3	18.9	44.5
Unweighted bases	*Male*			*19*
	Female			*31*

There were no respondents below 38 years requesting a telephone recall. The majority (78%) of respondents were 65 years or older (Table 14).

Table 14. Number and percentage of telephone request group by age group

Age group	*n=*	*%*
16-24 years	0	0
25-34 years	0	0
35-44 years	1	2
45-54 years	4	8
55-64 years	6	12
65-74 years	21	42
75+ years	18	36
Unweighted bases	*Male*	*19*
	Female	*31*

The majority (60%) of respondents requesting a telephone recall were in the most deprived, or second most deprived groups (Table 15). Only four respondents requested a telephone recall from the least deprived group (8%).

Table 15. Number and percentage of telephone request group by SIMD quintile

SIMD quintile	*n=*	*%*
1 (most deprived)	15	30
2	15	30
3	5	10
4	11	22
5 (least deprived)	4	8
Unweighted bases	*Male*	*19*
	Female	*31*

4.8 Factors Influencing Response

Of those who consented to take part, participants who received an instant email and or text message were significantly more likely to complete two recalls than those who did not (p=<0.001) (Table 16). Those who received an email (including when receiving a text also) were significantly more likely to complete two recalls than those who only received a text (p=0.049).

Table 16. Recall completion by instant email and text message receipt

	Received email and text	Received email only	Received text only	Received neither email or text	Total
2+ recalls	789	160	62	42	1053
Not completed 2 recalls	444	101	62	61	668
% 2+ recalls	64.0	61.3	50.0	40.8	61.2
Base	*1233*	*261*	*124*	*103*	*1721*

There was no significant difference in the number of days between the SHeS interview date (planned first dietary recall date) and planned second dietary recall date (p=0.480) (Table 17). It was hypothesised the more time between planned dietary recall days would reduce completion of the second dietary recall, but this was not the case.

Table 17. Response to the Intake24 study, by total number of days between SHeS interview (planned first dietary recall day) and planned second dietary recall day

	2	3	4	5	6	8	Total
% no recalls	21.4	21.2	21.8	20.1	15.6	25.4	20.9
% 1 recall	22.2	18.4	17.6	15.7	20.7	13.6	18.0
% 2+ recalls completed	56.5	60.4	60.6	64.2	63.7	61.0	61.2
Base (those who consented to complete)	*248*	*364*	*404*	*408*	*179*	*118*	*1724*

4.9 Impact of Intake24 Pilot on SHeS Response

A key objective of the Intake24 Pilot was to minimise and monitor the impact on overall SHeS response rates. This objective was a consideration in every aspect of the data collection design. Table 18 gives an account of SHeS response rates pre and post the Intake24 pilot alongside the same periods of data collection for 2019, 2017 and 2016 to provide further context.

Table 18. SHeS 2018 Response before and during Intake24 pilot

	Addresses in scope	Productive addresses	Household response rate	Biological modules achieved against target
2018				
Jan-June (pre-pilot)	2676	1522	56.8%	85.5%
Jul-Dec (during pilot)	2970	1615	54.4%	91.4%
Difference			-2.4%	5.9%
2019				
Jan-June	2694	1566	58.1%	82.6%
Jul-Dec	2736	1519	55.5%	83.4%
Difference			-2.6%	0.8%
2017				
Jan-June	1939	1112	57.3%	79.2%
Jul-Dec	1973	1113	56.4%	77.3%
Difference			-0.9%	-1.9%
2016				
Jan-June	2031	1150	56.6%	77.8%
Jul-Dec	2019	1138	56.3%	83.1%
Difference			-0.3%	5.3%

There was a difference of -2.4% in the response rate in the second half of 2018 during the Intake24 pilot. However, this difference cannot be easily attributed to the Intake24 pilot having had a detrimental impact on SHeS household response rates. A similar number of biological modules were completed pre and during the Intake24 pilot. When considering these figures, it is important to take into account the following points:

- Household response rates in SHeS can vary from year to year often with no clear reason and comparisons between survey years provide limited insights due to the range of factors that can influence fieldwork outcomes
- There is no established pattern for biological module completion rates in the first and second halves of SHeS field years so it is unclear whether Intake24 influenced this
- SHeS household response rates tend to be lower in the second half of the field year (see 2016, 2017 and 2019 above)
- In 2018 a higher proportion of sampled addresses issued in quarters 1 and 2 of the survey year (43.2%) were re-issued than sampled addresses issued in quarters 3 and 4 of the survey year. (29.1%), a similar pattern was evident in 2017 when 52.8% of Q1-Q2 addresses were re-issued compared to 38.2% of Q3-Q4

addresses, this will have influenced higher response rates in the first half of the year

- Feedback from interviewers who participated in the Intake24 pilot provided no evidence that the introduction of Intake24 had a detrimental impact on response overall but one commented that it may have reduced participation in the biological module

4.10 Recall Time Analysis

Due to the skewness of the data, pragmatic cut offs of 120 minutes and 60 minutes were used as well as percentiles. Further information about the recall time analysis is in the methods (section 3.7.5). The average time to complete a recall when either of the cut offs were applied was less than 16 minutes (Table 19).

Table 19. Two-day average time to complete recalls for adults (16 years+) SD, min and max nutrient intake completing Intake24 recalls within 120 and 60 minutes

Time completed	*Mean*	*SD (±)*	*Min*	*Max*
120 minutes or less (all)	15.9	13.8	2.5	111.5
60 minutes or less (all)	14.5	9.6	2.5	58.5
Unweighted base	<120 mins			991
	<60 mins			972
Weighted base	<120 mins			986
	<60 mins			967

The times to complete recalls were examined and due to the data being skewed, only completion times within the 95th percentile of data were included in the time analysis. Although this normalised the data slightly, the data remained skewed, and therefore median and interquartile range (IQR) are presented (Table 20).

Table 20. Two-day median recall completion for study respondents completing recalls within 95th percentile (173 minutes)

	Median	*IQR*
All respondents	13.0	8.5-20.5
Respondents with times within 95th percentile	12.5	8.2-19.0
Weighted base		1006

4.11 Respondent Feedback on Intake24

Respondents were asked to complete a feedback questionnaire on Intake24 including questions about usability, any problems that occurred whilst using Intake24, and how they felt about the tool.

Of those who received feedback on their diet, 85% found it very useful or somewhat useful (41% of the 818 who answered this question, indicated that they did not receive dietary feedback) (Figure 2). The majority (71%) of respondents agreed Intake24 accurately captured their diet with just 8% disagreeing with this statement (Figure 3).

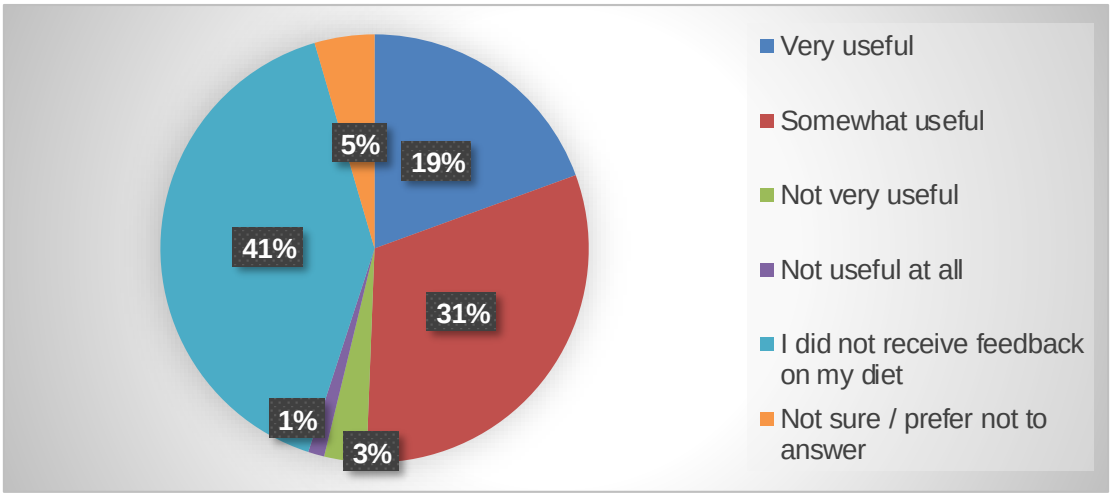


Figure 2. If you chose to receive feedback on your diet in Intake24, what did you think of it? *N*=818.

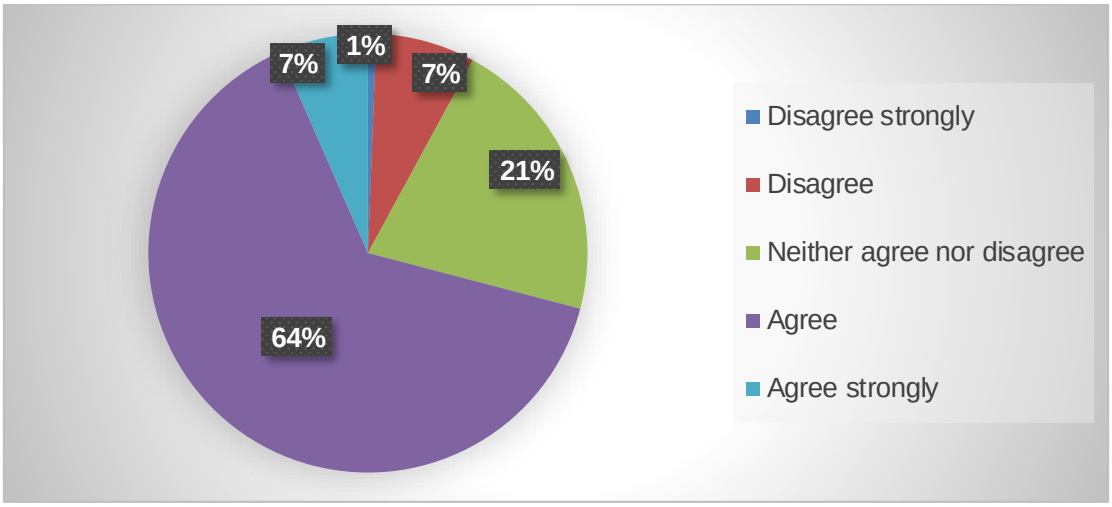


Figure 3. Intake24 captured my diet accurately. *N*=808.

The majority of respondents (87%) felt they were able to complete Intake24 in a reasonable time with only 4% disagreeing, and no one strongly disagreeing with this statement (Figure 4) and 33% of respondents indicated that they would make changes to their diet as a result of completing Intake24 with 44% neither agreeing or disagreeing, and 23% disagreeing with this (**Figure 5**).

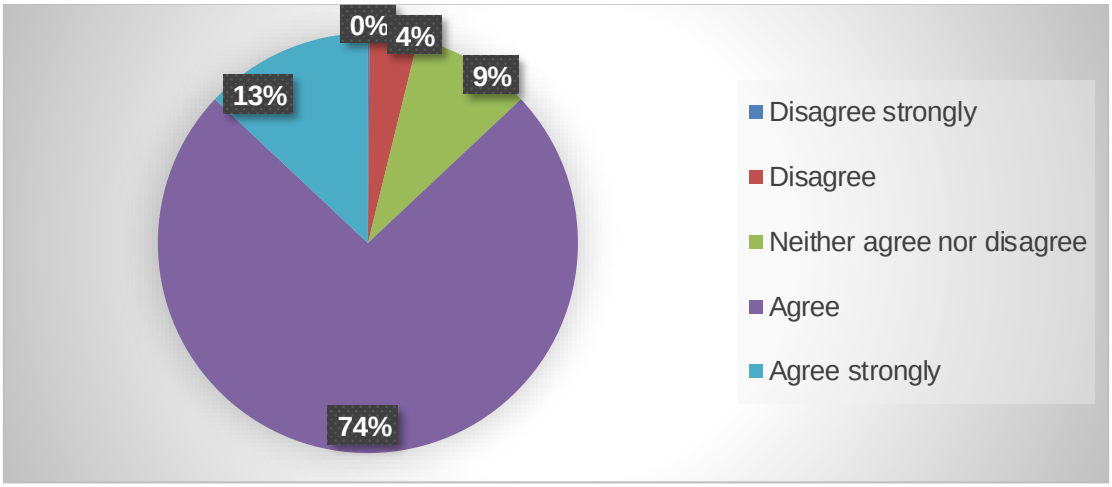


Figure 4. I felt I was able to complete Intake24 in a reasonable amount of time. *N*=808.

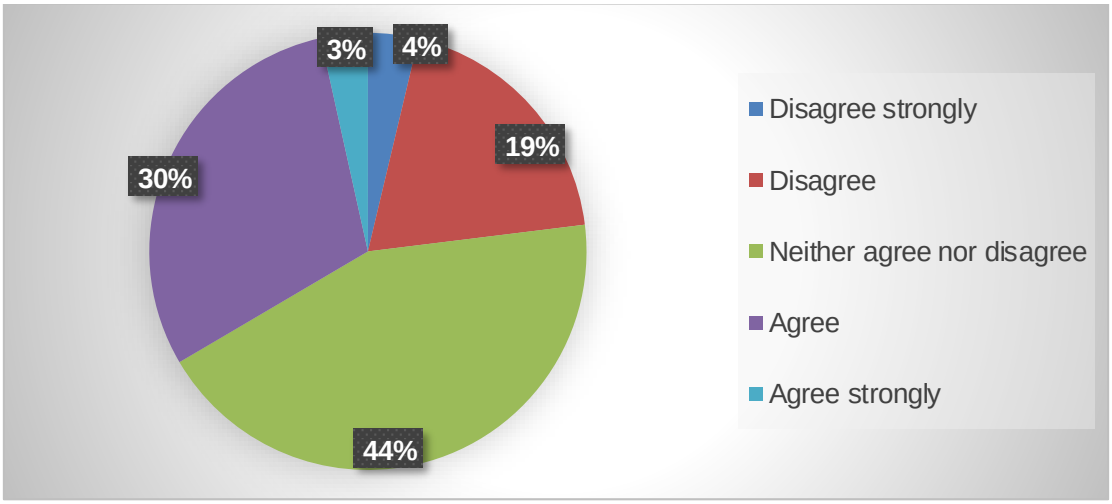


Figure 5. I will make changes to my diet as a result of completing Intake24. *N*=807.

There are additional pie chart graphs in Appendix J. Responses to the questionnaire found when respondents were asked which method (Intake24 or SHeS EHM/FVM) they felt enabled them to give the most accurate information about their diet, 50% chose Intake24, with a further 27% selecting there was no difference between the methods (Figure 15 in Appendix J). Respondents indicated that being sent a link to Intake24 via email or text message made them more likely to complete a recall (76%), 42% of respondents would have been happy to complete Intake24 on four separate days rather than two (with 21% disagreeing and the remainder of respondents choosing 'neither agree nor disagree') (Figure 16, Figure 17 in Appendix J). The majority (63%) liked the way Intake24 looked (Figure 18 in Appendix J).

In terms of problems occurring when using Intake24, the following questions were asked:

- Did you have any problems logging in to Intake24?
- Did you have any problems with finding different types of foods in Intake24?
- Did you have any problems with the portion size selection in Intake24?
- Did you have any problems when entering missing food items in Intake24?

The findings for these questions are shown in Figure 6 below. Just 5% reported that they had problems logging in, with less than 7% reporting problems with adding missing foods or estimating portion sizes. Eighteen % reported problems with finding foods; the comments submitted around problems with finding foods indicated that some respondents could not find exact foods they were looking for so had to choose nearest equivalents. Examples of foods that respondents stated they had problems with included 'peppermint tea' where herbal tea is an option in Intake24 and some specific brands of foods.

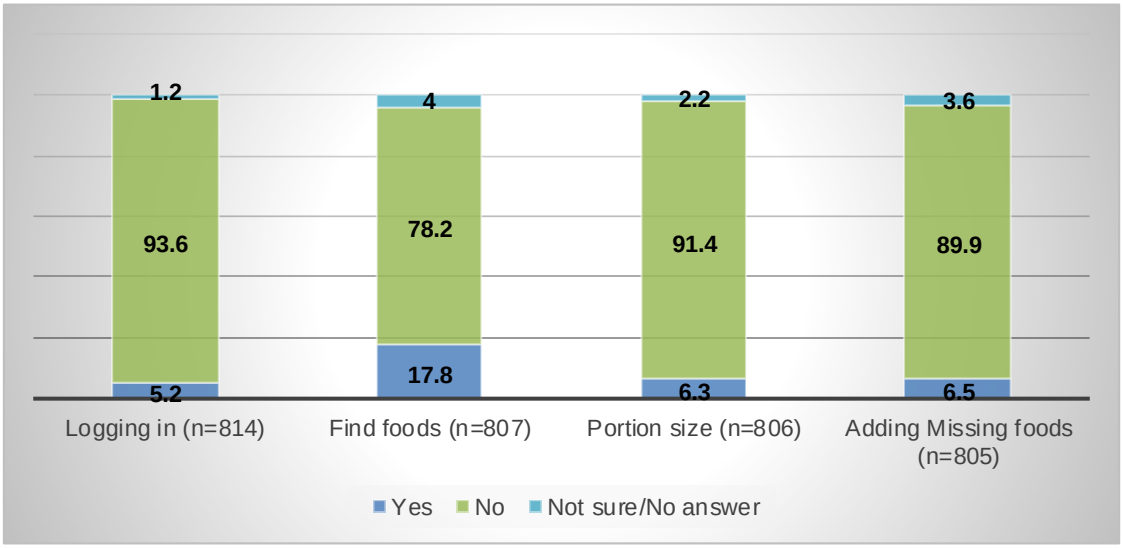


Figure 6. Summary of respondents who had problems when using Intake24 (%)

In addition to fixed choice questions in the questionnaire, respondents were also asked for any additional comments on Intake24. The 127 comments made were grouped into categories: positive, mixed, neutral or negative. In total, 62% of comments were grouped as neutral (17%) or positive (45%), with 8% of comments grouped as mixed and 30% as negative (Figure 7) The following are examples of positive comments:

- “Completing this made me more aware of hidden calories I consume in things like butter mayonnaise. Was also more conscious of portion size and lack of veg” *(female, 54 years)*
- “It’s brilliant!” *(male, 56 years)*
- “I think this is an insightful survey that will be put towards genuine and practical use” *(female, 20 years)*

The following are examples of mixed comments:

- “It seems very good but it would still be possible to forget about a small snack here or there” *(male, 32 years)*
- “Overall it was a good thing to use in theory. Maybe a bit difficult to get everyone to use and to carry on using it to record their intake” *(sic) (male, 21 years)*

Below are some examples of neutral comments:

- “Hope my answers are of help!” *(female, 63 years)*

And finally, some examples of negative comments:

- “2 days does not give an accurate picture of anyone’s diet and as a result I felt the advice was not accurate. Much of what was advised I follow over a week.” *(female, 66 years)*
- “Annoying to keep answering “did you leave any” as I always eat it all unless it is bad” *(male, 70 years)*
- “Doesn’t display perfectly on smartphone” *(male, 66 years)*

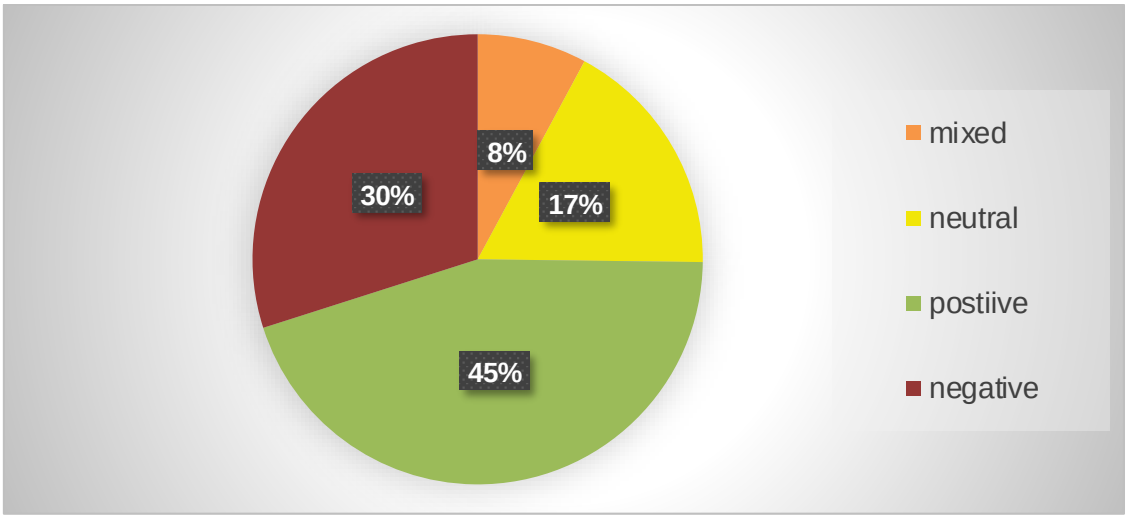


Figure 7 Respondent comments after categorisation through sentiment grouping N=127

4.12 System Usability Scale Questions

Questions were also asked to assess the usability of Intake24 based on the system usability scale (SUS) [38]. The minimum value achievable is 0 and the maximum is 100, and it is important to note that these figures are not a percentage, but a score. The

classification of scores is as follows: Worst Imaginable 0-25; Poor 25.1-51.6; OK 51.7-71.0; Good 71.1-80.7; Excellent 80.8-84.0; Best Imaginable 84.1-100 [45].

The SUS scores were calculated and shown below (Table 21). Pie charts for each SUS question are presented in Appendix K. The average score for Intake24 based on all respondents completing the SUS questions (*n*=742) was 71.5, which is classed as 'good' [46]. When analysed by age group, the over 65 years group gave the lowest score of 67.7 (classed as OK) with the 16-24 year group rating the highest of 74.7 (classed as good) (Table 21).

Table 21. Intake SUS descriptives by age group (all completers, unweighted)

Age Group	Mean	Median	SD (±)	Min	Max	95% CI	
All ages	71.5	72.5	12.0	12.0	100.0	70.6	72.3
11-15 years	71.3	72.5	12.4	35.0	95.0	66.9	75.8
16-24 years	74.7	72.5	10.9	42.5	100.0	71.8	77.5
25-34 years	74.6	75.0	10.2	45.0	100.0	72.2	77.0
35-44 years	73.6	72.5	11.7	22.5	100.0	71.5	75.8
45-54 years	72.2	72.5	11.4	12.5	100.0	70.3	74.1
55-64 years	70.8	72.5	12.7	12.5	100.0	68.9	72.8
65+ years	67.7	67.5	11.9	32.5	100.0	65.9	69.5
Unweighted bases	*All ages*						*742*
	11-15y						*32*
	16-24y						*58*
	25-34y						*71*
	35-44y						*117*
	45-54y						*136*
	55-64y						*158*
	65+y						*170*

4.13 Interviewer Feedback

Nearly three in four interviewers said that, in general, they found gaining consent from respondents to take part in Intake24 either "very easy" (29%) or "quite easy" (45%), whilst 14% found it "quite difficult". Most interviewers felt that the £20 conditional incentive encouraged respondents to take part "a great deal" (46%) or "quite a lot" (28%). A minority (11%) of interviewers felt that the £20 incentive was "not very much" of an encouragement. This was in contrast to the perceived influence of receiving dietary feedback as an incentive to take part. Around seven in ten interviewers felt that the offer of dietary feedback to respondents acted as "some" (46%) or "not very much" (24%) encouragement to respondent to take part in general. Others stated that the dietary feedback encouraged "quite a lot" (19%) or "a great deal" (11%). Examples of interviewer feedback are given below.

- They found the SHeS quite straightforward and interesting and were keen to get the incentive for the Intake 24. (found gaining consent "quite easy")
- It depended on age. Young people savvy with tech were pretty amenable and the financial incentive helped. Elderly were much more resistant especially after a lengthy survey. Some had no internet and health issues that were prohibitive. (found gaining consent "quite easy")
- The respondents appeared to be interested in completing the diary. The incentive was a big part of obtaining participation. (found gaining consent "very easy")
- In general respondents were open to completing Intake24 dietary recalls and the incentive was perceived to be an important influence on gaining participation. (found gaining consent "quite easy")
- A lot of the people were elderly and not use to computers also the health survey is so long a lot of them just wanted you to leave after survey done. (found gaining consent "quite difficult")
- Most households with working parents and families seemed to find taking part in SHeS time consuming in the first place and I think were too time consumed. I found older participants did have the time to spare but felt challenged by the IT commitment required. (found gaining consent "quite difficult")

If respondents consented to take part, interviewers worked through the process of setting them up; recording an email and or phone number and filling in their log on card. The majority of interviewers said that they found administering this process either "quite easy" (38%) or "very easy" (22%). Around one in ten (9%) stated that they found the process "quite difficult". There were no concerns raised (as part of the feedback process) by interviewers in relation to the instructions they received for administering the Intake24 set up. Interviewers were also asked "On average, how did you find the time it took to set up and administer Intake24?". Three in five answered "about right", a little over one in three felt that it was "a bit too long", and a small minority responded "much too long" (4%).

- quite straight forward for me and quick as well (found administering the set up "very easy")
- I found intake 24 very easy to administer, it was better than the rest of the programme (found administering the set up "very easy")
- just very straightforward people did not have as many questions as I imagined they might (found administering the set up "quite easy")
- took a while to get used to it, after the first few it was very easy. (found administering the set up "quite easy")

Finally, interviewers were asked what impact, if any, they felt the inclusion of Intake24 had on delivering the SHeS interview. A little over two in five felt that the impact was "very positive" (11%) or "slightly positive" (30%). While more than one in three interviewers (37%) said that the inclusion of Intake24 had "no impact" on delivering SHeS, therefore more than 3 in 4 interviewers (78%) felt the impact had been positive or neutral. The remaining, nearly one in four interviewers (23%) deemed the impact to have been "negative" (17%) or "very negative" (6%).

The main reasons given for a positive impact were around the incentive and the value of the data:

- You could refer to the vouchers on the doorstep and I think it encouraged other family members to take part, who weren't present at first interview session (felt Intake24 had a "slightly positive impact" on delivering SHeS)
- respondents felt they were making a further contribution to improving data regarding the health of the nation (felt Intake24 had a "slightly positive impact" on delivering SHeS)
- It's a modern slant and gives them control over what they are doing, so I think they may enjoy it and feel more involved. (felt Intake24 had a "very positive impact" on delivering SHeS)
- ….people liked the incentive and found it interesting and relevant (felt Intake24 had a "slightly positive impact" on delivering SHeS)
- ….helped getting young adults to take part where there was a cash incentive (felt Intake24 had a "slightly positive impact" on delivering SHeS)

Most who felt that there was "no impact" referred to the fact that respondents did not know that Intake24 was an additional element of the survey:

- The participant did not have prior knowledge of the intake part of the study, so they had nothing to compare (felt Intake24 had "no impact" on delivering SHeS)
- The household had already engaged with the survey and participated. It's introduced this right at the end and people would at least listen. Some did comment about yet another thing and it might've put them of further participation but I didn't think it impacted (felt Intake24 had "no impact" on delivering SHeS)

The main reason for perceiving Intake24 as a negative impact in SHeS was the additional time required:

- It really has reached to maximum possible, especially with the bio modules, so the whole process is a behemoth of an interview, and unless the respondent is super-enthusiastic, or has nothing else to do with their life, they can get rather fed up of the intrusion and time taken (felt Intake24 had a "negative impact" on delivering SHeS)
- I got the impressions after doing the whole interview being asked about further input put them off as too much time taken up (felt Intake24 had a "negative impact" on delivering SHeS)
- I lost several "IBIOs" [SHeS biological module] as a direct result of it coming before IBIO introduced (felt Intake24 had a "very negative impact" on delivering SHeS)
- …..on an already time consuming and heavily administered interview the addition of this element was in my experience not universally welcomed by respondents (felt Intake24 had a "very negative impact" on delivering SHeS)

5 Dietary Intake Findings – Intake24 reported energy, nutrient intakes

The following section provides a summary of the SDGs and UK Dietary Reference Values and presents the key nutrient intakes reported through Intake24 for the study population by age, gender, BMI and SIMD.

5.1 Summary of Scottish Dietary Goals

The Revised SDGs[11] are an updated set of dietary recommendations established by the Scottish Government in March 2016 based on scientific evidence. Goals are set for changes in intake of nutrients or food groups in the diet, and these include Calorie reduction and recommended intake in grams of fruit and vegetables, oily fish, red meat and fibre (see Table 22 below). The SDGs support the Eatwell guide, the main consumer facing advice on healthy eating in the UK. The SDGs and the Eatwell Guide recommendations are summarised in Table 22 (below) and Eatwell Guide and Dietary Reference Values

Table 37 (8Appendix IAppendix I).

Table 22. Scottish Dietary Goals summarised [16]

Scottish Dietary Goals	Summary (average /day or /week)	Additional Information
Calories	A reduction in calorie intake by 120 kcal/person/day Average energy density of the diet to be lowered to 125 kcal/100g by reducing intake of high fat and/or sugary products and by replacing with starchy carbohydrates (e.g. bread, pasta, rice and potatoes), fruits and vegetables.	Energy density is based on the energy from foods and milk only (not the energy from other drinks)
Fruit and Vegetables	Average intake of a variety of fruit and vegetables to reach at least 5 portions/person/ day (> 400g per day)	
Oily Fish	Oil rich fish consumption to increase to one portion/ person (140g) /week	
Red Meat	Average intake of red and processed meat to be pegged at around 70g/ person/ day Average intake of the highest consumers of red and processed meat (90g/ person/ day) not to increase.	Cooked weight. Only red and red processed meat (white processed meat not included)

[11] Further information about the SDGs can be found here: https://www2.gov.scot/Resource/0049/00497558.pdf

Scottish Dietary Goals	Summary (average /day or /week)	Additional Information
Fats	Average intake of total fat to reduce to no more than 35% food energy Average intake in saturated fat to reduce to no more than 11% food energy Average intake of trans-fatty acids to remain below 1% food energy	% food energy based on total energy minus the energy from alcohol.
Free Sugars	Average intake of free sugars, not to exceed 5% of total energy in adults and children over 2 years	% total energy
Salt	Average intake of salt to reduce to 6g /day	
Fibre	An increase in average consumption of AOAC fibre for adults (16+) to 30g/day. Dietary fibre intakes for children to increase in line with SACN recommendations	SACN recommendations for 11-16 year olds = 25g/day.
Total Carbohydrate	Total carbohydrate to be maintained at an average population intake of approximately 50% of total dietary energy with no more than 5% total energy from free sugars	% total energy

5.2 Mean Nutrient Intakes

Nutritional data presented are based on adults (16 years or over) who completed two dietary recalls (*n*=1001). There were also 55 children (11-15 years) who completed two dietary recalls (sum total adults and children *n*= 1056). Data are presented for adults only due to the small number of children.

Non-Milk Extrinsic sugars (NMES) are used as values for free sugars due to no free sugars data being available at the time of data collection (*note*: the difference between the two methods are that NMES includes 50% of the sugar in dried, stewed or canned fruit towards the value, whereas free sugars does not include this).

Total fat and saturated fat are presented as the percentage contribution of the nutrient to total food energy, including food and drinks (but excluding energy from alcohol) (stated as '%total food E'). Total carbohydrate and NMES are presented as the percentage contribution of the nutrient to the total energy including all foods and drinks (including alcohol) (stated as %total E). NMES and Saturated fat are also presented in grams along with estimated AOAC fibre (which is calculated using a conversion factor of Englyst fibre (g) multiplied by 1.33). Additional nutrient intake data are available in Appendix L.

For all adults (16+ years) the energy intake ranged from 594-5067 kcals with an average intake of 1668 kcal/day. The %total food E coming from fat and saturated fat was 33.8% and 12.8% respectively. The %total E from NMES was 11.9%. The estimated AOAC fibre intake was 15.9g/day on average.

Table 23. Weighted two-day average, for adults (16+ years) SD, min and max nutrient intake.

	Nutrient	Mean	SD (±)	Min	Max
Adults 16+ years	Energy (kcal)	1668.1	615.9	593.9	5066.9
	Total fat (%total food E)	33.8	7.7	9.8	61.4
	Saturated fat (g)	24.0	12.9	2.1	90.4
	Saturated fat (%total food E)	12.8	4.0	2.7	29.8
	Total carbohydrate (%total E)	47.9	8.6	8.4	81.1
	NMES (g)	56.9	54.5	0.0	583.1
	NMES (%total E)	11.9	9.0	0.0	59.7
	Estimated AOAC fibre (g)	15.9	6.7	3.0	59.2
Unweighted base	*All adults*				*1001*
Weighted base	*All adults*				*994*

Reported average energy intakes for male and female adults (16+ years) was 1862 and 1500 kcals/day respectively. Male's intakes of fat and saturated fat as a %total food E were 34.2% and 13.0% respectively, and female's intakes were 33.3% and 12.7%. NMES as a %total E were above the 5% guidelines with male reported intakes at 12.9% and females at 11.1%.

Table 24. Weighted two-day average, for adults (16+ years) SD, min and max nutrient intake by gender.

Gender	Nutrient	Mean	SD (±)	Min	Max
Males	Energy (kcal)	1862.1	636.8	677.6	4369.3
	Total fat (%total food E)	34.2	7.2	14.2	55.4
	Saturated fat (g)	26.8	13.7	4.3	90.4
	Saturated fat (%total food E)	13.0	3.8	4.6	25.5
	Total carbohydrate (%total E)	46.9	8.6	8.4	70.2
	NMES (g)	66.8	59.8	0.0	392.2
	NMES (%total E)	12.9	10.0	0.0	59.7
	Estimated AOAC fibre (g)	16.0	6.9	3.0	59.2
Females	Energy (kcal)	1499.9	544.3	593.9	5066.9
	Total fat (%total food E)	33.3	7.6	9.8	61.4
	Saturated fat (g)	21.6	11.5	2.1	77.5
	Saturated fat (%total food E)	12.7	4.1	2.7	29.8
	Total carbohydrates (%total E)	48.8	8.4	11.2	81.1
	NMES (g)	48.4	48.0	0.0	583.1
	NMES (%total E)	11.1	8.0	0.0	44.7
	Estimated AOAC fibre (g)	15.8	6.5	3.0	48.3

Unweighted bases	*Males*	*393*
	Females	*608*
Weighted bases	*Males*	*462*
	Females	*532*

When examining intakes by age groups, the 65-74 years group reported the lowest energy intake of 1583 kcal/day with the 35-44 years group reporting the highest of 1785 kcal/day. NMES as a %total E were highest in the 16-24 years at 14.8%. Fibre intakes remained lower than recommended in all age groups ranging from 14.1g/day in the 16-24 years group to 16.8g/day in the 35-44 years group.

Table 25. Weighted two-day average, for adults (16+ years) SD, min and max nutrient intake by age group

Age group	Nutrient	Mean	SD (±)	Min	Max
16-24 years	Energy (kcal)	1613.1	556.4	713.5	3787.6
	Total fat (%total food E)	33.4	6.6	16.3	45.2
	Saturated fat (g)	21.8	10.3	3.8	57.1
	Saturated fat (%total food E)	11.9	3.5	3.7	21.7
	Total carbohydrate (%total E)	49.1	8.0	33.8	68.6
	NMES (g)	62.6	44.8	0.4	212.0
	NMES (%total E)	14.8	11.4	0.2	59.7
	Estimated AOAC fibre (g)	14.1	6.0	3.0	38.6
25-34 years	Energy (kcal)	1758.4	669.2	593.9	5066.9
	Total fat (%total food E)	33.1	7.6	14.3	54.9
	Saturated fat (g)	23.2	12.6	4.3	76.3
	Saturated fat (%total food E)	11.9	4.1	3.5	22.4

Age group	Nutrient	Mean	SD (±)	Min	Max
	Total carbohydrates (%total E)	48.7	9.8	29.6	73.8
	NMES (g)	74.9	79.0	0.6	583.1
	NMES (%total E)	14.4	10.0	0.3	49.2
	Estimated AOAC fibre (g)	15.3	8.0	4.9	59.2
35-44 years	Energy (kcal)	1784.8	616.3	619.6	3868.6
	Total fat (%total food E)	33.1	7.2	11.0	54.3
	Saturated fat (g)	25.0	12.4	3.2	67.0
	Saturated fat (%total food E)	12.6	3.7	4.1	23.5
	Total carbohydrate (%total E)	48.5	8.1	9.9	81.1
	NMES (g)	62.8	55.6	1.2	350.1
	NMES (%total E)	12.3	8.6	0.4	43.3
	Estimated AOAC fibre (g)	16.8	6.0	4.2	38.4
45-54 years	Energy (kcal)	1649.8	653.5	600.3	3469.2
	Total fat (%total food E)	33.0	8.2	9.8	55.4
	Saturated fat (g)	23.5	14.7	2.7	73.3
	Saturated fat (%total food E)	12.5	4.3	3.1	29.8
	Total carbohydrates (%total E)	47.9	8.9	22.9	70.5
	NMES (g)	51.8	42.4	0.0	208.7
	NMES (%total E)	11.7	9.0	0.0	43.7
	Estimated AOAC fibre (g)	15.9	7.1	4.5	43.1

Age group	Nutrient	Mean	SD (±)	Min	Max
55-64 years	Energy (kcal)	1639.0	631.4	626.8	3844.2
	Total fat (%total food E)	34.0	7.5	10.2	61.4
	Saturated fat (g)	24.5	14.3	2.1	89.8
	Saturated fat (%total food E)	13.1	4.0	2.7	26.9
	Total carbohydrates (%total E)	47.4	8.2	8.4	75.9
	NMES (g)	51.3	59.5	0.0	329.2
	NMES (%total E)	10.2	8.5	0.0	42.3
	Estimated AOAC fibre (g)	16.6	6.5	3.0	48.3
65-74 years	Energy (kcal)	1583.2	568.6	657.8	4369.3
	Total fat (%total food E)	34.7	7.4	17.4	54.6
	Saturated fat (g)	24.7	12.8	4.6	90.4
	Saturated fat (%total food E)	14.1	3.9	4.8	27.8
	Total carbohydrates (%total E)	46.2	8.3	27.7	65.0
	NMES (g)	41.6	37.2	0.0	244.4
	NMES (%total E)	9.0	6.2	0.0	31.6
	Estimated AOAC fibre (g)	16.0	6.3	4.6	36.8
75+ years	Energy (kcal)	1630.2	536.1	757.7	3096.3
	Total fat (%total food E)	35.8	6.4	12.8	50.2
	Saturated fat (g)	25.7	9.7	6.7	64.2
	Saturated fat (%total food E)	14.2	3.2	5.9	24.1

Age group	Nutrient	Mean	SD (±)	Min	Max
	Total carbohydrates (%total E)	47.7	8.1	26.1	60.7
	NMES (g)	56.3	44.0	6.2	242.6
	NMES (%total E)	12.1	6.6	1.3	26.3
	Estimated AOAC fibre (g)	15.9	6.1	7.3	36.8
Unweighted bases	*16-24 years*				*79*
	25-34 years				*116*
	35-44 years				*167*
	45-54 years				*189*
	55-64 years				*209*
	65-74 years				*181*
	75+ years				*60*
Weighted bases	*16-24 years*				*119*
	25-34 years				*141*
	35-44 years				*150*
	45-54 years				*189*
	55-64 years				*162*
	65-74 years				*141*
	75+ years				*92*

When looking at nutrient intakes by BMI group, those in the healthy weight category reported the highest energy intake at 1725 kcal/day. Fibre intake was reported highest in the healthy and overweight BMI groups at 16.1g/day. It is recognised that the underweight group has low base numbers.

Table 26. Weighted two-day average, for adults (16 years+) intake of variables by BMI (note *n*=157 not included due to data being unavailable)

BMI groups	Nutrient	Mean	SD (±)	Min	Max
<18.5 (Underweight)	Energy (kcal)	[1513.1]	734.7	978.4	3763.1
	Total fat (%total food E)	[28.9]	4.6	18.7	36.1
	Saturated fat (g)	[18.9]	9.8	9.4	33.9
	Saturated fat (%total food E)	[11.1]	2.3	7.8	14.8
	Total carbohydrate (%total E)	[52.2]	7.7	46.7	70.2
	NMES (g)	[89.0]	102.5	30.7	448.1
	NMES (%total E)	[19.0]	11.9	9.1	44.7
	Estimated AOAC fibre (g)	[14.7]	6.3	5.4	26.3
18.5 - <25.0 (Healthy weight)	Energy (kcal)	1725.1	632.9	598.3	5066.9
	Total fat (%total food E)	34.1	7.1	11.0	54.7
	Saturated fat (g)	24.7	12.6	3.3	90.4
	Saturated fat (%total food E)	13.0	3.8	4.1	26.9
	Total carbohydrates (%total E)	47.4	9.2	8.4	81.1
	NMES (g)	65.9	66.8	0.3	583.1
	NMES (%total E)	13.1	10.2	0.1	59.7
	Estimated AOAC fibre (g)	16.1	7.7	4.0	59.2

BMI groups	Nutrient	Mean	SD (±)	Min	Max
25.0 - <30 (Overweight)	Energy (kcal)	1702.5	626.1	600.3	4054.4
	Total fat (%total food E)	33.8	7.3	12.8	61.4
	Saturated fat (g)	24.2	13.0	3.2	89.8
	Saturated fat (%total food E)	12.7	3.9	3.5	29.8
	Total carbohydrate (%total E)	47.5	8.7	11.2	72.6
	NMES (g)	58.6	54.2	0.0	392.2
	NMES (%total E)	12.0	8.9	0.0	49.2
	Estimated AOAC fibre (g)	16.1	6.6	3.0	48.3
30 - <40 (Obese)	Energy (kcal)	1627.5	578.0	593.9	3712.5
	Total fat (%total food E)	33.4	7.4	10.2	55.4
	Saturated fat (g)	23.7	12.7	2.1	73.3
	Saturated fat (%total food E)	12.8	4.0	2.7	26.0
	Total carbohydrates (%total E)	47.4	7.1	28.6	70.2
	NMES (g)	47.4	39.4	0.0	228.4
	NMES (%total E)	10.6	7.8	0.0	43.4
	Estimated AOAC fibre (g)	15.4	6.2	4.5	33.9
40 + (Very obese)	Energy (kcal)	[1530.3]	592.9	746.7	3939.2
	Total fat (%total food E)	[33.4]	8.4	14.9	49.9
	Saturated fat (g)	[21.6]	11.1	7.3	60.2

BMI groups	Nutrient	Mean	SD (±)	Min	Max
	Saturated fat (%total food E)	[12.6]	4.1	4.8	22.4
	Total carbohydrates (%total E)	[48.9]	8.9	31.1	64.5
	NMES (g)	[52.2]	52.7	0.7	296.8
	NMES (%total E)	[11.2]	8.0	0.4	29.1
	Estimated AOAC fibre (g)	[14.2]	5.6	4.9	28.6
Unweighted bases	*BMI group <18.5*				*[9]*
	BMI group 18.5 - <25.0				*253*
	BMI group 25.0 - <30				*309*
	BMI group 30 - <40				*229*
	BMI group 40 +				*[44]*
Weighted bases	*BMI group <18.5*				*[8]*
	BMI group 18.5 - <25.0				*243*
	BMI group 25.0 - <30				*292*
	BMI group 30 - <40				*187*
	BMI group 40 +				*[43]*

Note: numbers in square brackets have low base numbers

Using the Scottish Index of Multiple Deprivation (SIMD) groups, the most deprived group (SIMD1) had the lowest reported energy intake of 1563 kcal/day and the highest NMES intakes as a %total E at 13.3%. The least deprived group (SIMD5) had the highest fibre intake at 16.8g/day.

Table 27. Weighted two-day average, for adults (16 years+) intake of variables by SIMD.

SIMD group	Nutrient	Mean	SD (±)	Min	Max
SIMD 1 (most deprived)	Energy (kcal)	1563.3	519.3	626.8	3103.7
	Total Fat (%total food E)	32.1	8.3	9.8	54.3
	Saturated fat (g)	21.9	11.5	2.7	65.6
	Saturated fat (%total food E)	12.4	4.3	29.8	3.1
	Total carbohydrates (%total E)	50.3	8.5	27.7	73.8
	NMES (g)	59.4	53.1	0.6	268.6
	NMES (%total E)	13.3	9.4	0.2	43.7
	Estimated AOAC fibre (g)	15.0	7.4	4.0	59.2
SIMD 2	Energy (kcal)	1624.0	650.8	593.9	5066.9
	Total Fat (%total food E)	33.1	6.9	14.0	54.9
	Saturated fat (g)	22.6	12.2	3.2	90.4
	Saturated fat (%total food E)	12.5	4.1	4.4	26.0
	Total carbohydrates (%total E)	48.6	8.1	26.7	71.2
	NMES (g)	60.7	68.6	0.0	583.1
	NMES (%total E)	12.6	10.0	0.0	49.2
	Estimated AOAC fibre (g)	14.6	6.0	3.0	43.1

SIMD group	Nutrient	Mean	SD (±)	Min	Max
SIMD 3	Energy (kcal)	1733.5	639.0	646.5	3868.6
	Total Fat (%total food E)	33.8	7.7	10.2	60.9
	Saturated fat (g)	25.0	12.7	2.1	68.3
	Saturated fat (%total food E)	12.9	3.8	2.7	27.8
	Total carbohydrate (%total E)	47.7	8.8	9.9	81.1
	NMES (g)	58.3	57.3	0.0	350.1
	NMES (%total E)	11.6	8.3	0.0	41.0
	Estimated AOAC fibre (g)	16.4	5.9	3.0	34.2
SIMD 4	Energy (kcal)	1801.8	642.9	632.0	3844.2
	Total Fat (%total food E)	35.7	7.1	16.6	61.4
	Saturated fat (g)	27.5	14.5	4.3	89.8
	Saturated fat (%total food E)	13.6	3.8	5.1	26.9
	Total carbohydrates (%total E)	45.4	8.1	11.2	72.6
	NMES (g)	54.1	38.2	0.0	179.3
	NMES (%total E)	10.9	6.6	0.0	37.3
	Estimated AOAC fibre (g)	16.7	6.8	4.3	48.3

SIMD group	Nutrient	Mean	SD (±)	Min	Max
SIMD 5 (least deprived)	Energy (kcal)	1620.5	584.6	598.3	3495.5
	Total fat (%total food E)	34.1	6.7	13.1	54.7
	Saturated fat (g)	23.2	12.5	3.8	77.0
	Saturated fat (%total food E)	12.8	3.9	3.5	26.9
	Total carbohydrate (%total E)	47.5	8.8	8.4	75.9
	NMES (g)	51.8	48.5	0.0	329.2
	NMES (%total E)	11.4	10.0	0.0	59.7
	Estimated AOAC fibre (g)	16.8	7.0	4.0	38.4
Unweighted bases	*SIMD 1 (most deprived)*				*146*
	SIMD 2				*229*
	SIMD 3				*214*
	SIMD 4				*219*
	SIMD 5 (least deprived)				*193*
Weighted bases	*SIMD 1 (most deprived)*				*187*
	SIMD 2				*222*
	SIMD 3				*194*
	SIMD 4				*195*
	SIMD 5 (least deprived)				*196*

6 Food groups comparison of Intake24 with Scottish Health Survey eating habits module and Fruit and Vegetable Consumption Module

6.1 Intake24 Food Group Intakes

Red and processed meat and oily fish intake reported through Intake24 are reported below (Table 28). Red processed meat includes meats such as beef, lamb and pork meat that has been preserved by smoking, curing, salting or adding preservatives. Red and processed meat (including white processed meat) combined intake was 48.2g /day, and oily fish intake was 6.6g /day for all adults. It must be noted that it was not possible in this analysis to separate white processed meat from red processed meat and therefore both are included in this food group. The SDG does not include white processed meat in the recommendation.

Table 28. Weighted two-day average, for adults (16 years+) intake of red and processed meat and oily fish.

Food Group	Mean	SD (±)	Min	Max
Intake24 – Red meats (g)	24.5	38.7	0.0	300.0
Intake24 – Processed meats (g)	23.7	35.9	0.0	294.8
Intake24 Red and processed meats (g)	48.2	53.2	0.0	419.5
Oily fish (g)	6.6	24.8	0.0	336.7
Unweighted base				*1001*
Weighted base				*994*

Red and processed meat and oily fish intakes were also examined for consumers only (those who consumed an average of >1g over the two days). The average intake of red and processed meat and oily fish were 62.0g/day and 37.2g/day respectively.

Table 29. Weighted two-day average, for adults (16 years+) consumers (consuming more than 1g) of red and processed meat or oily fish.

Food Group	Mean	SD (±)	Min	Max
Intake24 Red and processed meats (g)	62.0	51.8	1.05	419.5
Oily fish (g)	37.2	48.0	1.0	336.7
Unweighted bases	*Red and processed meat*			*813*
	Oily fish			*167*
Weighted bases	*Red and processed meat*			*819*
	Oily fish			*180*

6.2 Fruit and Vegetable Intake

6.2.1 Direct Comparisons with SHeS Fruit and Vegetable Module

Fruits and vegetable portions reported using Intake24 and FVM are presented below (Table 30). The daily mean number of fruit and vegetable portions reported for all adults was 2.9 portions/day using Intake24, and 3.1 portions/day using FVM.

Table 30. Weighted two-day average, for adults (16+ years) SD, min and max nutrient intake for fruit and vegetable consumption.

Food Group	Mean	SD (±)	Min	Max
Intake24 total fruit portions	1.5	1.3	0.0	10.6
Intake24 total vegetable portions	1.4	1.5	0.0	11.5
Intake24 total fruit & vegetable portions	2.9	2.3	0.0	19.2
SHeS FVM total fruit & vegetable portions	3.1	2.6	0.0	29.5
Unweighted base				*1001*
Weighted base				*994*

When directly comparing those respondents who completed Intake24 for the same day as the FVM (*n*=671, Table 31) Intake24 and FVM reported 3.0 portions/day and 3.1 portions/day respectively, showing good agreement between the two methods at the population level.

Table 31. Weighted 1-day average, for adults (16+ years) SD, min and max nutrient intake for fruit and vegetable consumption, for those who completed the SHeS FVM for the same day as their first Intake24 recall was reported for.

Food Group	Mean	SD (±)	Min	Max
Intake24 total fruit & vegetable portions	3.0	2.9	0.0	26.3
SHeS FVM total fruit & vegetable portions	3.1	2.7	0.0	29.5
Unweighted base				*671*
Weighted base				*646*

When looking at those who reportedly consumed less than one, or five or more portions of fruit and vegetables through Intake24, 22% of the study population consumed less than one portion of fruit and vegetables /day compared to 16.3% through the FVM. This suggests Intake24 may be a more reliable marker for those who did not consume fruit and vegetables as in Intake24, respondents are not specifically asked about fruit and vegetable consumption. For those who reportedly consumed five or more portions /day, there were 16.3% respondents through Intake24 and 20.8% through the FVM.

Table 32. Percentage of the study population consuming <1 portion or 5+ portions of fruit and vegetables based on the weighted two-day average for Intake24 and 1-day for FVM, for adults (16 years+).

	% Respondents	
Intake24 – consumed less than one portion	22.0%	
Intake24 – consumed more than five portions	16.3%	
FVM – consumed less than one portion	16.3%	
FVM – consumed more than five portions	20.8%	
Unweighted base	*Intake24 <1*	*177*
	Intake24 5+	*185*
	FVM <1	*136*
	FVM 5+	*221*
Weighted base	*Intake24 <1*	*219*
	Intake24 5+	*162*
	FVM <1	*162*
	FVM 5+	*207*

In addition to directly comparing the mean reported intakes of fruit and vegetable portions, the agreement between the two methods was examined using the method of Bland and Altman as described in section 3.7.7 Agreement Analysis. The wide limits of agreement between the two methods ranging between 0.09 and 8.38 indicate poor agreement between the two methods at the individual level (although it is noted that population level agreement is more important). The ratio of the geometric mean at 0.88 shows that at a population level, Intake24 reported intakes of fruit and vegetable portions 12% lower than the FVM (Table 33). This lower reported consumption through Intake24 may be a more reliable measure as respondents are not specifically asked about fruit and vegetable consumption.

Table 33. Weighted geometric means with limits of agreement for adults (16+ years) for fruit and vegetable consumption for respondents who completed the SHeS FVM for the same day that their first Intake24 recall was reported for

	Intake24 Geometric mean	SHeS F&V Module (FVM) Geometric mean	Ratio of geometric mean (Intake24: FVM)	Limits of agreement Lower	Upper
Fruit & Vegetables	1.75	1.99	0.88	0.09	8.83
Unweighted base					*671*
Weighted base					*646*

6.3 Indirect Food Group Comparisons

Indirect comparison analysis was carried out to assess the differences in reporting of food groups (Non-diet soft drinks, Chocolate and sweets, Crisps, Biscuits and Milk and bread types) by respondents using both the EHM, and Intake24 (this is described in detail in section 3.7.8).

It must be noted that there are differences in methodologies between the two methods, so exact matches between the two methods was not expected. For example, the classification of foods into food groups will vary between the methods (i.e. a chocolate biscuit bar could be classed either as a biscuit or as chocolate). Furthermore, though respondents report their usual 'type' of foods consumed (e.g. that they usually consume semi skimmed milk), the day that is reported through may have not been 'usual' (e.g. respondent consumed whole milk at a friend's house when they usually drink semi skimmed).

This analysis was carried out for all respondents (adults and children) and for only those respondents who carried out Intake24 and the EHM for the same day. There were no differences in the percentage of matches when looking at those who completed Intake24 and EHM for the same day, therefore only data for 'all respondents' is shown.

Table 34. Percentage of 'matches' of food groups reported through Intake24 and EHM for adults and children

Food Group	SHeS & Intake24 Match
Non-diet soft drinks (usually consume once or more a day)	78%
Chocolate and sweets (usually consume once or more a day)	73%
Crisps (usually consume once or more a day)	69%
Biscuits (usually consume once or more a day)	69%
Whole milk (usual type consumed)	84%
Skimmed/ semi skimmed milk (usual type consumed)	61%
White bread (usual type consumed)	65%
Brown/ granary/ wholemeal bread (usual type consumed)	65%
Base	*1056*

6.4 Comparison of Dietary Intakes with Scottish Dietary Goals

When comparing the intake of food groups and nutrient intakes reported through Intake24 with the SDGs, respondent's intake of fruit and vegetables and fibre are well below the dietary recommendations. Intake of total carbohydrates and total fat are approximately in line with recommendations, and red and processed meat and trans-fatty acids are below the maximum recommendations and therefore meeting the SDGs. NMES intake and saturated fat intake both exceeded the SDGs.

Table 35. Weighted two-day average, for adults (16+ years) of food group and nutrient intakes compared with chosen Scottish Dietary Goals (summarised)

Food Group/Nutrient	Scottish Dietary Goals	Reported in Intake24 Pilot
Fruit and vegetables	At least 5 portions /day	2.9 portions /day
Red & processed meat	Pegged at around 70g /day	48.2g /day
Total fat	No more than 35% food energy	33.8% total food energy
Saturated fat	No more than 11% food energy	12.8% total food energy
Trans-fatty acids	Remain below 1% food energy	<1% total food energy
Total carbohydrate	Maintain at 50% of total dietary energy	47.9% total dietary energy
Free sugars	Not to exceed 5% of total energy in adults and children over 2 years	11.9% total dietary energy (NMES)
Fibre	Increase to 30g /day	15.9g /day
Unweighted base		*1001*
Weighted base		*994*

6.5 Comparison of Dietary Intakes with National Data

It is useful to compare the dietary data collected in this pilot study with nationally collected data to investigate whether Intake24 gives similar outcomes to larger dietary intake surveys using more intensive data collection methods (for example, four days of food dietary intake through food recalls) to ensure the Intake24 data is similar to other population dietary intake data. When comparing the dietary intake estimates from Intake24 with national data collected through the NDNS rolling programme years 7-8 (data collected between years 2014/15 and 2015/16), Intake24 mostly gives slightly lower, but comparable data with reported intakes of approximately 220 kcal difference for males 19-64y years and 120 kcal difference for females aged 19-64 years. NMES were reported to be slightly higher in most age groups through Intake24 compared with the NDNS. It must however be noted that these comparisons are on different study samples using different dietary data collection methods and the NDNS is based on a UK population whereas this study sample was for Scotland only. Note that fat and saturated fat is presented as %total E rather than %total food E for comparison purposes.

Table 36. Mean macronutrient intakes reported in Intake24 SHeS pilot (Scotland) and the NDNS Rolling Programme Years 7-8 (UK data) . Note: this table shows the percentage energy from total diet (including energy from alcohol).

Gender	*Age group*	*Nutrient*	*Intake24 SHeS Pilot*	*NDNS Years 7 - 8*
Male	11-18y	Energy (MJ)	7.35	7.87
		Estimated AOAC fibre (g)[12]	15.2	16.7
		Total fat (%total E)	33.1	33.7
		Saturated fat (%total E)	12.2	12.5
		NMES (%total E)[13]	14.3	13.9
	19-64 y	Energy (MJ)	7.90	8.79
		Estimated AOAC fibre (g)	16.0	20.7
		Total fat (%total E)	33.0	32.6
		Saturated fat (%total E)	12.4	11.6
		NMES (%total E)	13.6	11.1
	65+ y	Energy (MJ)	7.7	7.95
		Estimated AOAC fibre (g)	16.7	19.0
		Total fat (%total E)	34.3	33.2
		Saturated fat (%total E)	13.6	12.8
		NMES (%total E)	10.4	12.1
Female	11-18y	Energy (MJ)	6.58	6.55
		Estimated AOAC fibre (g)	14.1	15.0
		Total fat (%total E)	32.9	33.7
		Saturated fat (%total E)	12.6	12.2
		NMES (%total E)	15.1	14.4

[12] AOAC fibre calculated by Englyst fibre value multiplied by 1.33
[13] NDNS years 7-8 and Intake24 SHeS pilot measured NMES rather than Free sugars

Gender	*Age group*	*Nutrient*	*Intake24 SHeS Pilot*	*NDNS Years 7 - 8*
	19-64 y	Energy (MJ)	6.37	6.87
		Estimated AOAC fibre (g)	16.0	17.4
		Total fat (%total E)	32.0	33.8
		Saturated fat (%total E)	11.9	12.2
		NMES (%total E)	11.4	11.2
	65+ y	Energy (MJ)	6.06	5.98
		Estimated AOAC fibre (g)	15.5	16.4
		Total fat (%total E)	34.1	34.1
		Saturated fat (%total E)	14.0	13.7
		NMES (%total E)	10.1	10.4
Unweighted bases	Males 11-18y		46	270
	Males 19-64y		276	450
	Males 65+y		109	141
	Females 11-18y		34	272
	Females 19-64y		459	632
	Females 65+y		132	194
Weighted bases	Males 11-18y		--	--
	Males 19-64y		344	--
	Males 65+y		95	--
	Females 11-18y		--	--
	Females 19-64y		375	--
	Females 65+y		139	--

Note: The Intake24 pilot intakes for 11-18 year olds are on unweighted data

7 Discussion and Conclusions[14]

7.1 Summary of Response to Intake24 and Findings

7.1.1 Response

The response rate, at 44.1% of the eligible SHeS sample completing two or more dietary recalls, was slightly higher than the predicted participation rate of 43%. However due to there being fewer eligible participants than estimated (2386 in this pilot compared to the estimated 2500) the final number of respondents completing two or more recalls at 1053 was within the target range of between 1000 and 1500 participants but 139 short of the estimated 1192.

Of the eligible SHeS sample 72.3% consented to take part, of these, around 1 in 5 (20.9%) did not complete any recalls. Of those who completed 1 recall, 77.3% went on to complete 2 or more recalls.

There were some significant demographic factors that influenced response including adults aged over 64 years being less likely than younger respondents to consent, with particularly low levels of participation among those aged over 75. There was little difference in response when comparing adults (16+ years) and children (11-15 years). However, those aged between 65 and 74 were the most likely to go on to complete two or more recalls. Although there was no difference in levels of consent between males and females, females were significantly more likely than males to go on to complete two or more recalls. There were no statistically significant differences in participation by deprivation or BMI category groups, although those who did not consent to their height and weight being collected during their SHeS interview were less likely to consent to take part.

7.1.2 Respondent and Interviewer Feedback

Considering the number of respondents completing recalls, there were very few requests for help using Intake24 (*n*=33), with nearly all of these relating to logging on. On the most part, the NU researchers could easily resolve these queries by providing an alternative Intake24 link. The process of carrying out telephone interviews ran smoothly, with only a small number of issues arising when some respondents could not be contacted as they did not respond to phone calls, voicemails and messages. In future, if the telephone interviews were offered in a national survey, a set protocol could be established to give guidance on the number of times researchers should attempt to contact participants before classifying them as non-contactable.

[14] A total of 1056 participants completed 2 Intake24 recalls in the pilot study. However response data was only available for 1053 participants at the time of reporting due to a pilot study programming error. This error does not impact the key findings.

Respondents completed Intake24 in under 16 minutes on average, this is comparatively faster than the time taken to complete other interviewer-led 24 hour recalls (usually taking around 20-30 minutes) [6], and also comparable or quicker than online 24 hour recall tools which took between 16 and 41 minutes [7, 8]. Respondents agreed through the feedback questions that they were able to complete a recall through Intake24 in a 'reasonable amount of time' and 42% would have been happy to complete a further two recalls using Intake24, suggesting the time required to complete a recall was acceptable.

Respondent answers to the feedback questions were generally very positive. Intake24 was considered a tool that; accurately captured their diets, provided useful feedback, looked acceptable and could be completed in a reasonable time. In addition, Intake24 scored well through the System Usability Scale with a classification of 71.5 and 'good', comparing favourably to other online 24-hour recall tools [9] [10].

The 'further comments' section of the feedback where respondents were able to add additional remarks highlighted some already known improvements that need to be developed, such as minimising the number of foods that could not be found by ensuring the Intake24 food database is kept up to date with new and missing products. Another desirable development is to include a question asking the respondent if the day they are reporting their diet for is 'normal' and also if they are following a particular diet. This will allow respondents to report if they ate a particularly small or large amount compared to their usual diet, as well as providing potential reasons if their diet seems to be unusual (e.g. low calorie intake on some days if following the 5:2 diet). Since completion of the pilot, some developments have already been carried out, for example addressing the issue of respondents having portion sizes of foods that were either smaller or larger than the photographs shown to them by the addition of 'less than' and 'more than' buttons.

Around three quarters of interviewers found gaining consent from SHeS respondents to take part in Intake24 either "very easy" or "quite easy", whilst 14% found it "quite difficult". A similar majority of interviewers felt that the £20 conditional incentive encouraged respondents to take part "a great deal" or "quite a lot"; the offer of dietary feedback to respondents in contrast was perceived by interviewers as much less of an incentive with less than a third saying that it encouraged respondents "quite a lot" or "a great deal". Interviewers felt that those who had found the SHeS interview straightforward and were 'tech savvy' were keen to take part in the pilot whilst more elderly and/or unwell respondents and those who had already found the SHeS interview very long were less keen to take part.

Around two thirds of interviewers found administering this process either "quite easy" or "very easy" and around one in ten stated that they found the process "quite difficult". Most found the time taken to administer "about right" however around a third felt that it was "a bit too long" or "much too long".

Around three quarters of interviewers felt that the impact of the Intake24 pilot on SHeS response had been positive or neutral. However, the remaining interviewers felt the impact was negative or very negative mainly due to the time required to obtain consent. This may have reduced participation in the biological module which was scheduled for after Intake24 consent for a sub-sample. However, the 2018 SHeS response data does not determine conclusively that the presence of Intake24 had a negative impact on response to the biological module.

7.1.3 Dietary Intakes and Food Group Agreement

Reported average daily energy intakes for male and female adults (16+ years) was 1862 and 1500 kcals respectively. Male's intakes of fat and saturated fat as a percentage of total food energy (%total food E) were 34.2% and 13.0% respectively, and female's intakes were 33.3% and 12.7%. NMES as a percentage of total energy (%total E) were above the 5% SDG recommendations, with male reported intakes at 12.9% and females at 11.1%.

Fibre consumption calculated through Intake24 also showed that on average, the SDG of 30g of fibre/day was not met with males and females consuming an average of around 16g/day. In relation to energy density, it was not possible in this survey to directly compare energy density to the SDG, as the SDG is based on energy from food and milk only, and it is currently not possible to separate food and milk from other drinks in Intake24.

When looking at dietary intakes within demographic groups in the pilot survey, NMES intake as a %total E was highest in the 16-24 years group at 14.8%, which is around three times the recommended intake, and lowest in the 65-74 years age group at around 9%. Fibre intakes were lower than recommended in all age groups ranging from 14.1g/day in the 16-24 years group to 16.8g/day in the 35-44 years group. The most deprived group (SIMD 1) had the lowest reported energy intake of 1563 kcal/day and the highest NMES intakes as a %total E at 13.3%. SIMD 1 also had the second lowest fibre intake at 15.0g/day. The least deprived group (SIMD 5) had the second lowest NMES intake as a %total E at 11.4% and the highest fibre intake at 16.8g/day. It must be noted that no statistical comparisons were made between groups.

The comparisons between the mean portions of fruit and vegetable intake reported by respondents using Intake24 and the FVM were found to be similar with an intake of 2.9 portions/day and 3.1 portions/day respectively for all adults, and 3.0 and 3.1 portions/day for those completing Intake24 for the same day as the FVM. The ratio of the geometric mean at 0.88 shows that at a population level, Intake24 reported intakes of fruit and vegetable portions 12% lower than the FVM. Whilst the population intakes were similar, the fruit and vegetable agreement analysis found wide limits of agreement between the two methods indicating poor agreement on an individual level. The individual differences are likely because of the differences in what the two methods are actually measuring. For example, Intake24 includes all fruits and vegetables in composite dishes to count towards the estimated portions of fruit and veg (e.g. carrots, onions in Bolognese sauce and soups) whereas the FVM does not and specifically excludes the vegetables in soup. Intake24 also collects the weight of fruits and vegetables (not within composite dishes) eaten by the respondent using food photographs (e.g. respondents could report from 17g-180g of apple using the food photos of slices apples) whereas the weight of fruits through the SHeS FVM are given a standard weight (e.g. an apple was coded as one portion (e.g. 80g)). In addition, in the FVM, a bowl of salad, regardless if it is leafy salad or a bean/pulse salad is coded as one portion and also, dried fruit portions are capped at one portion whereas in Intake24 (in line with the 5 a day guidelines) there was no cap on the number of dried fruit portions contributing to the total fruit portion intake. Further, there may be differences in reporting between methods when respondents are face to face with interviewers in SHeS due to potential social desirability bias. Irrespective of method used, at a population level, the consumption of fruit and vegetable portions were

similar, and both fell well below the '5 a day' target. Through Intake24 it was estimated that 22% of the study population consumed a daily intake of one or less than one portion of fruit and vegetables, this was estimated at 16% using the FVM.

Through the indirect comparison analysis between the EHM and Intake24, the majority (over 60%) of all food groups were 'matched'. The food groups 'non-diet soft drinks' and 'whole milk' were particularly well matched with 78% and 84% respectively. This, along with the Intake24 and FVM average fruit and vegetable consumption indicates that Intake24 and the EHM are comparable.

7.2 Integration of Intake24 in SHeS

A key objective of this pilot was to determine the optimum approach for integrating Intake24 in SHeS and collecting two recalls from participants. The approach adopted in this pilot was based on learning from the 2015 field test in SHeS and as such incorporated key elements such as the reminder systems to enhance response. The pilot exceeded the estimated response rates and the number of respondents completing two dietary recalls was within the target range with very few help requests received and those were easily resolved.

In this pilot we saw substantially more people aged over 64 taking part than in the previous SHeS field test, however there was still a significantly lower response from those aged 75 and over. In the previous field test those in the most deprived quintile were half as likely to take part than those in the least deprived quintile whereas in this pilot there were no statistically significant differences in response by SIMD. However, the 2015 field test involved four recalls, rather than two, which may have influenced this difference, given that there was no significant association with SIMD classification and consent to take part in 2015. Similarly, unlike in the previous field test there was no clear impact of BMI on response. These differences are probably due in part to the widened access to the internet and to the decision to use interviewers to introduce the pilot and help with internet access issues as well as the introduction of other improvements like instant emails and text messages providing instant links to each respondent's own Intake24 dietary recalls.

There is no evidence to suggest that the Intake24 pilot had a detrimental effect on SHeS response rates. The majority of interviewers felt that they were able to integrate the pilot into the interview quite well and respondents on the whole found the Intake24 system easy to use and enjoyable. This would suggest that the approach taken to integrate Intake24 to SHeS in this pilot was broadly successful.

There are a number of areas that require attention, to enhance response rates if Intake24 were to be used in SHeS in the future:

- Minimising the time required for interviewers to gain consent and gather respondent details at the end of the SHeS interview
- Maximising the number of respondents who give email as a contact detail and minimising the number of respondents who give a text number only
- Whilst the response data does not suggest any clear negative impact of Intake24 on response to the SHeS biological module, given feedback from interviewers that

this might have happened, there should be consideration for placing the Intake24 introduction after the biological module to minimise any negative impact on response. That being said, moving the Intake24 module after the biological module may still negatively impact response as 24% of respondents who refused consent to Intake24 cited a lack of time as a reason

- Finding ways to encourage more older adults to participate, this is a key challenge for interviewers. Introducing some "practice questions" for respondents to complete and get a feel for the usability of the programme, if they're reluctant due to technical concerns, may be of some benefit. This approach is used on the CASI self-complete data collection (where the interviewer provides the respondent with a tablet, mobile phone or a computer to self-record their answers directly into the device) section of the Scottish Crime and Justice Survey. Relatedly, the Survey of Health, Ageing and Retirement in Europe (SHARE) has previously trialled an interviewer bonus for achieving interviews with respondents aged 80+ years
- Finding ways to maximise the number of children (aged 11-15) and those adults aged 16-24 years who consent to take part to then go on to complete as this group was least likely to complete two dietary recalls
- Find ways to encourage more males to complete the dietary recalls, in particular the first recall
- A staggered incentive strategy (for example £5 for completing the first recall and £15 for the second) may be worth consideration, as a means of increasing consent and reducing dropout after consent. In this pilot, 42.9% of eligible respondents did not complete any recalls whereas 77.3% of respondents who completed one recall went on to complete a second. Therefore, an incentive strategy that focusses more on encouraging respondents to complete their first recall may lead to greater numbers completing two recalls. This being said, a staggered incentive strategy may lead to an increase in the dropout rate after one recall

Analysis of the pilot respondent characteristics (e.g. age, deprivation) suggests that there was little bias in the Intake24 sample, and a suitable weighting could be applied. However, based on the response in this pilot, it is likely that if Intake24 were to replace the FVM and EHM, only around 44% of the eligible SHeS adult sample would provide dietary and nutrient data. This would equate to an adult sample of around 2100 /year if the SHeS sample were to remain unchanged in future years. Providing detailed dietary data at Local Authority level on a four-year basis would be challenging with these numbers.

Although in this pilot respondents were asked to provide two dietary recalls and there was some drop-off in response between the first and second recalls, about two thirds of respondents said they would have been willing to complete four dietary recalls on separate days. Although two dietary recalls are deemed sufficient to provide high quality data at population level, and the findings in this pilot were similar to that in NDNS, more recalls will increase data quality. This is something that should be considered given that NDNS currently ask respondents to provide four dietary recalls and have similar response rates to this pilot. However, this would be likely to result in a further reduced sample of four completed recalls.

Less than 5% of those participating in the Intake24 pilot used the option of a telephone call for the completion of their second dietary recall. As this is a relatively time consuming and costly part of the exercise it is worth considering only including those who are able to participate independently online. However, although internet use among older adults continues to increase with time, taking out the telephone option would potentially bias the sample further, as the mean age of those completing by telephone was 71 (mean SIMD of 2.5).

A further argument in favour of adopting Intake24 is that its implementation would free up around the five minutes currently required for the FVM and EHM take in the SHeS interview. The average lengths of time currently required for the FVM and EHM in the SHeS interview are 2.5 and 4.7 minutes. Introducing Intake24 would free up around five minutes currently in the main SHeS interview, as the time taken for interviewers to introduce Intake24 cannot be discounted, although there are ways that this could be reduced by streamlining the process. In addition to measuring key national health indicators SHeS also aims to be responsive to the health information needs of the Scottish Government; but in recent years incorporating new topics such as Adverse Childhood Experiences or questions on drug use have proved challenging due to the lack of space in the interview for new and rotating questions.

One aspect of the introduction of Intake24 to respondents that would merit review is the sheet of access codes that interviewers used to enable access to those who did not want to give email or text contact details and as a contingency for those who did. This was a cumbersome and time-consuming aspect of the process for interviewers and it is not clear how much it supported response rates.

The incentive for the Intake24 pilot was generous at £20 for the completion of two dietary recalls. Perhaps unsurprisingly, feedback from interviewers suggests that this incentive was very influential on response. If Intake24 was to be run in the full SHeS sample at the current rates there would be an additional incentive cost of around £42,000.

Finally, in terms of integration, it is important to consider how Intake24 and SDG data would best be presented in SHeS. Over the years SHeS has developed to become a highly accessible resource for academics, policy makers, health and social care practitioners, service providers, journalists and the general public. Whilst some key areas are easily transferrable such as reporting on five a day, others such as weights of foods or energy intakes are less well known publicly and less accessible to a wide audience. If Intake24 were to be introduced to SHeS in future, it will be of key importance to ensure that the data are presented in a way that is both accurate and meaningful to the diverse SHeS audience.

7.3 Nutritional data: Advantages and Limitations of Introducing Intake24 to SHeS

Intake24 can provide quantifiable outcomes in terms of nutrients and food groups which can be directly compared to dietary recommendations such as the SDGs. A limitation to this pilot was that comparing energy density from the SDGs with the data collected through Intake24 was not possible due to difficulty distinguishing 'foods and milk' from 'drinks', and therefore 'total energy' from 'total energy from food and milk' which is

required for the SDGs. Once developments have been made to identify 'food/milk' vs 'drinks' input into Intake24, data collected can be compared to the energy density SDG to enable progress towards meeting the goals at a population level to be assessed.

There are also methodological differences between the EHM and FVM with Intake24. Although Intake24 does provide more detailed and measurable data, the methods will likely give slightly different outcomes. Differences in agreement between the two measures need to be considered – such as whether the intake of fruit and vegetables is comparable, does it matter that this is based on slightly different data? Given the potential for desirability bias in FVM (although unproven) it is not clear that Intake24 is more accurate – however it can offer more precise nutritional data, and of course, measures against SDGs. Furthermore, through the respondent feedback questionnaire, it was found that more individuals who took part in the pilot thought they were able to give the most accurate data about their diet through Intake24 compared to the SHeS interview (50% compared to 18%).

7.4 Further Developments for Intake24

The pilot has highlighted a number of ways in which Intake24 could be further developed and improved, including:

- Updating the foods in the database to ensure there are minimal problems with finding foods. This can be resolved by using the more up to date NDNS version of the food database, which includes more foods and also includes free sugars as well as NMES
- Requesting more information from the respondent about the day that the recall has been completed for by adding 'usual day' and 'special diet' questions
- Adding a flag to items in the Intake24 database so that the energy density can be easily calculated
- To minimise time taken for quality checks, a flag added to the Intake24 output highlighting where certain prompts have been triggered would enable quicker checking of the dietary data e.g. a flag for when the "one item per line" message has been triggered
- Using the updated 'NDNS' version of Intake24 will reduce the time taken to analyse the dietary data as fruit and vegetable disaggregate data is included in the dietary output
- A supplementary brief food frequency questionnaire could be added either into Intake24, or as part of the SHeS interview (as is currently the practice in NDNS) to collect additional data on consumption of oily and white fish, fruit juice and soft drinks.
- The addition of a sentence to the chaser emails such as: "If you already completed your first/second diary earlier today then please ignore this email and thank you for taking part"

7.5 Conclusions

Intake24 enables the collection of more detailed data from the SHeS sample and offers a more effective way to measure population dietary intakes against the SDGs along with differences between population groups. However, the pilot raises a number of key areas that would require careful consideration prior to introducing Intake24 to SHeS.

Although introducing Intake24 to SHeS is unlikely to have a detrimental impact on the overall SHeS response rate, the Intake24 sample will be around 44% of the overall SHeS sample which will limit Local Authority level analysis, which is routinely carried out using a 4-year combined dataset. Intake24 provided very similar population estimates of average daily fruit and vegetable portion consumption but gave a higher estimate of those eating less than one portion of fruit and vegetables /day and a lower estimate of those eating five or more portions so the time series for SHeS is likely to be impacted, albeit with more detailed data. It will be important to weigh up the advantages of collecting more detailed food and nutrient data that can better inform how dietary intakes in Scotland compare with the SDGs and freeing up vital SHeS interview time for new topics against the disadvantages of a smaller sample of dietary data, limited local level analysis potential, changes in time series and additional costs.

The sample in this pilot had less demographic bias than that of the 2015 field test, however efforts should be made to increase response rates among key groups such as older and younger adults, children and men. Additionally, efforts should be made to ensure that emails are used as the main form of contact with respondents to maximise response.

There are still some aspects of Intake24 (e.g. categorisation of food and milk) that would need to be developed further to facilitate better analysis of dietary data against the SDGs. These adaptations are recommended to be put in place prior to the introduction of Intake24 to SHeS.

Other areas for consideration include:

- Streamlining the administration and set-up of Intake24
- Including a short food frequency questionnaire for key foods such as oily and white fish, fruit juice and soft drinks
- Moving to web only as few used the telephone recall option, however this could further reduce the response from adults over 75
- Ensuring that Intake24 and SDG data are presented in SHeS in a highly accessible way to the very large and wide ranging SHeS audience
- Collecting four instead of two dietary recalls, although this could be detrimental to response rates

8 Appendices

Appendix A Eating Habits Module and Fruit and Vegetable Module Questionnaire Extract

SHeS 2018 Questionnaire Extract

Eating habits module (2-15) (Version A – all age 2 +)

ASK ALL AGED 2-15 AND AGED 16+ VERSION A ONLY

[UsBread][15]

What kind of bread do you usually eat? Is it ... READ OUT…

CODE ONE ONLY

INTERVIEWER: Soda Bread, Chollah = CODE 1;

Wheatgerm, Wheatmeal, Granary, Rye, German, Highbran = CODE 2

1 white

2 brown, granary, wheatmeal,

3 wholemeal

4 SPONTANEOUS: (Wholemeal/white mixture e.g. 'Best of Both')

5 SPONTANEOUS: (Does not have usual type)

6 (Does not eat any type of bread)

7 (Other type of bread that does not fit above codes)

If UsBred08 =Other type of bread

[15] The question wording and answer categories changed in 2008.

[BreadOth]*

INTERVIEWER: PLEASE SPECIFY…

Text: Maximum [90] characters

ASK ALL WHO EAT BREAD (AT UsBread08)

[BrSlice]

SHOW CARD G1

Now looking at this card, how many **slices of bread**, or how many **rolls**, do you usually eat on any **one day**?

INTERVIEWER: If varies, ask for an average

1 6 a day or more

2 4-5 a day

3 2-3 a day

4 One a day

5 Less than one per day

ASK ALL AGED 2-15 AND AGED 16+ VERSION A ONLY

[Milk08][1]

What kind of milk do you usually use for drinks, in tea or coffee and on cereals?

Is it ... READ OUT…

CODE ONE ONLY

1 whole milk

2 semi-skimmed

3 skimmed

4 or, some other kind of milk? (TRY TO USE CODES BELOW)

5 (Soya/Rice/Oat-based milk)

6 (Goat's milk)

7 (Infant formula milk)

8 (Does not have usual type)

9 (Does not drink milk)

[Cereal08][16]

Which type of breakfast cereal, including porridge, do you normally eat?

CODE ONE ONLY FROM CODING LIST 1

1 High fibre & high sugar

2 High fibre & low or no sugar

3 Low fibre & high sugar

4 Low fibre & low or no sugar

5 Other cereal **not** on coding list

6 SPONTANEOUS: (Does not have usual type)

7 (Does not eat breakfast cereal)

IF Cereal08 = Other THEN

[CerOth]*

PLEASE SPECIFY

[16] The question wording and answer categories changed in 2008.

IF Cereal08=1 to 6 OR DON'T KNOW

[Cereals]

SHOW CARD G2

How often do you eat **breakfast cereals, including porridge**?

DO NOT COUNT BREAKFAST CEREAL BARS

1 6 or more times a day

2 4 or 5 times a day

3 2 to 3 times a day

4 Once a day

5 5 or 6 times a week

6 2 to 4 times a week

7 Once a week

8 1 to 3 times per month

9 Less often or never

(The answer options used at Cereals, on show card G2, are used repeatedly in the eating habits module. Further mentions of show card G2 will not, therefore, list out the options in full).

ASK ALL AGED 2-15 AND AGED 16+ VERSION A ONLY

[Chips]

SHOW CARD G2

How often do you eat **chips**?

1 6 or more times a day

2 4 or 5 times a day

3 2 to 3 times a day

4 Once a day

5 5 or 6 times a week

6 2 to 4 times a week

7 Once a week

8 1 to 3 times per month

9 Less often or never

[Potatoes]

SHOW CARD G2

Other than chips, how often do you eat **potatoes, pasta or rice**?

[Meat03]

SHOW CARD G2

How often do you eat **meat such as beef, lamb, pork etc**, not including poultry?

[MeatProd]

SHOW CARD G2

How often do you eat **meat products** such as sausages, meat pies, bridies, corned beef, or burgers?

INTERVIEWER: INCLUDE LORNE, SLICED, AND LINKS SAUSAGES

[TFish]

SHOW CARD G2

How often do you eat **canned tuna fish**? Please don't count fresh or frozen tuna.

[WFish03]

SHOW CARD G2

How often do you eat **white fish** such as cod, haddock, whiting, sole or plaice, including fresh or frozen fish?

[FshOil03]

SHOW CARD G2

How often do you eat **other types of fish** such as herring, mackerel, salmon or kippers, including fresh, frozen or canned fish?

INTERVIEWER: If asked, include fresh or frozen tuna here.

[Cheese]

SHOW CARD G2

How often do you eat **cheese** not including cottage cheese and other reduced fat cheeses?

[Confec]

SHOW CARD G2

How often do you eat **sweets or chocolates**?

[IceCream]

SHOW CARD G2

How often do you eat **ice cream**?

[Crisps]

SHOW CARD G2

How often do you eat **crisps or other savoury snacks**?

[DietDr]

SHOW CARD G2

How often do you drink diet, low-calorie or no-added sugar **soft drinks**?

Include diet fizzy drinks, low-cal flavoured water and no-added sugar diluting juice. *(adults only)* Include diet or low-calorie soft drinks added to alcohol. Do **not** include fresh fruit juice or plain water

[SoftDr]

SHOW CARD G2

How often do you drink **sugary soft drinks**?

Include fizzy drinks, energy drinks and diluting juice with added sugar.

(adults only) Include sugary soft drinks added to alcohol.

INTERVIEWER: Do **not** include diet, low-calorie or no-added sugar drinks or fresh fruit juice.

IF (Age<=15) THEN

[MilkDr]

SHOW CARD G2

How often does (he/she/name) drink milk, **not** including milk used for tea, coffee and cereals, or in milkshakes and other flavoured milks?

INTERVIEWER: include soya / goat's milk.

ASK ALL AGED 2-15 AND AGED 16+ VERSION A ONLY

[CakesEtc]

SHOW CARD G2

How often do you eat **cakes, scones, sweet pies or pastries**?

[Biscuits]

SHOW CARD G2

How often do you eat **biscuits?**

ASK ALL WHO EAT BISCUITS AT LEAST ONCE A DAY (IF [Biscuits] in [1..4])

[Biscuit]

SHOW CARD G1 AGAIN

How many **biscuits** do you usually eat on any one day?

INTERVIEWER: If varies, ask for an average

1 6 a day or more

2 4-5 a day

3 2-3 a day

4 One a day

5 Less than one per day

ASK ALL WHO EAT CAKES / SCONES / PIES ETC AT LEAST ONCE A DAY

[CakeScon]

SHOW CARD G1 AGAIN

How many **cakes, scones, sweet pies or pastries** do you usually eat on any one day?

INTERVIEWER: If varies, ask for an average

1 6 a day or more

2 4-5 a day

3 2-3 a day

4 One a day

5 Less than one per day

Fruit and vegetable module ALL VERSIONS (2+)

ASK ALL AGED 2+

[VFInt]*

I'd like to ask you a few questions about some of the things you ate and drank yesterday. By yesterday I mean 24 hours from midnight to midnight. First I'd like to ask you some questions about the amount of fruit and vegetables you have eaten.

1 Continue

[VegSal]

Did you eat any salad yesterday? Don't count potato, pasta or rice salad or salad in a sandwich.

INTERVIEWER: Salads made mainly from beans can **either** be included here **or** at the next question.

1 Yes

2 No

IF VegSal = Yes THEN

[VegSalQ]

How many cereal bowlsful of salad did you eat yesterday?

IF ASKED: 'Think about an average-sized cereal bowl'.

Range: 0.5 ..50.0

ASK ALL AGED 2+

[VegPul]

Did you eat any pulses yesterday? By pulses I mean lentils and all kinds of peas and beans, including chickpeas and baked beans. Don't count pulses in foods like Chilli con carne.

1 Yes

2 No

IF VegPul = Yes THEN

[VegPulQ]

SHOW CARD G3

How many tablespoons of pulses did you eat yesterday?

IF ASKED: 'Think about a heaped or full tablespoon'.

FOR INFO: An average sized can of baked beans = 10 tablespoons.

Range: 0.5.. 50.0

ASK ALL AGED 2+

[VegVeg]

Not counting potatoes, did you eat any vegetables yesterday?

Include fresh, raw, tinned and frozen vegetables.

1 Yes

2 No

IF VegVeg = Yes THEN

[VegVegQ]

SHOW CARD G3

How many tablespoons of vegetables did you eat yesterday?

IF ASKED: 'Think about a heaped or full tablespoon'.

Range: 0.5...50.0

ASK ALL AGED 2+

[VegDish]

(Apart from anything you have already told me about, did I Did) you eat any (*other)* dishes made **mainly** from vegetables or pulses yesterday, such as vegetable lasagne or vegetable curry?

Don't count vegetable soup, or dishes made mainly from potatoes.

1 Yes

2 No

IF VegDish = Yes THEN

[VegDishQ]

SHOW CARD G3

How many tablespoons of vegetables or pulses did you eat (*in these kinds of dishes)* yesterday?

IF ASKED: 'Think about a heaped or full tablespoon'.

Range: 0.5 - 50.0

ASK ALL AGED 2+

[VegUsual]

Compared with the amount of vegetables, salads and pulses you usually eat, would you say that yesterday you ate...

...READ OUT...

1 less than usual,

2 more than usual,

3 or about the same as usual?

[FrtDrk09]

Did you drink any pure fruit juice yesterday? Don't count diluting juice, squashes, cordials or fruit-drinks.

INTERVIEWER: Include pure fruit juice from concentrate.

1 Yes

2 No

IF FrtDrk09 = Yes THEN

[FrtDrnkQ]

How many small glasses of pure fruit juice did you drink yesterday?

IF ASKED: 'A small glass is about a quarter of a pint'.

Range: 0.5.-.50.0

ASK ALL AGED 2+

[Frt]

Did you eat any fresh fruit yesterday? Don't count fruit salads, fruit pies, etc.

1 Yes

2 No

FrtC TO FrtMor REPEATED FOR EACH FRUIT CODED AT FrtC OR MENTIONED AT FrtOth

IF Frt = Yes (OR FrtMor = Yes)

[FrtC]* *(Variable names: FrtC01-FrtC08)*

What kind of fresh fruit did you eat yesterday?

INTERVIEWER: Use the **Fresh Fruit Size list** in the coding booklet to code the size of this fruit (common examples listed below, **if in doubt** use the coding booklet).

INTERVIEWER: IF MORE THAN ONE KIND OF FRUIT MENTIONED AND IF SAME SIZE, CODE EACH KIND OF FRUIT SEPARATELY.

For example: If respondent ate 2 apples and 1 banana code size of apple first (in this case 3 – medium fruit) then enter quantity of apples (in this case 2). Next code size of banana (3 – medium fruit) then quantity of bananas (in this case 1).

1 Very large fruit (e.g. melon (all types), pineapple)

2 Large fruit (e.g. grapefruit, mango)

3 Medium-sized fruit (e.g. apple, banana, orange, peach)

4 Small fruit (e.g. kiwi, plum, apricot)

5 Very small fruit (e.g. strawberry, grapes (all types))

6 Not on coding list

IF (FrtC = Very large fruit ... Very small fruit)

[FrtQ] ***(Variable names: FrtQ01-FrtQ08)***

IF FrtC= 'Very large fruit': How many average slices of this fruit did you eat yesterday?

IF FrtC= 'Large / Medium / Small fruit': How much of this fruit did you eat yesterday?

IF FrtC= 'Very small fruit': How many average handfuls of this fruit did you eat yesterday?

Range: 0.5.-.50.0

IF (FrtC = Not on coding list)

[FrtOth] ***(Variable names: FrtOth01-FrtOth15)***

What was the name of this fruit?

Text: Maximum 50 characters

[FrtNotQ] ***(Variable names:FrtNot01-FrtNot15)***

How much of this fruit did you eat?

Text: Maximum 50 characters

REPEAT FOR UP TO 15 ADDITIONAL FRUITS

[FrtMor] ***(Variable names: FrtMor01-FrtMor15)***

Did you eat any other fresh fruit yesterday?

1 Yes

2 No

ASK ALL AGED 2+

[FrtDry]

Did you eat any dried fruit yesterday? Don't count dried fruit in cereal, cakes, etc.

1 Yes

2 No

IF FrtDry = Yes THEN

[FrtDryQ] SHOW CARD WITH SPOON PICTURES)

SHOW CARD G3

How many tablespoons of dried fruit did you eat yesterday?

IF ASKED: 'Think about a heaped or full tablespoon'.

Range: 0.5.-.50.0

ASK ALL AGED 2+

[FrtFroz]

Did you eat any frozen or tinned fruit yesterday?

1 Yes

2 No

IF FrtFroz = Yes THEN

[FrtFrozQ] (SHOW CARD WITH SPOON PICTURES)

SHOW CARD G3

How many tablespoons of frozen or tinned fruit did you eat yesterday?

IF ASKED: 'Think about a heaped or full tablespoon'.

Range: 0.5.-.50.0

ASK ALL AGED 2+

[FrtDish]

(Apart from anything you have already told me about,) Did you eat any (*other)* dishes made **mainly** from fruit yesterday, such as fruit salad or fruit pie? Don't count fruit in yoghurts.

1 Yes

2 No

IF FrtDish = Yes THEN

[FrtDishQ]

SHOW CARD G3

How many tablespoons of fruit did you eat (*in these kinds of dishes)* yesterday?

IF ASKED: 'Think about a heaped or full tablespoon'.

Range: 0.5.-.50.0

ASK ALL AGED 2+

[FrtUsual]

Compared with the amount of fruit and fruit juice you usually eat and drink, would you say that yesterday you ate and drank...

...READ OUT...

1 less than usual,

2 more than usual,

3 or about the same as usual?

Appendix B Intake24 Example Images

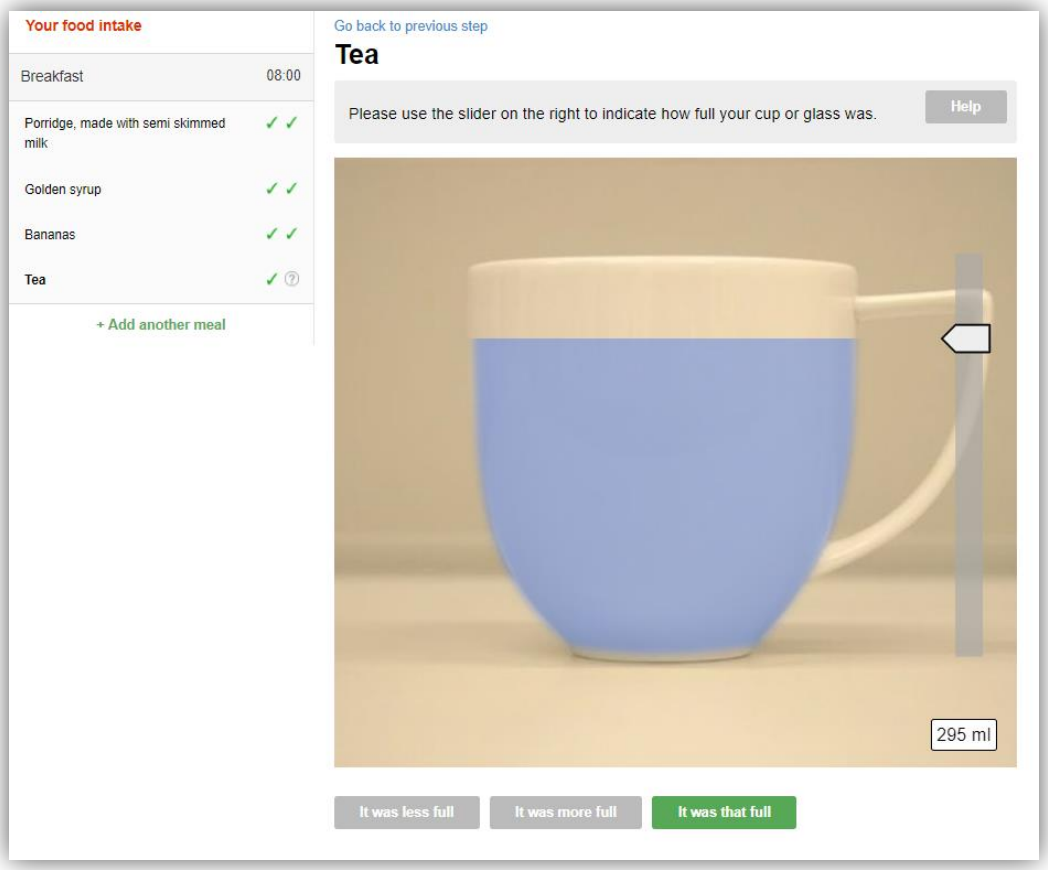


Figure 9. Example of how to estimate portion size of drinks

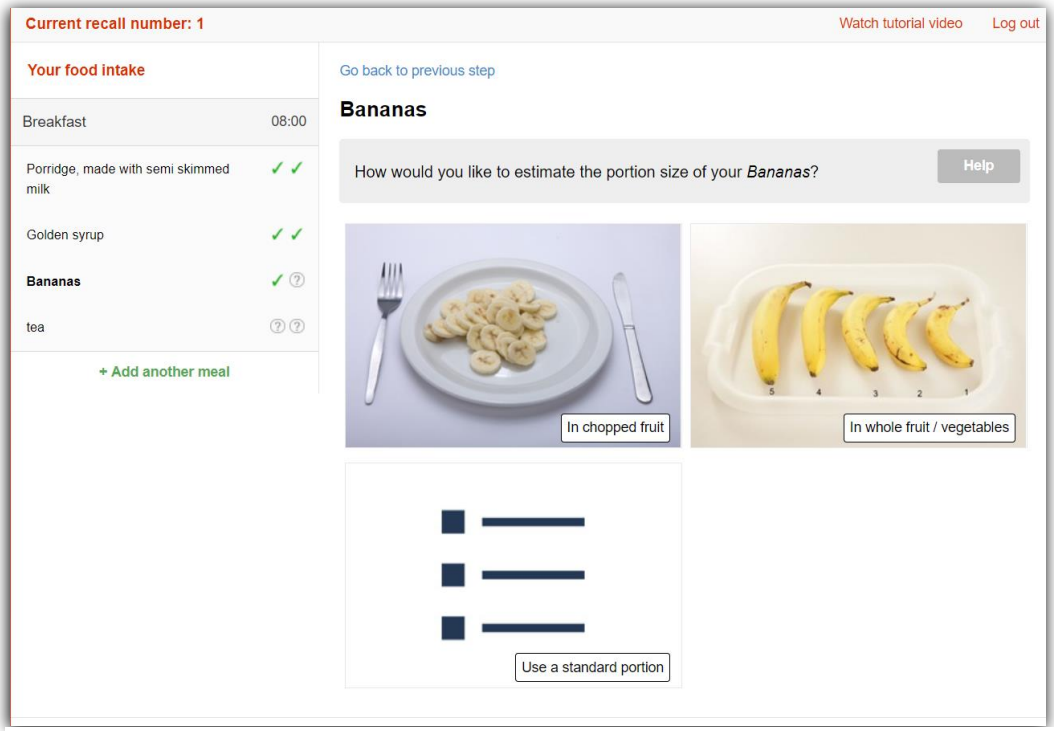


Figure 8. Examples of different ways to estimate portion sizes

Appendix C Intake24 Dietary Feedback

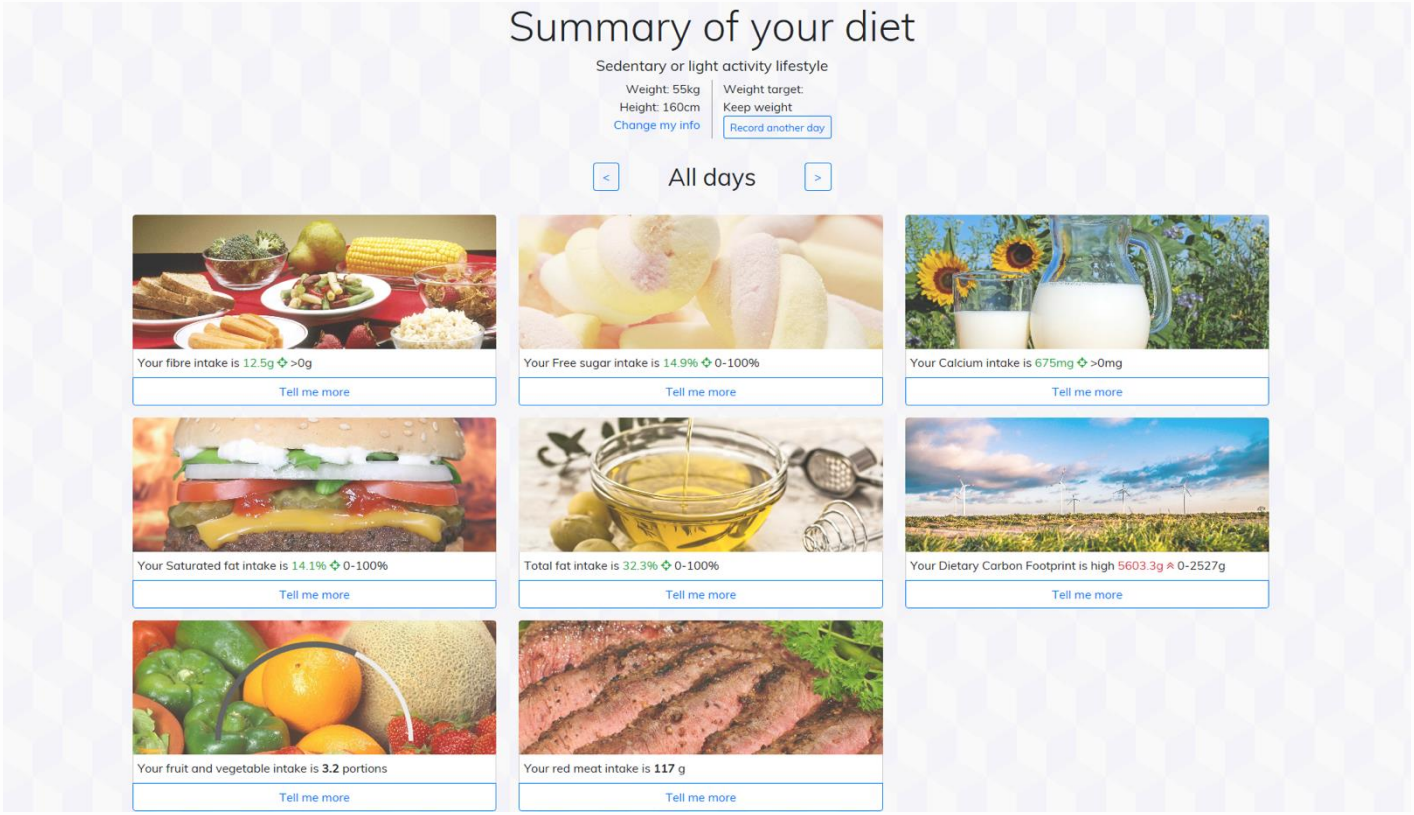


Figure 10. Example of dietary feedback given to respondent's after completion of a recall (can be based on a single recall or average of multiple recalls)

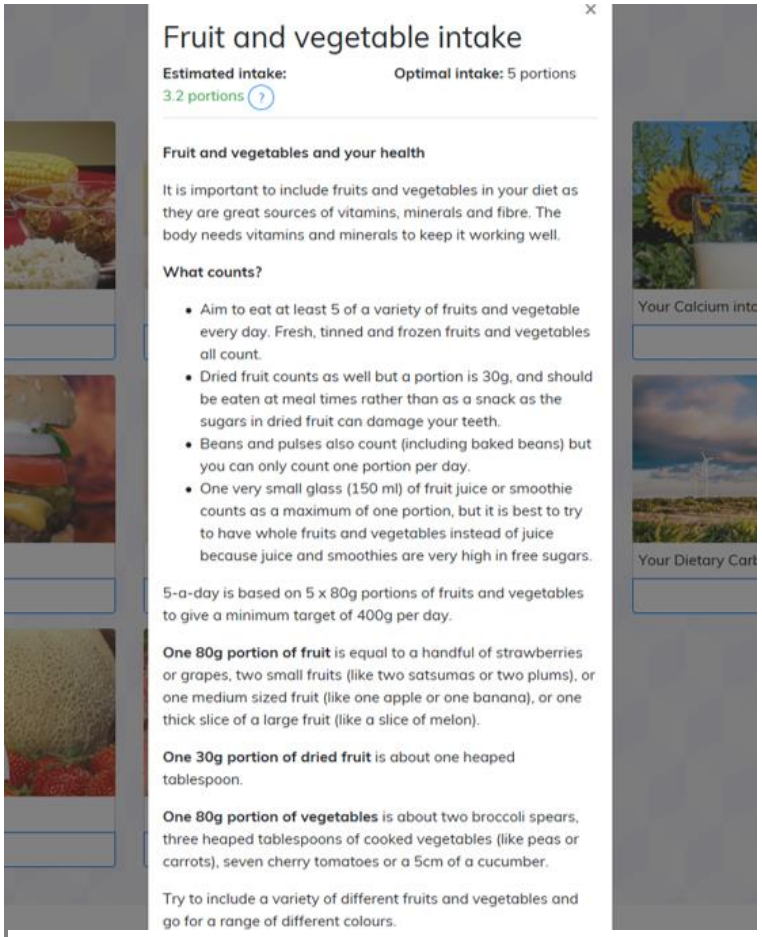


Figure 11. Example dietary feedback information given to respondents if they click on "learn more" for 'Fruit and Vegetable intake'

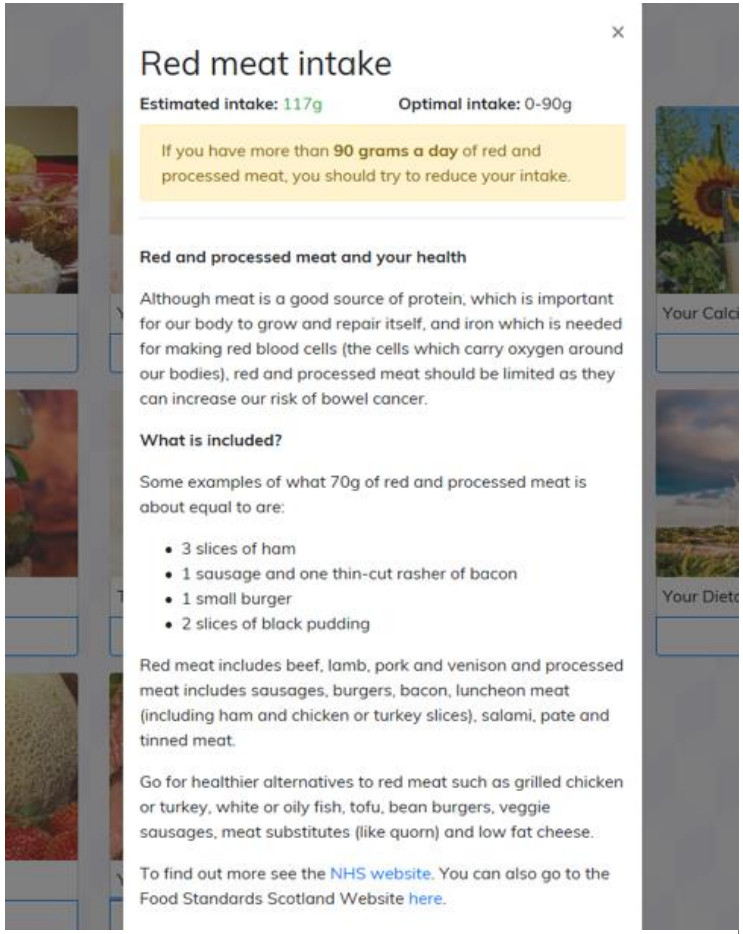
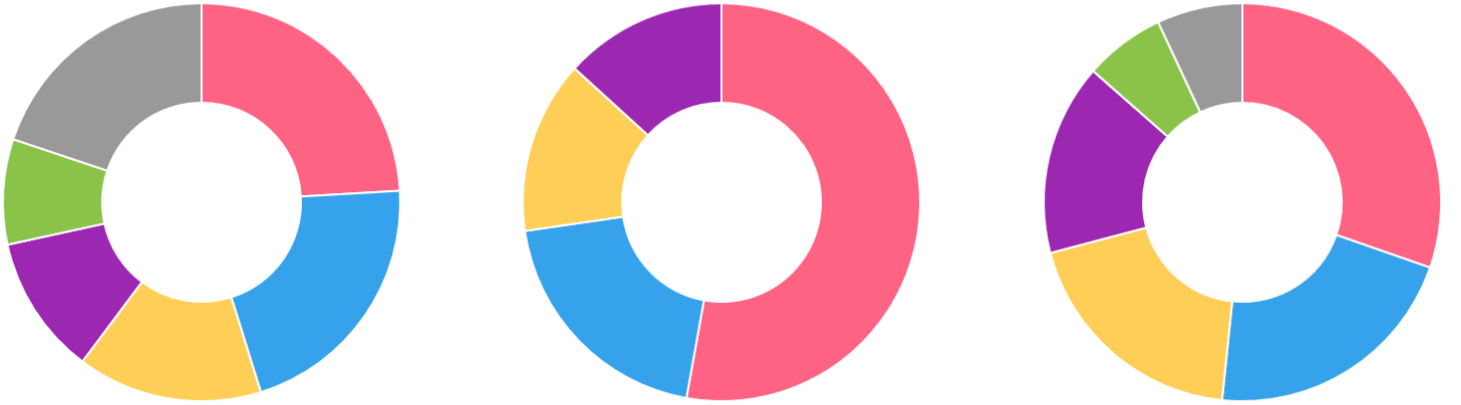


Figure 12. Example dietary feedback information given to respondents if they click on "learn more" for 'Red meat intake'



Highest in calories

1. Oven chips
2. Porridge, made with whole milk
3. Beef fillet steak, grilled
4. Fusilli/penne pasta in a tomato-based sauce
5. Fresh orange juice, from concentrate
6. Other food

Highest in free sugar

1. Fresh orange juice, from concentrate
2. Golden syrup
3. Chocolate coated biscuit e.g. Rocky bar, Club, Breakaway
4. Caster sugar

Highest in saturated fat

1. Porridge, made with whole milk
2. Beef fillet steak, grilled
3. Fusilli/penne pasta in a tomato-based sauce
4. Chocolate coated biscuit e.g. Rocky bar, Club, Breakaway
5. Bacon (fat around edge only) grilled
6. Other food

Was our feedback helpful?

Figure 13. Example of dietary feedback, showing the foods/drinks highest in Calories, Free sugars and Saturated fats

Appendix D Intake24 Information Leaflet

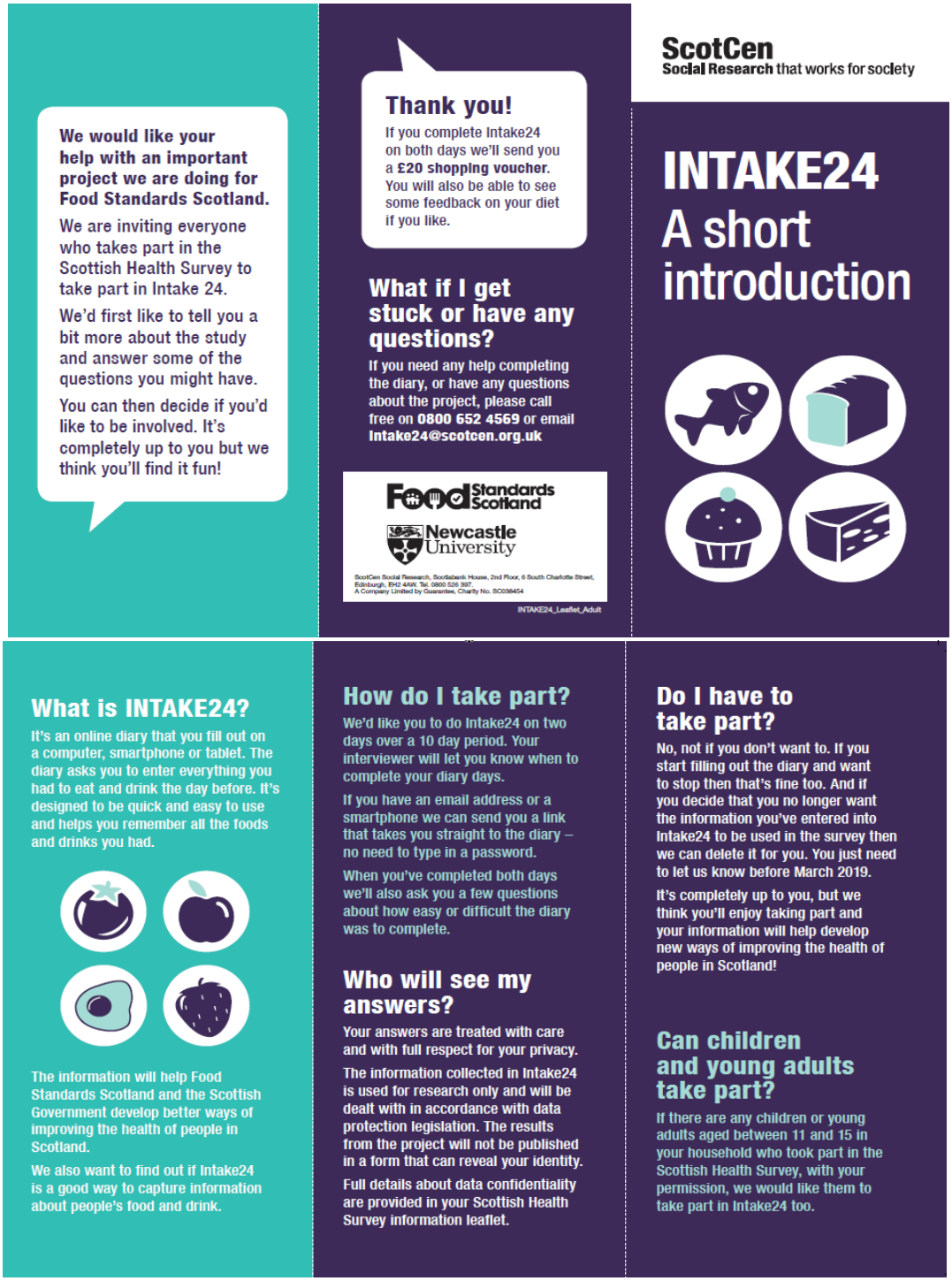


Figure 14. Intake24 Introduction leaflet

Appendix E Instant email template

Direct template (for those who provided their own email address)

Conditions for receiving: All who provided own email

When received: Immediately after consent and contact details given

Sender name = ScotCen Social Research

Email subject = "Your Intake24 food diary"

Dear <Forename>

Thank you for taking part in Intake24.

Please complete your first diary **today**. To fill in the diary click the link above.

If the link doesn't work, go to **intake24.co.uk/surveys/health** and enter your Intake24 code shown below in both the Username and Password fields (i.e. use the same code in both fields).

Intake24 code: <AccCode>

Please complete your 2nd diary on: <recall2day> <recall2datenumeric> <recall2month>.

Once you've completed the diary twice we'll send you a £20 gift voucher and you can get feedback on your diet if you like. We'll also ask some questions about what you thought of Intake24.

If you have any questions, call 0800 652 4569 or email Intake24@scotcen.org.uk

I hope you will enjoy taking part.

Dr Joanne McLean

Project Director

ScotCen Social Research

Proxy template (for those who provided another household member's email address)

Conditions for receiving: All who provided proxy email

When received: Immediately after consent and contact details given

Sender name = ScotCen Social Research

Sender email = TBC

Email subject = "Intake24 food diary"

Hi there,

Thank you for helping <Forename> take part in Intake24.

Please ask them to complete their first diary **today**. To fill in the diary they can click the link above.

If the link doesn't work, they can go to **intake24.co.uk/surveys/health** and enter their Intake24 code shown below in both the Username and Password fields (i.e. use the same code in both fields).

Intake24 code: <AccCode>

Please ask them to complete the 2nd diary on: <recall2day> <recall2datenumeric> <recall2month>.

Once they've completed the diary twice we'll send a £20 gift voucher and they can get feedback on their diet if they like. We'll also ask some questions about what they thought of Intake24.

If they have any questions, they can call 0800 652 4569 or email Intake24@scotcen.org.uk

I hope <Forename> will enjoy taking part.

Dr Joanne McLean

Project Director

ScotCen Social Research

Appendix F Thankyou email

Direct template (for those who provided their own email address)

Conditions for receiving: All who completed 2 recalls and gave own email address and has not already been sent thank you email

When to be sent: after completion of second Intake24 recall

Sender name: “ScotCen Social Research”

Subject line: "Intake24 voucher – thank you for taking part"

Thank you for taking part in Intake24

Dear [Forename]

Many thanks for taking part in Intake24.

Let us know what you thought

Please let us know what you thought of Intake24 by completing a short questionnaire.

To access it, simply click the link below.

[unique link to participation feedback questionnaire]

To say thank you

Here are the details for your £20 Amazon voucher:

Voucher code: {~AmazonCode~}

Expiry date: {~Expiry~}

For more information on how to redeem your voucher, visit amazon.co.uk/vouchers.

Best wishes,

Dr Joanne McLean,
Project Director
ScotCen Social Research

Proxy template (for those who provided another household member's email address)
Conditions for receiving: All who completed 2 recalls and gave proxy email address and has not already received thank you email

When received: after completion of second recall

Sender name: "ScotCen Social Research"

Subject line: "Intake24 voucher – thank you for taking part"

Thank you for taking part in Intake24

Hi there,

Please pass on our thanks to [Forename] for taking part in Intake24.

We'd like to know what they thought of Intake24

We'd like them to complete a short questionnaire.

To access it, they just click the link below.

[unique link to participation feedback questionnaire]

To say thank you

Here are the details for their £20 Amazon voucher:

Voucher code: {~AmazonCode~}

Expiry date: {~Expiry~}

For more information on how they can redeem their voucher, they can visit amazon.co.uk/vouchers.

Best wishes,

Dr Joanne McLean,
Project Director
ScotCen Social Research

Appendix G Access sheet for interviewer

Intake24 2018 Logon Card

To take part:

1) Click on the **link** sent to you via email or text

OR:

2) Go to **intake24.co.uk/surveys/health**

   Then, enter your Intake24 code (shown below) in both the Username and Password fields (i.e use the same code in both fields).

	Name	Intake24 code	2nd diary day
01			
02			
03			
04			
05			
06			
07			

08			
09			
10			
11			
12			

Appendix H Automated chaser messages

Email chase 1 (for recall 1) and 2 (for recall 2) - direct

Conditions for receiving: Those who did not complete recall 1 on day of SHeS interview or recall 2 on assigned day, and gave own email

When to be sent:

- *Chase 1: Day following SHeS interview date (afternoon)*
- *Chase 2: Day after recall 2 date (afternoon)*

Sender name: "ScotCen Social Research"

Subject line: "Still time to take part in Intake24"

<uniqueINTAKElink>

Hi <Forename>

Please complete your Intake24 food diary. To fill in the diary click the link above.

If the link doesn't work, go to **intake24.co.uk/surveys/health** and enter your Intake24 code shown below in both the Username and Password fields (i.e. use the same code in both fields).

Intake24 code: <AccCode>

If you have any questions or problems with logging in, call 0800 652 4569 or email Intake24@scotcen.org.uk

Thanks again for taking part.

Dr Joanne McLean

Project Director

ScotCen Social Research

Email chase 1 and 2 – proxy

Conditions for receiving: Those who did not complete recall 1 on day of SHeS interview or recall 2 on assigned day, and gave proxy email

When to be sent:

- *Chase 1: Day following SHeS interview date (afternoon)*
- *Chase 2: Day after recall2 date (afternoon)*

Sender name: "ScotCen Social Research"

Subject line: "Still time to take part in Intake24."

<uniqueINTAKElink>

Hi there,

Please ask <Forename> to complete their Intake24 food diary. To fill in the diary they can click the link above.

If the link doesn't work, they can go to **intake24.co.uk/surveys/health** and enter their Intake24 code shown below in both the Username and Password fields (i.e. use the same code in both fields).

Intake24 code: <AccCode>

If they have any questions or problems with logging in, they can call 0800 652 4569 or email Intake24@scotcen.org.uk

Thanks again for taking part.

Dr Joanne McLean
Project Director
ScotCen Social Research

Appendix I Eatwell Guide and Dietary Reference Values

Table 37. Eatwell guide booklet summarised [47] and UK Dietary Reference Values (DRVs) ([48])

UK Eatwell Guide	Summary (average/day or /week)
Fruit and vegetables	At least 5 portions/day, limit fruit juice to 150ml
Potatoes, bread, rice, pasta and other starchy carbohydrates	Eat plenty, choose wholegrain varieties and keep the skin on potatoes for more fibre, vitamins and minerals.
Dairy and Dairy alternatives	Eat some dairy or alternatives. Choose lower fat and sugar options.
Beans, pulses, fish, eggs, meat and other proteins	Eat some beans, pulses, fish, eggs, meat and other proteins, with at least 2 portions (140g) fish a week, one of which is oily. Limit processed meats such as bacon and cured meats. If you eat more than 90g/day, try to reduce to 70g/day.
Oils and spreads	Use these products sparingly.
UK DRVs	**% Daily total Energy**
Total Carbohydrate	50%
***of which* free sugars**	Not more than 5%
Total Fat	Not more than 35% food energy
***of which* saturated fat**	Not more than 11% food energy

Appendix J Respondent feedback

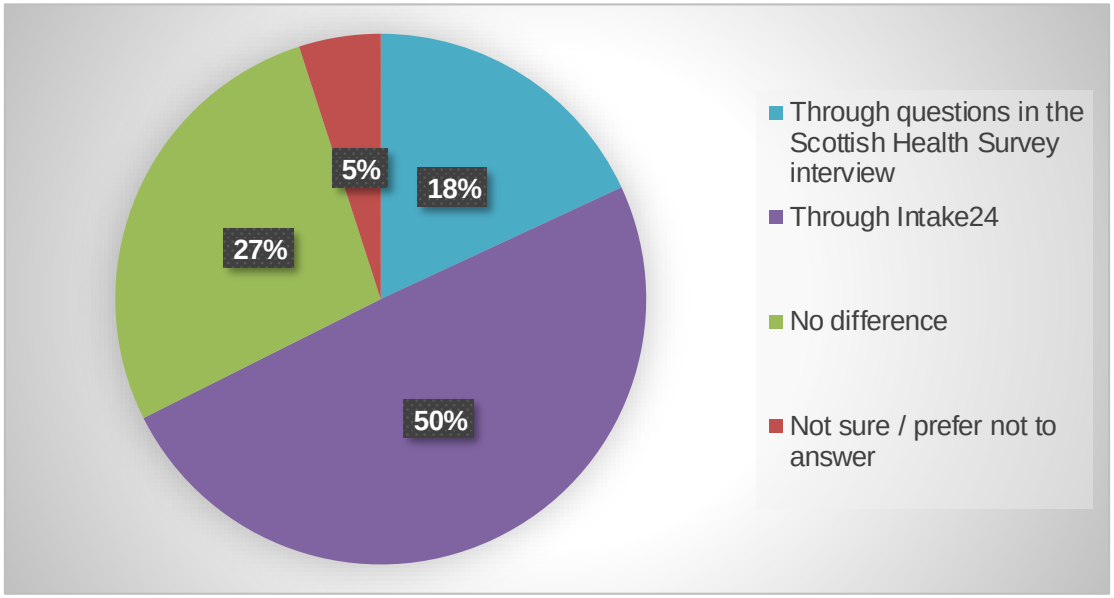


Figure 15. Do you feel you were able to give the most accurate information about your diet when using Intake24 or through the questions you answered in the Scottish Health Survey interview? *n*=824.

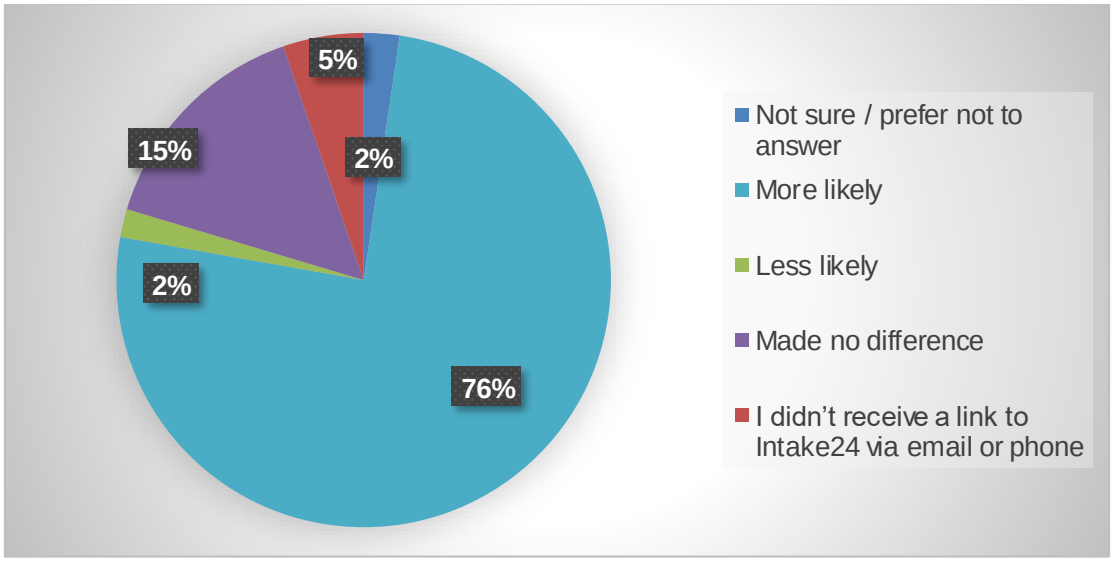


Figure 16. If you received a link to Intake24 via email or text, did this make you more or less likely to complete your online food diaries, compared with having the logon card alone? *n*=815.

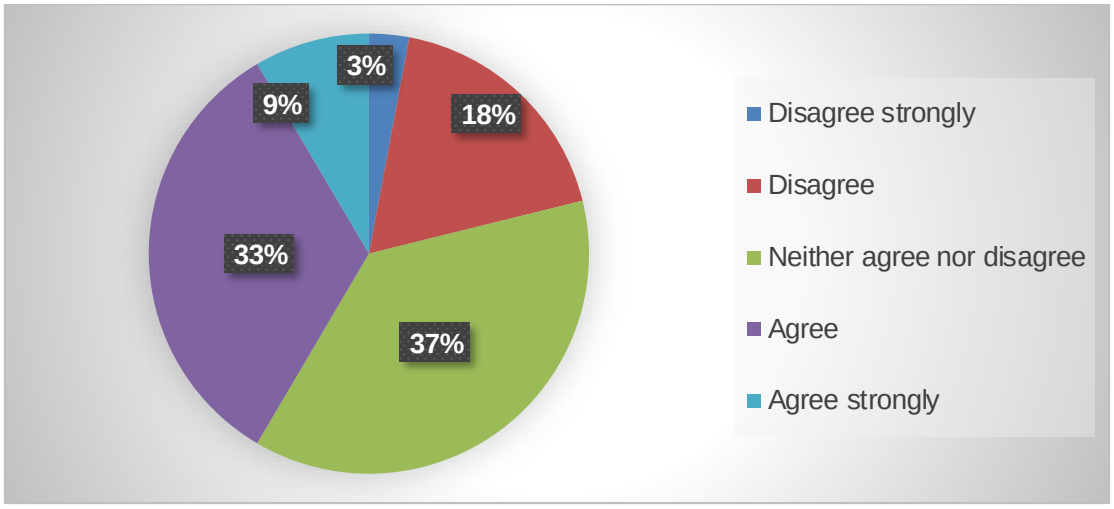


Figure 17. I would have been happy to complete Intake24 on four separate days, rather than just two. *n*=814.

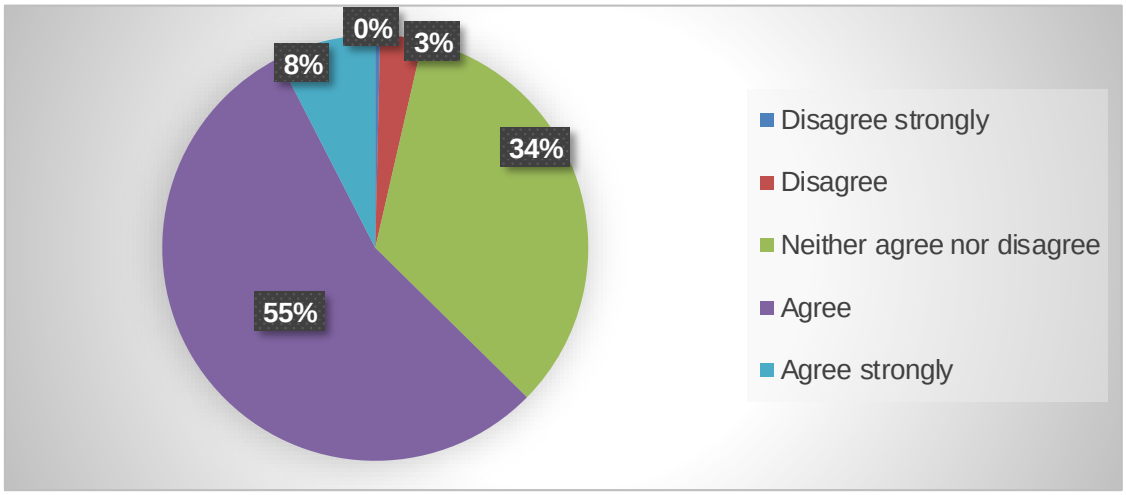


Figure 18. I like how Intake24 looks. *n*=808.

Appendix K System Usability Scale question outcomes

Answers to individual SUS questions are shown in figures below.

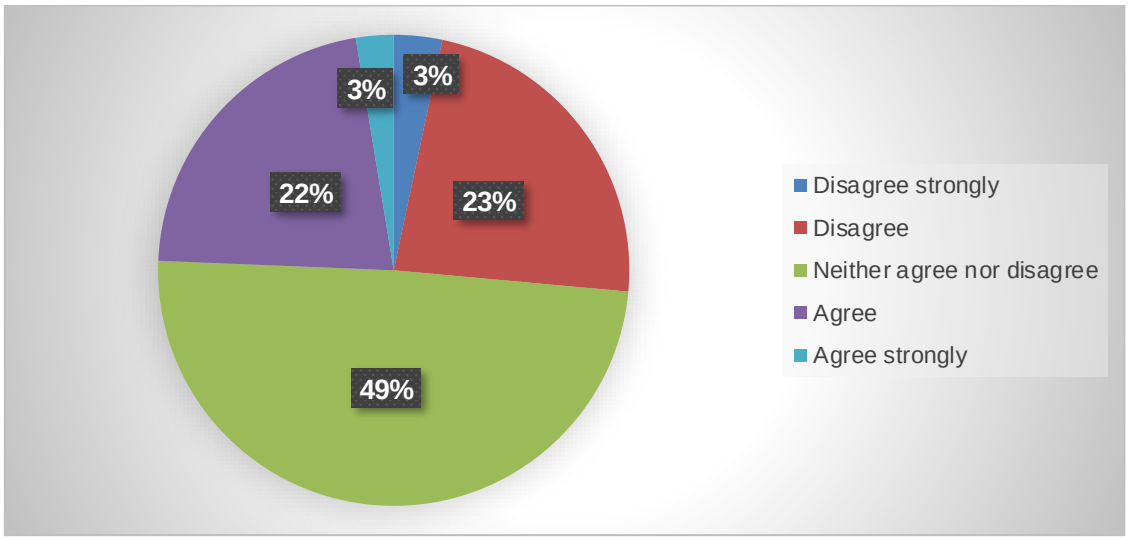


Figure 19. I would like to use Intake24 often (SUS question: I think that I would like to use this system frequently). *n*=814.

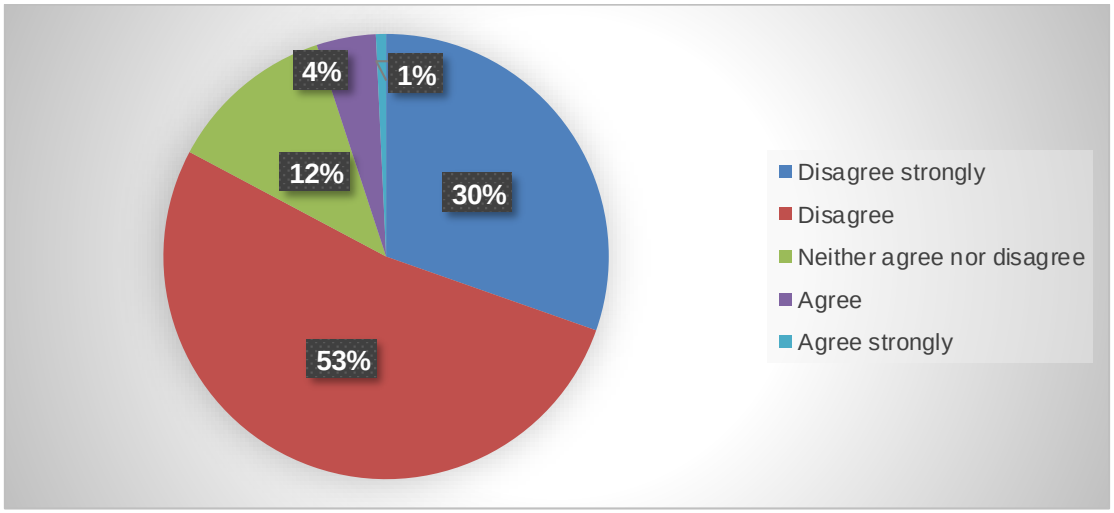


Figure 20. I would need help using Intake24 (SUS question: I think that I would need the support of a technical person to be able to use this system). *n*=813.

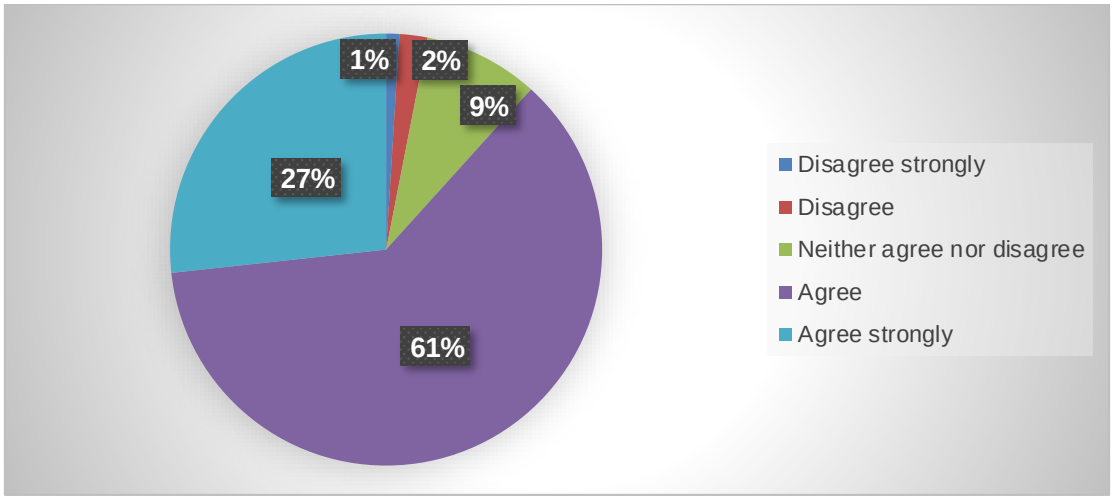


Figure 21. Intake24 was easy to use (SUS question: I thought the system was easy to use). *n*=812.

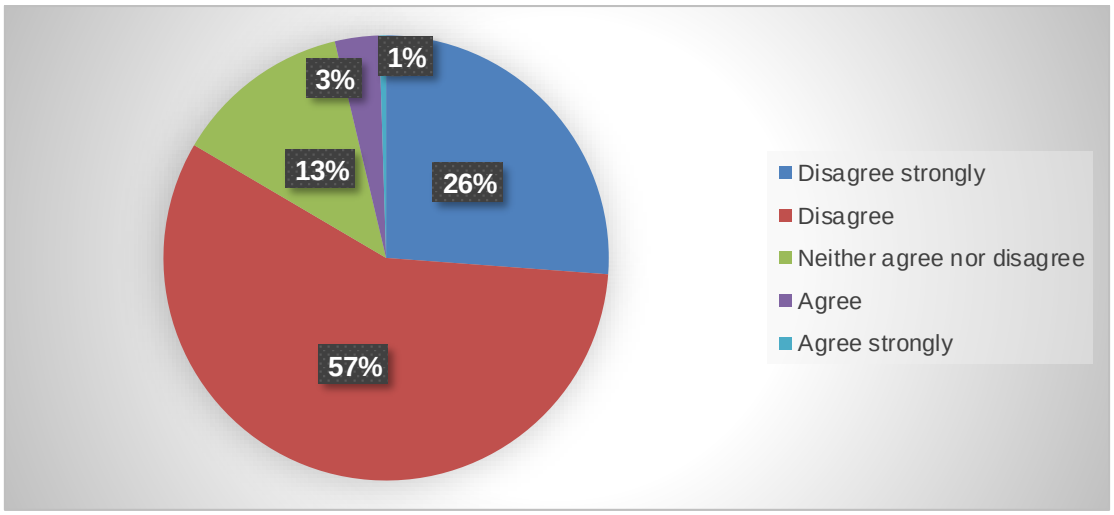


Figure 22. Intake24 was too complicated (SUS question: I found the system unnecessarily complex). *n*=810.

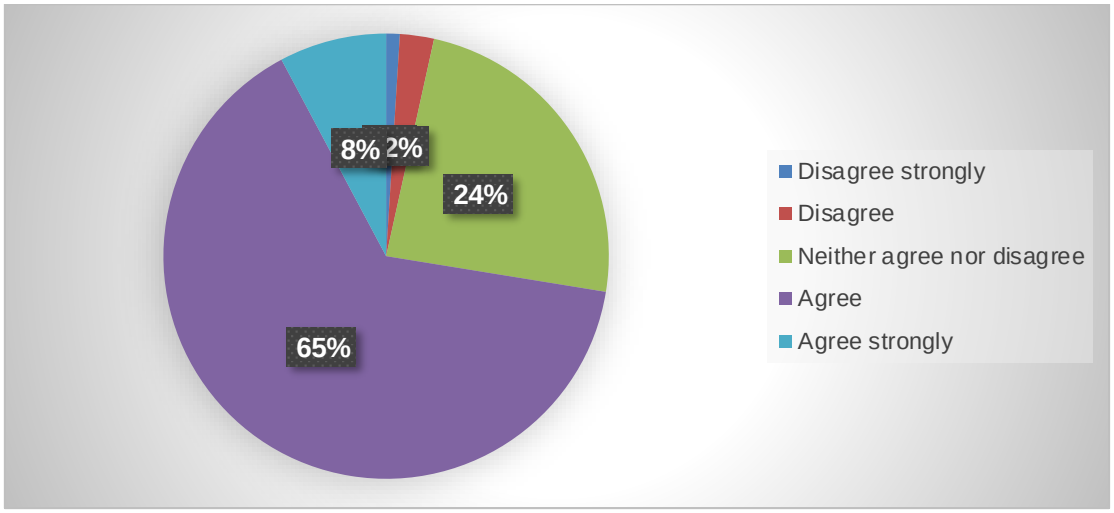


Figure 23. The different parts of Intake24 worked well together (SUS question: I found the various functions in this system were well integrated). *n*=809.

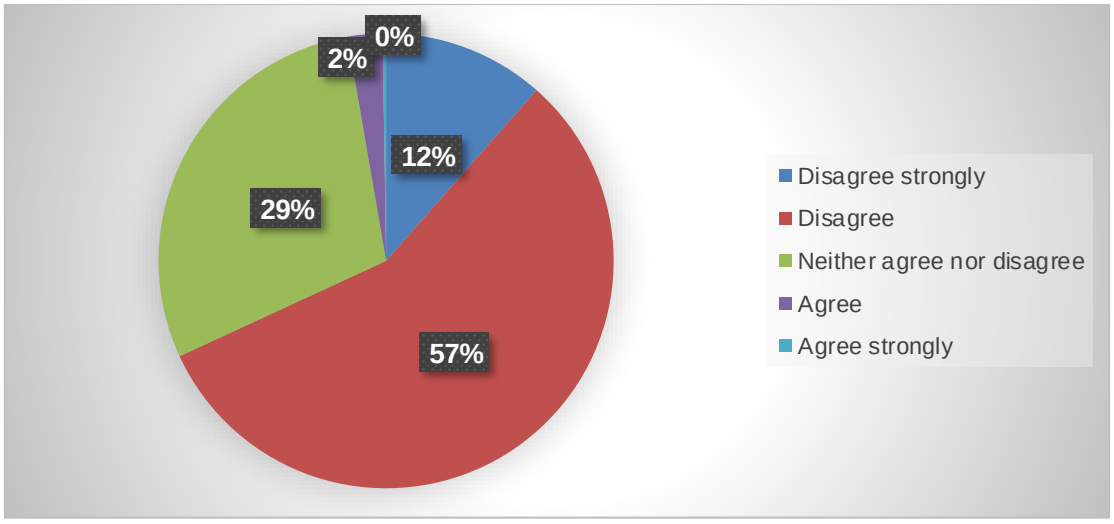


Figure 24. Intake24 was too inconsistent (SUS question: I thought there was too much inconsistency in this system). *n*=809.

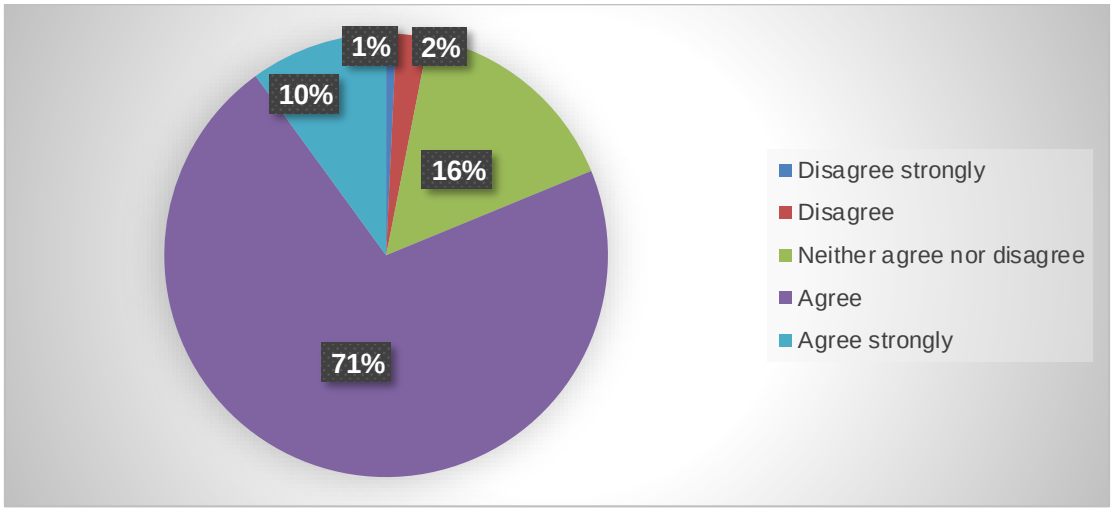


Figure 25. Most people would learn to use Intake24 quickly (SUS question: I would imagine that most people would learn to use this system very quickly). *n*=809.

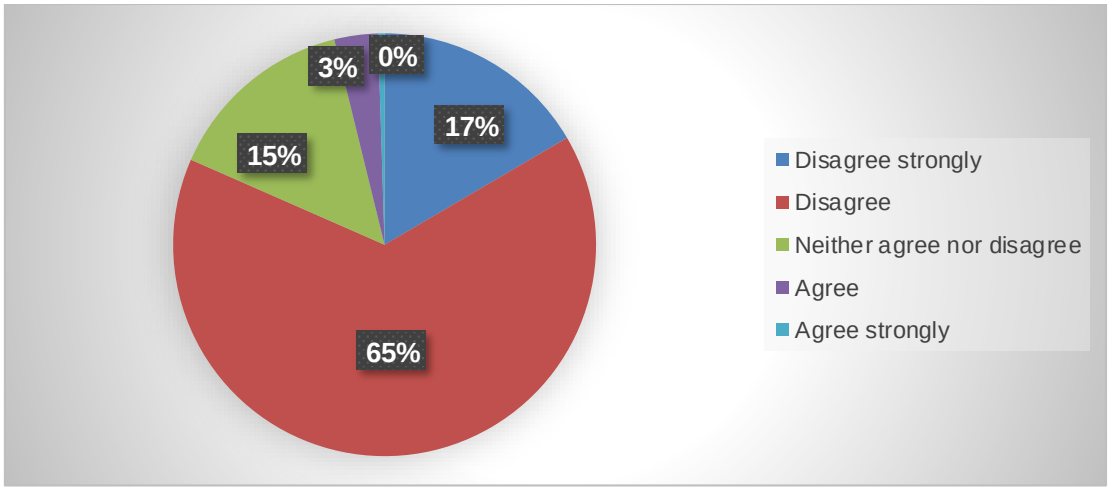


Figure 26. Intake24 is awkward to use (SUS question: I found the system very cumbersome to use). *n*=809.

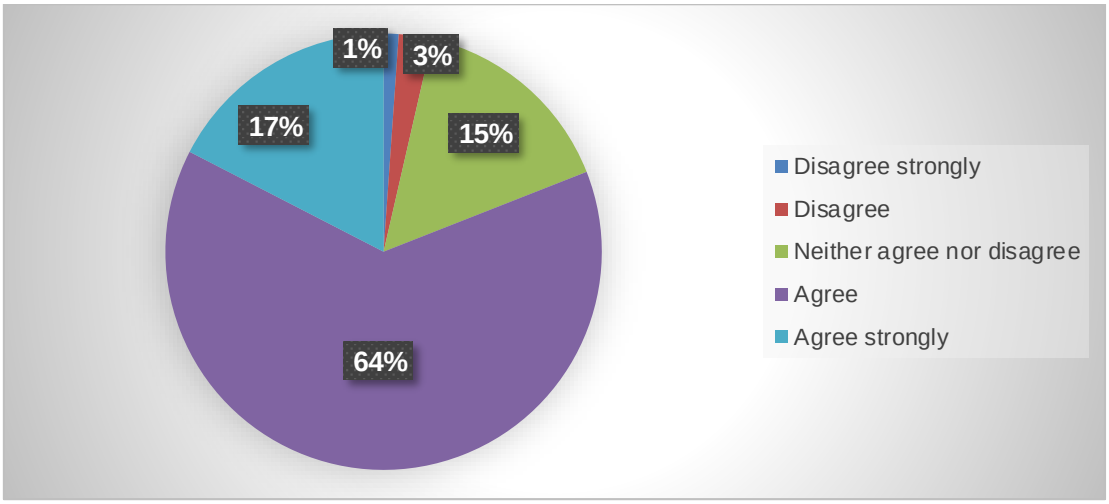


Figure 27. I felt very confident using Intake24 (SUS question: I felt very confident using the system). *n*=809.

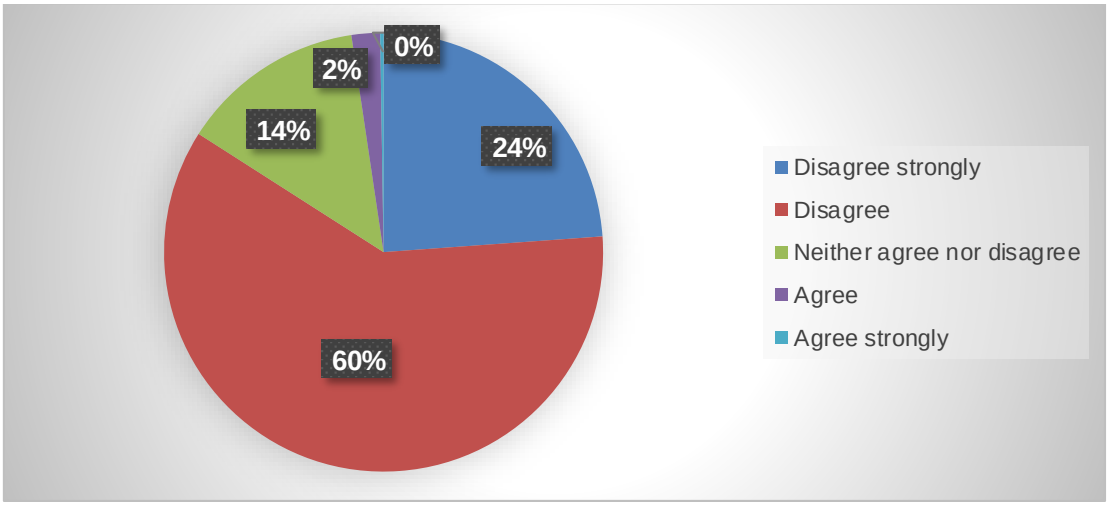


Figure 28. I needed to learn a lot before about Intake24 before I could use it (SUS question: I needed to learn a lot of things before I could get going with this system). *n*=809.

Appendix L Mean Nutrient Intakes

Table 38. Weighted two-day average, for adults (16+ years) SD, min and max nutrient intake. *n*= 1001

Nutrient	Mean	SD (±)	Min	Max
Energy (kcal)	1668	615	593	5066
Energy (kJ)	7020	2587	2504	21299
Total fat (g)	62.5	29.1	7.7	216.1
Total fat (% total food E)	33.8	7.4	9.8	61.4
Saturated fat (g)	24.0	12.9	2.1	90.4
Saturated fat (% total food E)	12.8	4.0	2.7	29.8
Trans-fatty acids (g)	0.9	0.6	0.0	4.1
Trans-fatty acids (% total food E)	0.5	0.2	0.0	1.5
Protein (g)	66.2	24.6	13.4	202.5
Protein (% total E)	16.7	4.8	3.9	39.9
Total carbohydrate (g)	211.0	84.9	18.5	804.1
Total carbohydrate (% total E)	47.9	8.6	8.4	81.1
Total sugars (g)	92.3	58.2	6.8	599.9
Total sugars (% total E)	20.6	9.3	1.9	75.2
NMES (g)	56.9	54.5	0.0	583.1
NMES (% total E)	11.9	9.0	0.0	59.7
Englyst fibre (g)	12.0	5.0	2.3	44.5
Estimated AOAC fibre (g)	15.9	6.7	3.0	59.2
Alcohol (g)	6.7	17.2	0.0	179.6
Alcohol (% total E)	2.3	5.4	0.0	42.2
Iron (mg)	9.5	3.9	1.8	26.3
Vitamin C (mg)	84.0	79.2	0.4	903.0
Calcium (mg)	759.3	345.4	153.7	2737.5

Unweighted bases	*1001*
Weighted bases	*994*

Table 39. Weighted two-day average, for adults (16+ years) SD, min and max nutrient intake by gender. Male (m) *n*=393 and female (f) *n*=608

Gender	Nutrient	Mean	SD (±)	Min	Max
M	Energy (kcal)	1862.1	636.8	677.6	4369.3
	Energy (kJ)	7835	2673	2860	18303
	Total fat (g)	70.1	30.5	14.6	216.1
	Total fat (%total food E)	34.2	7.1	14.2	55.4
	Saturated fat (g)	26.8	13.7	4.3	90.4
	Saturated fat (%total food E)	13.0	3.8	4.6	25.5
	Trans-fatty acids (g)	1.0	0.6	0.0	3.8
	Trans-fatty acids (%total food E)	0.5	0.2	0.0	1.5
	Protein (g)	74.2	25.8	13.4	202.5
	Protein (%total E)	16.8	4.9	3.9	39.9
	Total carbohydrate (g)	231.6	89.2	31.7	598.4
	Total carbohydrate (%total E)	46.9	8.6	8.4	70.2
	Total sugars (g)	100.5	63.7	6.8	427.2
	Total sugars (%total E)	20.1	9.8	1.9	62.0
	NMES (g)	66.8	59.8	0.0	392.2
	NMES (%total E)	12.9	10.0	0.0	59.7
	Englyst fibre (g)	12.0	5.2	2.3	44.5
	Estimated AOAC fibre (g)	16.0	6.9	3.0	59.2
	Alcohol (g)	8.9	21.6	0.0	179.6
	Alcohol (%total E)	2.9	6.3	0.0	42.2

Gender	Nutrient	Mean	SD (±)	Min	Max
	Iron (mg)	10.2	4.3	2.9	26.2
	Vitamin C (mg)	74.9	69.6	1.2	571.0
	Calcium (mg)	811.9	358.4	165.6	2737.5
F	**Energy (kcal)**	1499.9	544.3	593.9	5066.9
	Energy (kJ)	6313	2288	2504	21299
	Total fat (g)	56.0	26.0	7.7	167.4
	Total fat (%total food E)	33.3	7.6	9.8	61.4
	Saturated fat (g)	21.6	11.5	2.1	77.5
	Saturated fat (%total food E)	12.7	4.1	2.7	29.8
	Trans-fatty acids (g)	0.8	0.5	0.0	4.1
	Trans-fatty acids (%total food E)	0.5	0.3	0.0	1.5
	Protein (g)	59.2	21.1	15.7	139.2
	Protein (%total E)	16.6	4.8	6.3	38.2
	Total carbohydrate (g)	193.1	76.7	18.5	804.1
	Total carbohydrates (%total E)	48.8	8.4	11.2	81.1
	Total sugars (g)	85.1	52.0	7.1	599.9
	Total sugars (%total E)	21.1	8.7	3.7	75.2
	NMES (g)	48.4	48.0	0.0	583.1
	NMES (%total E)	11.1	8.0	0.0	44.7
	Englyst fibre (g)	11.9	4.8	2.3	36.3
	Estimated AOAC fibre (g)	15.8	6.5	3.0	48.3
	Alcohol (g)	4.8	12.0	0.0	100.7
	Alcohol (%total E)	1.8	4.4	0.0	36.0
	Iron (mg)	8.9	3.4	1.8	25.0
	Vitamin C (mg)	91.9	86.0	0.4	903.0

Gender	Nutrient	Mean	SD (±)	Min	Max
	Calcium (mg)	713.6	327.3	153.7	2416.6
Unweighted bases	*Male*				*393*
	Female				*608*
Weighted bases	*Male*				*452*
	Female				*532*

Table 40. Weighted two-day average, for adults (16+ years) SD, min and max nutrient intake by Age group.

Age group	Nutrient	Mean	SD (±)	Min	Max
16-24 years	Energy (kcal)	1613.1	556.4	713.5	3787.6
	Energy (kJ)	6787	2334	2999	15891
	Total fat (g)	61.2	27.6	15.8	167.4
	Total fat (%total food E)	33.4	6.6	16.3	45.2
	Saturated fat (g)	21.8	10.3	3.8	57.1
	Saturated fat (%total food E)	11.9	3.5	3.7	21.7
	Trans-fatty acids (g)	0.8	0.4	0.1	1.8
	Trans-fatty acids (%total food E)	0.5	0.2	0.1	1.0
	Protein (g)	65.1	25.6	13.4	135.9
	Protein (%total E)	16.9	6.4	3.9	39.9
	Total carbohydrate (g)	208.6	67.1	68.1	417.0
	Total carbohydrate (%total E)	49.1	8.0	33.8	68.6
	Total sugars (g)	91.8	45.2	13.7	259.1
	Total sugars (%total E)	22.1	10.3	7.3	62.0
	NMES (g)	62.6	44.8	0.4	212.0
	NMES (%total E)	14.8	11.4	0.2	59.7
	Englyst fibre (g)	10.6	4.5	2.3	29.0
	Estimated AOAC fibre (g)	14.1	6.0	3.0	38.6
	Alcohol (g)	2.5	8.2	0.0	46.2
	Alcohol (%total E)	0.7	2.2	0.0	13.1
	Iron (mg)	8.05	3.06	2.85	16.72
	Vitamin C (mg)	79.8	70.7	2.9	312.1
	Calcium (mg)	673.6	300.1	165.6	1500.1
25-34 years	Energy (kcal)	1758.4	669.2	593.9	5066.9
	Energy (kJ)	7398	2813	2504	21299

Age group	Nutrient	Mean	SD (±)	Min	Max
	Total fat (g)	63.3	28.2	13.8	155.4
	Total fat (%total food E)	33.1	7.6	14.3	54.9
	Saturated fat (g)	23.2	12.6	4.3	76.3
	Saturated fat (%total food E)	11.9	4.0	3.5	22.4
	Trans-fatty acids (g)	0.8	0.5	0.1	3.1
	Trans-fatty acids (%total food E)	0.4	0.2	0.1	1.4
	Protein (g)	66.4	25.6	23.2	202.5
	Protein (%total E)	16.1	4.2	6.6	30.7
	Total carbohydrate (g)	227.6	104.5	72.3	804.1
	Total carbohydrates (%total E)	48.7	9.8	29.6	73.8
	Total sugars (g)	107.1	81.3	13.9	599.9
	Total sugars (%total E)	22.2	10.2	5.5	54.3
	NMES (g)	74.9	79.0	0.6	583.1
	NMES (%total E)	14.4	10.0	0.3	49.2
	Englyst fibre (g)	11.5	6.0	3.7	44.5
	Estimated AOAC fibre (g)	15.3	8.0	4.9	59.2
	Alcohol (g)	9.7	22.2	0.0	108.7
	Alcohol (%total E)	2.9	6.4	0.0	35.9
	Iron (mg)	10.08	4.47	2.98	24.99
	Vitamin C (mg)	99.1	88.3	1.8	474.1
	Calcium (mg)	765.0	387.5	227.6	2416.6
35-44 years	**Energy (kcal)**	1784.8	616.3	619.6	3868.6
	Energy (kJ)	7509	2589	2615	16267
	Total fat (g)	66.2	29.3	8.2	177.5
	Total fat (%total food E)	33.1	7.2	11.0	54.3
	Saturated fat (g)	25.0	12.4	3.2	67.0

Age group	Nutrient	Mean	SD (±)	Min	Max
	Saturated fat (%total food E)	12.6	3.7	4.1	23.5
	Trans-fatty acids (g)	0.9	0.5	0.0	3.0
	Trans-fatty acids (%total food E)	0.5	0.2	0.0	1.5
	Protein (g)	70.7	22.7	15.7	150.4
	Protein (%total E)	16.8	4.9	6.3	33.9
	Total carbohydrate (g)	229.9	88.7	45.1	598.4
	Total carbohydrate (%total E)	48.5	8.1	9.9	81.1
	Total sugars (g)	101.3	63.7	6.8	427.2
	Total sugars (%total E)	20.8	9.7	3.7	75.2
	NMES (g)	62.8	55.6	1.2	350.1
	NMES (%total E)	12.3	8.6	0.4	43.3
	Englyst fibre (g)	12.6	4.5	3.2	28.9
	Estimated AOAC fibre (g)	16.8	6.0	4.2	38.4
	Alcohol (g)	5.8	13.0	0.0	86.4
	Alcohol (%total E)	2.1	4.9	0.0	34.0
	Iron (mg)	10.1	3.6	2.8	20.1
	Vitamin C (mg)	86.9	85.7	0.4	571.0
	Calcium (mg)	830.0	397.2	197.6	2486.5
45-54 years	Energy (kcal)	1649.8	653.5	600.3	3469.2
	Energy (kJ)	6937	2738	2532	14590
	Total fat (g)	61.2	32.4	9.1	151.0
	Total fat (%total food E)	33.0	8.2	9.8	55.4
	Saturated fat (g)	23.5	14.7	2.7	73.3
	Saturated fat (%total food E)	12.5	4.3	3.1	29.8
	Trans-fatty acids (g)	0.9	0.6	0.1	3.4

Age group	Nutrient	Mean	SD (±)	Min	Max
	Trans-fatty acids (%total food E)	0.5	0.3	0.0	1.5
	Protein (g)	66.1	25.2	19.7	189.8
	Protein (%total E)	17.0	4.9	7.7	38.2
	Total carbohydrate (g)	205.6	81.1	80.7	438.4
	Total carbohydrates (%total E)	47.9	8.9	22.9	70.5
	Total sugars (g)	85.7	47.1	11.7	230.3
	Total sugars (%total E)	20.3	9.8	4.1	56.8
	NMES (g)	51.8	42.4	0.0	208.7
	NMES (%total E)	11.7	9.0	0.0	43.7
	Englyst fibre (g)	12.0	5.3	3.4	32.4
	Estimated AOAC fibre (g)	15.9	7.1	4.5	43.1
	Alcohol (g)	8.6	24.4	0.0	179.6
	Alcohol (%total E)	2.8	6.9	0.0	42.2
	Iron (mg)	9.7	4.3	2.9	26.3
	Vitamin C (mg)	76.2	65.1	1.2	318.4
	Calcium (mg)	742.2	346.8	205.7	2184.8
55-64 years	Energy (kcal)	1639.0	631.4	626.8	3844.2
	Energy (kJ)	6898	2658	2636	16142
	Total fat (g)	62.1	30.2	7.7	205.3
	Total fat (%total food E)	34.0	7.5	10.2	61.4
	Saturated fat (g)	24.5	14.3	2.1	89.8
	Saturated fat (%total food E)	13.1	4.0	2.7	26.9
	Trans-fatty acids (g)	1.0	0.7	0.1	3.5
	Trans-fatty acids (%total food E)	0.5	0.2	0.1	1.4
	Protein (g)	66.1	24.4	17.8	138.9
	Protein (%total E)	16.9	4.5	7.9	33.4

Age group	Nutrient	Mean	SD (±)	Min	Max
	Total carbohydrate (g)	205.8	89.2	18.5	534.4
	Total carbohydrates (%total E)	47.4	8.2	8.4	75.9
	Total sugars (g)	89.8	60.3	7.1	353.3
	Total sugars (%total E)	20.1	8.5	1.9	52.1
	NMES (g)	51.3	59.5	0.0	329.2
	NMES (%total E)	10.2	8.5	0.0	42.3
	Englyst fibre (g)	12.5	4.9	2.3	36.3
	Estimated AOAC fibre (g)	16.6	6.5	3.0	48.3
	Alcohol (g)	5.9	11.3	0.0	65.4
	Alcohol (%total E)	2.3	4.2	0.0	22.6
	Iron (mg)	9.6	4.1	1.8	26.2
	Vitamin C (mg)	82.9	72.7	3.6	385.9
	Calcium (mg)	775.2	315.8	153.7	2737.5
65-74 years	**Energy (kcal)**	1583.2	568.6	657.8	4369.3
	Energy (kJ)	6672	2385	2781	18303
	Total fat (g)	60.1	27.9	19.0	216.1
	Total fat (%total food E)	34.7	7.4	17.4	54.6
	Saturated fat (g)	24.7	12.8	4.6	90.4
	Saturated fat (%total food E)	14.1	3.9	4.8	27.8
	Trans-fatty acids (g)	1.0	0.6	0.0	4.1
	Trans-fatty acids (%total food E)	0.6	0.3	0.0	1.5
	Protein (g)	65.4	24.0	15.8	149.4
	Protein (%total E)	17.0	4.5	7.7	33.6
	Total carbohydrate (g)	191.8	69.4	58.1	505.7
	Total carbohydrates (%total E)	46.2	8.3	27.7	65.0
	Total sugars (g)	80.1	44.4	11.4	282.9

Age group	Nutrient	Mean	SD (±)	Min	Max
	Total sugars (%total E)	18.7	7.5	3.7	43.1
	NMES (g)	41.6	37.2	0.0	244.4
	NMES (%total E)	9.0	6.2	0.0	31.6
	Englyst fibre (g)	12.1	4.7	3.4	27.7
	Estimated AOAC fibre (g)	16.0	6.3	4.6	36.8
	Alcohol (g)	8.5	18.9	0.0	131.6
	Alcohol (%total E)	3.2	6.4	0.0	36.1
	Iron (mg)	9.45	3.54	3.24	22.71
	Vitamin C (mg)	88.5	102.1	2.4	903.0
	Calcium (mg)	779.0	316.6	190.3	1992.5
75+ years	**Energy (kcal)**	1630.2	536.1	757.7	3096.3
	Energy (kJ)	6862	2262	3189	13010
	Total fat (g)	64.3	24.1	14.8	151.0
	Total fat (%total food E)	35.8	6.4	12.8	50.2
	Saturated fat (g)	25.7	9.7	6.7	64.2
	Saturated fat (%total food E)	14.4	3.2	5.9	24.1
	Trans-fatty acids (g)	1.0	0.5	0.3	2.8
	Trans-fatty acids (%total food E)	0.6	0.3	0.2	1.3
	Protein (g)	61.5	24.2	26.7	115.2
	Protein (%total E)	15.5	4.0	9.0	26.4
	Total carbohydrate (g)	207.1	79.6	98.1	484.8
	Total carbohydrates (%total E)	47.7	8.1	26.1	60.7
	Total sugars (g)	92.1	51.6	21.4	256.8
	Total sugars (%total E)	20.6	7.5	5.3	38.8
	NMES (g)	56.3	44.0	6.2	242.6
	NMES (%total E)	12.1	6.6	1.3	26.3

Age group	Nutrient	Mean	SD (±)	Min	Max
	Englyst fibre (g)	12.0	4.6	5.5	27.7
	Estimated AOAC fibre (g)	15.9	6.1	7.3	36.8
	Alcohol (g)	3.8	7.8	0.0	34.7
	Alcohol (%total E)	1.4	2.9	0.0	13.5
	Iron (mg)	9.3	3.5	3.7	20.0
	Vitamin C (mg)	72.9	56.7	4.9	234.5
	Calcium (mg)	722.8	309.7	219.1	1600.3
Unweighted bases		*16-24 years*			*79*
		25-34 years			*116*
		35-44 years			*167*
		45-54 years			*189*
		55-64 years			*209*
		65-74 years			*181*
		75+ years			*60*
Weighted bases		*16-24 years*			*119*
		25-34 years			*141*
		35-44 years			*150*
		45-54 years			*189*
		55-64 years			*162*
		65-74 years			*141*
		75+ years			*92*

Table 41. Weighted two-day average, for adults (16 years+) intake of variables by BMI (note n=157 not included as not available)

BMI group	Nutrient	Mean	SD (±)	Min	Max
<18.5	Energy (kcal)	1513.1	734.7	978.4	3763.1
	Energy (kJ)	6379	3118	4121	15994
	Total fat (g)	48.2	22.0	29.4	78.4
	Total fat (%total food E)	29.0	4.6	18.7	36.1
	Saturated fat (g)	18.9	9.8	9.4	33.9
	Saturated fat (%total food E)	11.1	2.3	7.8	14.8
	Trans-fatty acids (g)	0.7	0.5	0.2	1.8
	Trans-fatty acids (%total food E)	0.4	0.2	0.1	0.8
	Protein (g)	62.3	14.7	27.4	104.4
	Protein (%total E)	18.3	6.3	9.2	24.6
	Total carbohydrate (g)	217.2	144.1	118.3	704.4
	Total carbohydrate (%total E)	52.7	7.7	46.8	70.2
	Total sugars (g)	121.0	118.4	58.8	537.3
	Total sugars (%total E)	27.5	10.9	12.9	53.6
	NMES (g)	89.0	102.5	30.7	448.1
	NMES (%total E)	19.0	11.9	9.1	44.7
	Englyst fibre (g)	11.1	4.7	4.0	19.8
	Estimated AOAC fibre (g)	14.7	6.3	5.4	26.3
	Alcohol (g)	1.9	5.1	0.0	17.1
	Alcohol (%total E)	0.9	2.3	0.0	6.6
	Iron (mg)	9.0	5.2	2.9	24.7
	Vitamin C (mg)	102.9	67.5	8.2	209.3
	Calcium (mg)	672.9	274.2	429.0	1307.9
	Energy (kcal)	1725.1	632.9	598.3	5066.9

BMI group	Nutrient	Mean	SD (±)	Min	Max
18.5 - <25.0	Energy (kJ)	7258	2660	2524	21299
	Total fat (g)	64.1	28.0	8.2	216.1
	Total fat (%total food E)	34.1	7.1	11.0	54.7
	Saturated fat (g)	24.7	12.6	3.3	90.4
	Saturated fat (%total food E)	13.0	3.8	4.1	26.9
	Trans-fatty acids (g)	0.9	0.6	0.1	3.4
	Trans-fatty acids (%total food E)	0.5	0.3	0.1	1.4
	Protein (g)	67.0	26.2	13.4	202.5
	Protein (%total E)	16.3	5.3	3.9	39.9
	Total carbohydrate (g)	218.0	91.0	31.7	804.1
	Total carbohydrates (%total E)	47.4	9.2	8.4	81.1
	Total sugars (g)	100	68.8	7.1	599.9
	Total sugars (%total E)	21.1	10.4	1.9	75.2
	NMES (g)	65.9	66.8	0.3	583.1
	NMES (%total E)	13.1	10.2	0.1	59.7
	Englyst fibre (g)	12.2	5.8	3.0	44.5
	Estimated AOAC fibre (g)	16.1	7.7	4.0	59.2
	Alcohol (g)	8.5	16.9	0.0	86.4
	Alcohol (%total E)	3.0	5.7	0.0	34.0
	Iron (mg)	9.8	4.2	2.9	26.2
	Vitamin C (mg)	82.9	73.9	2.7	422.6
	Calcium (mg)	754.6	348.3	215.4	2257.4
25.0 - <30	Energy (kcal)	1702.5	626.1	600.3	4054.4
	Energy (kJ)	7164	2632	2532	17090
	Total fat (g)	63.0	28.7	13.2	205.3
	Total fat (%total food E)	33.8	7.3	12.8	61.4

BMI group	Nutrient	Mean	SD (±)	Min	Max
	Saturated fat (g)	24.2	13.0	3.2	89.8
	Saturated fat (%total food E)	12.7	3.9	3.5	29.8
	Trans-fatty acids (g)	0.9	0.6	0.1	4.1
	Trans-fatty acids (%total food E)	0.5	0.2	0.0	1.4
	Protein (g)	67.8	25.5	15.8	189.8
	Protein (%total E)	16.9	5.0	6.3	37.1
	Total carbohydrate (g)	213.8	88.2	18.5	582.9
	Total carbohydrate (%total E)	47.5	8.7	11.2	72.6
	Total sugars (g)	94.6	57.5	6.8	425.9
	Total sugars (%total E)	20.7	8.8	3.7	54.3
	NMES (g)	58.6	54.2	0.0	392.2
	NMES (%total E)	12.0	8.9	0.0	49.2
	Englyst fibre (g)	12.2	5.0	2.3	36.3
	Estimated AOAC fibre (g)	16.1	6.6	3.0	48.3
	Alcohol (g)	8.6	22.4	0.0	179.6
	Alcohol (%total E)	2.8	6.5	0.0	42.2
	Iron (mg)	9.8	4.0	1.8	26.3
	Vitamin C (mg)	92.2	93.2	1.2	903.0
	Calcium (mg)	765.4	352.7	165.6	2737.5
30 - <40	Energy (kcal)	1627.5	578.0	593.9	3712.5
	Energy (kJ)	6852	2426	2504	15591
	Total fat (g)	61.4	29.1	7.7	177.5
	Total fat (%total food E)	33.4	7.4	10.2	55.4
	Saturated fat (g)	23.7	12.7	2.1	73.3
	Saturated fat (%total food E)	12.8	4.0	2.7	26.0
	Trans-fatty acids (g)	0.9	0.6	0.0	3.4

BMI group	Nutrient	Mean	SD (±)	Min	Max
	Trans-fatty acids (%total food E)	0.5	0.2	0.0	1.5
	Protein (g)	68.6	23.9	24.3	150.4
	Protein (%total E)	17.7	4.8	8.8	38.2
	Total carbohydrate (g)	203.0	73.7	72.3	414.4
	Total carbohydrates (%total E)	47.4	7.1	28.6	70.2
	Total sugars (g)	80.9	43.4	7.1	272.5
	Total sugars (%total E)	18.9	8.0	3.7	50.7
	NMES (g)	47.4	39.4	0.0	228.4
	NMES (%total E)	10.6	7.8	0.0	43.4
	Englyst fibre (g)	11.6	4.6	3.4	25.5
	Estimated AOAC fibre (g)	15.4	6.2	4.5	33.9
	Alcohol (g)	5.3	14.6	0.0	131.6
	Alcohol (%total E)	1.9	4.7	0.0	36.1
	Iron (mg)	9.3	3.9	2.9	22.7
	Vitamin C (mg)	71.3	72.5	0.4	566.4
	Calcium (mg)	746.1	315.3	157.7	1947.7
40 +	Energy (kcal)	1530.3	592.9	746.7	3939.2
	Energy (kJ)	6439	2488	3145	16585
	Total fat (g)	58.3	31.1	25.2	155.4
	Total fat (%total food E)	33.4	8.4	14.9	49.9
	Saturated fat (g)	21.6	11.1	7.3	60.2
	Saturated fat (%total food E)	12.6	4.1	4.8	22.4
	Trans-fatty acids (g)	0.9	0.5	0.3	2.6
	Trans-fatty acids (%total food E)	0.5	0.2	0.2	1.2
	Protein (g)	61.2	21.2	22.2	126.6
	Protein (%total E)	16.8	4.3	8.9	28.4

BMI group	Nutrient	Mean	SD (±)	Min	Max
	Total carbohydrate (g)	197.7	84.2	78.6	582.6
	Total carbohydrates (%total E)	48.9	8.9	31.1	64.5
	Total sugars (g)	82.2	57.2	12.1	314.6
	Total sugars (%total E)	19.3	8.6	5.2	45.4
	NMES (g)	52.2	52.7	0.7	296.8
	NMES (%total E)	11.2	8.0	0.4	29.1
	Englyst fibre (g)	10.7	4.2	3.7	21.5
	Estimated AOAC fibre (g)	14.2	5.6	4.9	28.6
	Alcohol (g)	2.3	6.4	0.0	28.9
	Alcohol (%total E)	1.0	2.7	0.0	12.6
	Iron (mg)	8.4	3.0	2.8	16.4
	Vitamin C (mg)	85.4	68.9	1.8	257.2
	Calcium (mg)	765.0	342.5	173.5	1806.0
Unweighted bases		*<18.5*			*9*
		18.5 - <25.5			*253*
		25.5 - <30			*309*
		30 - <40			*229*
		40+			*44*
Weighted bases		*<18.5*			*8*
		18.5 - <25.5			*243*
		25.5 - <30			*292*
		30 - <40			*187*
		40+			*43*

Table 42. Weighted two-day average, for adults (16 years+) intake of variables by SIMD.

SIMD group	Nutrient	Mean	SD (±)	Min	Max
5 (least deprived)	Energy (kcal)	1620.5	584.6	598.3	3495.5
	Energy (kJ)	6819	2453	2524	14686
	Total fat (g)	61.0	27.1	10.5	149.0
	Total fat (%total food E)	34.1	6.7	13.1	54.7
	Saturated fat (g)	23.2	12.5	3.8	77.0
	Saturated fat (%total food E)	12.8	3.9	3.5	26.9
	Trans-fatty acids (g)	0.9	0.6	0.1	3.8
	Trans-fatty acids (%total food E)	0.5	0.3	0.1	1.4
	Protein (g)	63.6	19.9	13.4	139.2
	Protein (%total E)	16.6	4.8	3.9	36.0
	Total carbohydrate (g)	202.6	78.2	31.7	534.4
	Total carbohydrate (%total E)	47.5	8.8	8.4	75.9
	Total sugars (g)	90.2	51.0	7.1	353.3
	Total sugars (%total E)	20.9	9.5	1.9	62.0
	NMES (g)	51.8	48.5	0.0	329.2
	NMES (%total E)	11.4	10.0	0.0	59.7
	Englyst fibre (g)	12.7	5.3	3.0	28.9
	Calculated AOAC fibre (g)	16.8	7.0	4.0	38.4
	Alcohol (g)	7.8	19.6	0.0	179.6
	Alcohol (%total E)	2.8	5.8	0.0	42.2
	Iron (mg)	9.5	3.6	2.9	24.2
	Vitamin C (mg)	91.8	77.3	5.1	566.4
	Calcium (mg)	744.5	353.2	190.3	2184.9
4	Energy (kcal)	1801.8	642.9	632.0	3844.2
	Energy (kJ)	7576	2701	2636	16142
	Total fat (g)	70.9	32.8	13.8	205.3
	Total Fat (%total food E)	35.7	7.1	16.6	61.4

SIMD group	Nutrient	Mean	SD (±)	Min	Max
	Saturated fat (g)	27.5	14.5	4.3	89.8
	Saturated fat (%total food E)	13.7	3.8	5.1	26.9
	Trans-fatty acids (g)	1.0	0.6	0.1	3.5
	Trans-fatty acids (%total food E)	0.5	0.2	0.1	1.5
	Protein (g)	71.4	28.9	15.8	202.5
	Protein (%total E)	16.5	4.5	7.9	33.6
	Total carbohydrate (g)	216.0	80.5	18.5	571.5
	Total carbohydrates (%total E)	45.4	8.1	11.2	72.6
	Total sugars (g)	91.4	45.7	7.8	253.4
	Total sugars (%total E)	19.4	7.9	4.8	44.6
	NMES (g)	54.1	38.2	0.0	179.3
	NMES (%total E)	10.9	6.6	0.0	37.3
	Englyst fibre (g)	12.6	5.1	3.3	36.3
	Estimated AOAC fibre (g)	16.7	6.8	4.3	48.3
	Alcohol (g)	9.5	18.6	0.0	108.7
	Alcohol (%total E)	3.4	6.5	0.0	35.9
	Iron (mg)	10.4	3.9	2.9	26.3
	Vitamin C (mg)	96.1	99.0	1.2	903.0
	Calcium (mg)	830.8	367.8	221.0	2737.5
3	**Energy (kcal)**	1733.5	639.0	646.5	3868.6
	Energy (kJ)	7300	2685	2728	16267
	Total fat (g)	64.9	29.9	7.7	147.2
	Total fat (%total food E)	33.8	7.7	10.2	60.9
	Saturated fat (g)	25.0	12.7	2.1	68.3
	Saturated fat (%total food E)	12.9	3.8	2.7	27.8
	Trans-fatty acids (g)	1.0	0.6	0.1	3.4
	Trans-fatty acids (%total food E)	0.5	0.2	0.1	1.4
	Protein (g)	69.6	26.2	15.7	149.4

SIMD group	Nutrient	Mean	SD (±)	Min	Max
	Protein (%total E)	16.6	4.3	7.6	33.0
	Total carbohydrate (g)	218.4	89.1	45.0	598.4
	Total carbohydrate (%total E)	47.7	8.8	9.9	81.1
	Total sugars (g)	93.8	60.4	10.2	427.2
	Total sugars (%total E)	20.1	8.7	4.0	75.2
	NMES (g)	58.3	57.3	0.0	350.1
	NMES (%total E)	11.6	8.3	0.0	41.0
	Englyst fibre (g)	12.3	4.5	2.3	25.7
	Estimated AOAC fibre (g)	16.4	5.9	3.0	34.2
	Alcohol (g)	7.0	15.2	0.0	131.6
	Alcohol (%total E)	2.6	5.4	0.0	36.1
	Iron (mg)	10.0	4.2	1.8	26.2
	Vitamin C (mg)	80.6	77.4	3.3	571.0
	Calcium (mg)	778.9	341.3	157.7	2486.5
2	**Energy (kcal)**	1624.0	650.8	593.9	5066.9
	Energy (kJ)	6833	2734	2504	21299
	Total fat (g)	59.4	27.9	13.2	216.1
	Total Fat (%total food E)	33.1	6.9	14.0	54.9
	Saturated fat (g)	22.6	12.2	3.2	90.4
	Saturated fat (%total food E)	12.5	4.1	4.4	26.0
	Trans-fatty acids (g)	0.8	0.5	0.0	4.1
	Trans-fatty acids (%total food E)	0.5	0.2	0.0	1.4
	Protein (g)	63.1	23.0	18.0	138.0
	Protein (%total E)	16.6	5.3	6.3	39.9
	Total carbohydrate (g)	208.9	95.0	68.1	804.1
	Total carbohydrates (%total E)	48.6	8.1	26.7	71.2
	Total sugars (g)	93.2	71.1	13.7	599.9
	Total sugars (%total E)	20.9	9.6	5.3	54.3

SIMD group	Nutrient	Mean	SD (±)	Min	Max
	NMES (g)	60.7	68.6	0.0	583.1
	NMES (%total E)	12.6	10.0	0.0	49.2
	Englyst fibre (g)	11.0	4.5	2.3	32.4
	Estimated AOAC fibre (g)	14.6	6.0	3.0	43.1
	Alcohol (g)	7.2	20.1	0.0	175.2
	Alcohol (%total E)	2.2	5.3	0.0	37.2
	Iron (mg)	9.0	3.9	2.9	24.7
	Vitamin C (mg)	76.0	73.2	1.2	360.2
	Calcium (mg)	730.0	339.2	153.7	2416.6
1 (most deprived)	Energy (kcal)	1563.3	519.3	626.8	3103.7
	Energy (kJ)	6581	2183	2645	13063
	Total fat (g)	56.6	25.2	9.1	145.7
	Total Fat (%total food E)	32.1	8.3	9.8	54.3
	Saturated fat (g)	21.9	11.5	2.7	65.6
	Saturated fat (%total food E)	12.4	4.2	3.1	29.8
	Trans-fatty acids (g)	0.8	0.5	0.1	2.7
	Trans-fatty acids (%total food E)	0.5	0.3	0.1	1.5
	Protein (g)	63.5	23.2	25.7	144.6
	Protein (%total E)	17.0	5.4	6.6	38.2
	Total carbohydrate (g)	209.3	78.5	66.3	446.4
	Total carbohydrates (%total E)	50.3	8.5	27.7	73.8
	Total sugars (g)	92.7	58.3	6.8	334.4
	Total sugars (%total E)	21.9	10.3	3.7	56.8
	NMES (g)	59.4	53.1	0.6	268.6
	NMES (%total E)	13.3	9.4	0.2	44.5
	Englyst fibre (g)	11.3	5.5	3.0	44.5
	Estimated AOAC fibre (g)	15.0	7.4	4.0	59.2
	Alcohol (g)	1.6	8.4	0.0	79.8
	Alcohol (%total E)	0.5	2.7	0.0	25.4

SIMD group	Nutrient	Mean	SD (±)	Min	Max
	Iron (mg)	8.7	3.7	2.8	20.5
	Vitamin C (mg)	76.3	63.9	0.4	422.6
	Calcium (mg)	714.5	313.8	197.6	2003.2
Unweighted bases		*SIMD 5*			*193*
		SIMD 4			*219*
		SIMD 3			*214*
		SIMD 2			*229*
		SIMD 1			*146*
Weighted bases		*SIMD 5*			*196*
		SIMD 4			*195*
		SIMD 3			*194*
		SIMD 2			*222*
		SIMD 1			*187*

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