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The Scottish Health Survey: 2024 Technical Report

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Chapter 1 Methodology and response

Victoria Wilson, Rory McClelland, Sarah Bierbaum-Williams

1.1 Introduction

1.1.1 The Scottish Health Survey (SHeS) series

The SHeS series was established in 1995 to provide data about the health of the population living in private households in Scotland. It was repeated in 1998 and 2003 and has been carried out annually since 2008.

The 2024 survey was conducted by the Scottish Centre for Social Research. Since 2023, SHeS saw a return to the standard SHeS methodology, following some disruption to the survey during the COVID-19 pandemic.

Fieldwork for SHeS 2020 was suspended in March 2020 and, whilst data for some of the key measures from SHeS were collected via a telephone survey in August and September 2020, due to the different methodology, these results were published as experimental statistics and have not been included in time series analysis presented in the main report. Whilst the 2021 survey included most of the usual SHeS questions and key indicators, interviews were still conducted by telephone and this, along with the different approach to sampling, is likely to have impacted the responses received and thus comparability with the SHeS data from other survey years. The 2022 survey was a transitional year moving from pandemic approaches back to the usual SHeS methodology.

Details of the approaches used for the 2024 survey can be found below.

1.1.2 The SHeS 2024 Fieldwork

The SHeS 2024 launched in February 2024. Interviews for all samples were undertaken using primarily an in-home face-to-face approach. Potential respondents were contacted by letter and invited to take part in an in-home interview. A telephone contingency was retained for respondents unwilling to have the interviewer enter their home due to health concerns.

In 2024, fieldwork for the child boost sample continued to utilise a sample linked to the Community Health Index (CHI) database, an approach that has been approved by the Scottish Government's Public Benefits and Privacy Panel. The transition to the use of the CHI database was undertaken to increase the efficiency of the sample. Prior to the suspension of fieldwork at the outset of the COVID-19 pandemic, the child boost sample was drawn without any indication as to whether there may be children under 16 living in the sampled households. This meant that approximately four-fifths of households visited did not have

children under the age of 16 living in them. The transition to sampling via CHI database linkage was used to try and identify households with children under 16 living in them and while a margin for error remains with this approach, it was found to be much more efficient than the previous sampling approach.

1.1.3 Aims of the SHeS

The purpose of SHeS is to provide information at national level about the health of the population and the ways in which lifestyle factors are associated with health. This level of information is not available from administrative or operational databases, as hospitals and GPs are not able to collect detailed information about peoples' lifestyles and health-related behaviours. In addition, it is crucial that the Scottish Government has information about the health of the population, including people who do not access health services regularly.

The specific aims of SHeS are:

- To estimate the prevalence of particular health conditions in Scotland.
- To estimate the prevalence of certain risk factors associated with these health conditions and to document the pattern of related health behaviours.
- To look at differences between regions and between subgroups of the population in the extent of their having these particular health conditions or risk factors, and to make comparisons with other national statistics for Scotland, England, Wales and Northern Ireland.
- To monitor trends in the population's health and health related behaviour over time.
- To make a major contribution to monitoring progress towards health targets.

Each survey in the SHeS series has a set of main questions and measurements (height and weight and, if applicable, blood pressure, waist circumference and saliva samples), plus modules of questions on specific health conditions and health risk factors that vary from year to year. Each year the main sample has been augmented by an additional boosted sample for children.

The SHeS series now has trend data going back 29 years and providing this time series is an important function of the survey.

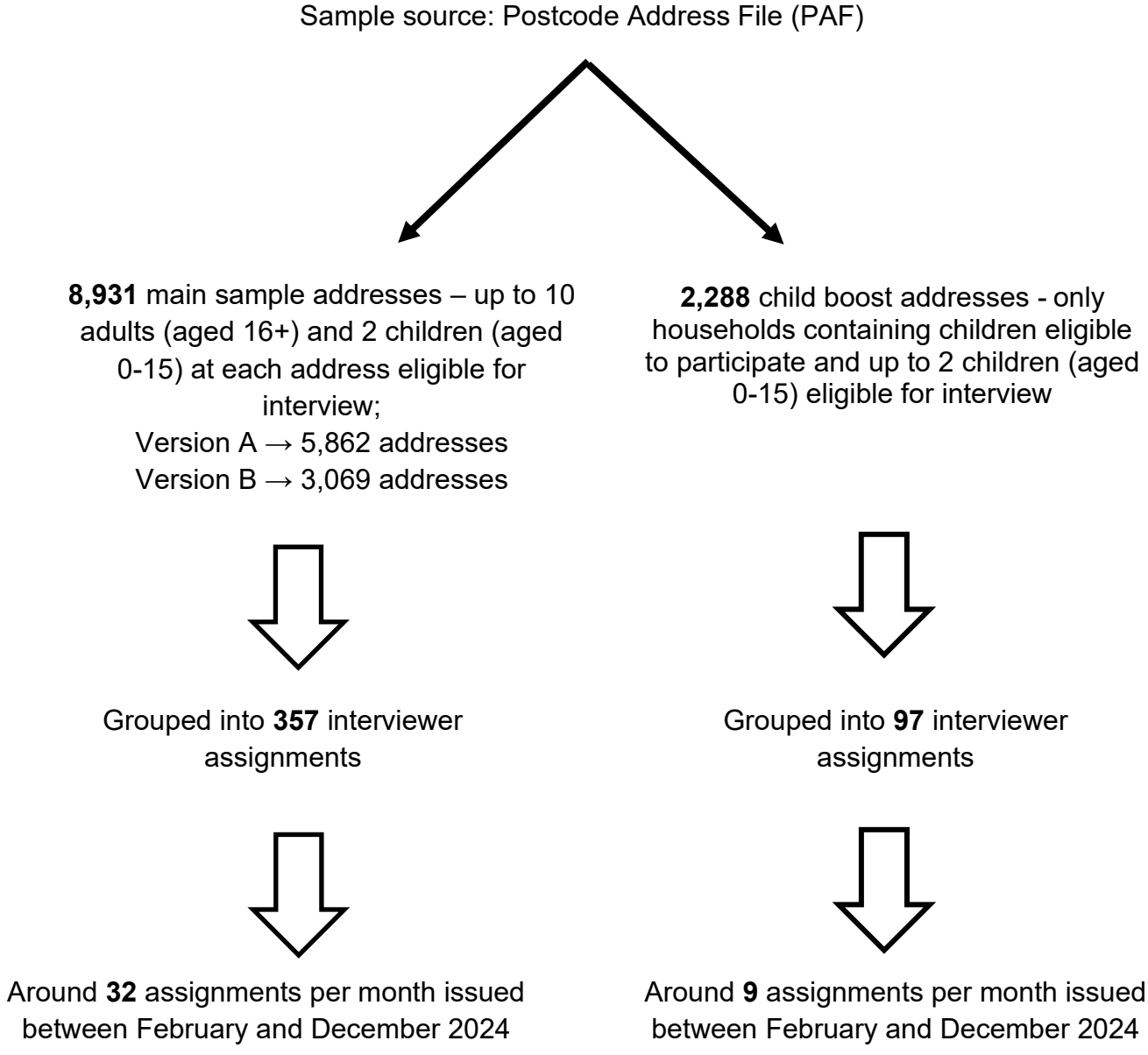
1.1.4 The 2024 survey

The 2024 SHeS was designed to provide data at national level about the population living in private households in Scotland. The survey covered all ages, with the target sample sizes for the 2024 survey the same as those for 2018-2023.

The flowchart overleaf shows the total number of addresses drawn from the postcode address file (PAF) for each sample type (main and child boost).

The sample for the 2024 survey was drawn on the basis of being worked as primarily face-to-face in-home.

Figure 1: Sample selection and allocation process by sample type



Data collection involved a main computer assisted personal (CAPI) or telephone interview (CATI), and paper self-completion questionnaire.

Standardised interviewer-administered height and weight measurements were reintroduced as part of in-home interviews in 2022 and have continued since. For interviews conducted by telephone, no height and weight measurements or biological measures could be taken. Participants were asked to estimate their own height and weight during these interviews.
The main version B sample completed a biological module, and these addresses were only assigned to trained bio interviewers. Version B

interviews included a slightly longer self-completion to cover the depression, anxiety, self-harm and attempted suicide questions which are included in the biological module.

1.1.5 The 2024 SHeS annual report

The 2024 report consists of two volumes:

- Volume 1 presents results for adults and children on a variety of health topics and includes a summary of key results.
- Volume 2 (this report) provides methodological information and survey documentation.

Both volumes are available on the Scottish Government's SHeS website. An interactive data dashboard is also available presenting key indicators for Scotland, NHS Boards and local authority areas.

1.1.6 Comparisons with previous surveys in the SHeS series

In the 2024 report, comparisons are made with data collected earlier in the series (1998-2019 and 2021-2023 for children and 2003-2019 and 2021-2023 for adults). However, it should be noted that, due to the difference in method for 2021, caution should be applied when comparing results from this survey year to 2024. For more information, see Chapter 2 of this report.

In addition, the report and/or dashboard include analysis from combined datasets 2021/2022/2023/2024, 2022/2023/2024, 2023/2024 and 2022/2024.

This is to aid analysis of small subsamples of the population and/or for questions which are included in the survey every second year. Combining data across years in this way allows for a more detailed analysis of subgroups in the sample and allows for analysis of questions with small sample sizes in one survey year.

1.1.7 Health Board and local authority level analysis

Since 2008, the SHeS sample has been designed to be representative of adults at Health Board level (for all Health Boards) following four years of data collection and in 2018 the sample size was increased to allow analysis by local authority. Analysis of the 2021, 2022, 2023 and 2024 data combined by NHS Health Board and by local authority is published via the SHeS dashboard. Areas with larger samples may be able to analyse data at their area level based on fewer years of data collection and users should consult the SHeS website for further guidance on sub-geographies analysis.

Changes in the sample design for the 2012 survey mean that users are not advised to combine data for periods spanning 2011 and 2012. Since 2012, however, the sample has been designed to be representative of

the population of Scotland at Health Board level for every four-year period. Hence the survey can be analysed using combined data from:

- 2012/2013/2014/2015,
- 2013/2014/2015/2016,
- 2014/2015/2016/2017,
- 2015/2016/2017/2018,
- 2016/2017/2018/2019,
- 2017/2018/2019/2021,
- 2018/2019/2021/2022,
- 2019/2021/2022/2023 and
- 2021/2022/2023/2024.

It should be noted that no data for 2020 is available by Health Board or Local Authority.

1.1.8 Access to SHeS data

Data from the 2024 survey will be deposited at the UK Data Service (UKDS) along with combined 2021/2022/2023/2024, 2022/2023/2024, 2022/2024 and 2023/2024 datasets. The datasets from earlier years in the series are also deposited at the UK Data Service.

1.2 Sample design

1.2.1 Requirements

The sample specification for the 2024 SHeS was designed by the Scottish Government. The design was coordinated with the designs for the Scottish Household Survey (SHS) and the Scottish Crime and Justice Survey (SCJS) to improve survey efficiency and to allow the samples of the three surveys to be pooled for further analysis[1].

There were two elements to the SHeS sample in 2024:

1) Main sample - to allow annual reporting of Scotland level results and results at Health Board and local authority level for adults using the 2021, 2022, 2023 and 2024 data combined. This required an annual interview target of 5,112 adults for Scotland as a whole and a minimum target of 125 for each local authority. There were additional targets of 1,000 adults to complete each biological measure and 1,026 child interviews.

2) Child boost sample – overall there was a requirement for 2,031 child interviews for Scotland. As the main sample was only expected to yield 1,026 child interviews, a further 1,005 interviews were required from a separate boost sample.

1.2.2 Sample design and assumptions

In 2024, the sample utilised a two-stage clustered sample design, with intermediate geographies randomly selected at the first stage and address points at the second stage. With the exception of Orkney, Shetland and Na h-Eileanan Siar councils, the sample was clustered by intermediate geographies (IG) with one quarter of IGs selected for each year of fieldwork. In Orkney, Shetland and Na h-Eileanan Siar the sample was clustered by data zone.

1.2.3 Main sample

As stated above, the annual target sample size for Scotland was 5,112 adults with a minimum local authority target sample size of 125 adults. These sample sizes were the minimum required to allow effective reporting of Scotland-level results annually and Health Board and local authority results with four years of data combined. An iterative approach was taken to efficiently allocate the sample across all Health Boards and local authorities. For the first iteration, 4,000 adult interviews were allocated across local authorities in proportion to the adult population. Any local authorities allocated fewer than 125 adult interviews had their allocation increased to 125.

The remaining sample was then allocated over the remaining local authorities. Where allocations were not whole numbers the number was rounded up. This resulted in a total target of 5,112 adult interviews. The results of the allocation are shown in Table 1.

Table 1: SHeS target annual adult interviews, 2024, by Health Board

Health Board	Target Annual Adult Interviews
Ayrshire and Arran	375
Borders	125
Dumfries and Galloway	125
Fife	271
Forth Valley	375
Grampian	488
Greater Glasgow and Clyde	1,075
Highland	297
Lanarkshire	482
Lothian	749
Orkney	125
Shetland	125
Tayside	375
Western Isles	125
Total	**5,112**

To allow for reporting at local authority level over a four-year period (2021/2022/2023/2024) and coordination with the sample selection of the SHS and SCJS, the required sample sizes were set at local authority level. This was done by allocating the target Health Board samples to local authorities proportionate to population.

The number of addresses selected in order to provide the target number of interviews was calculated by:

1) Estimating the number of productive adult interviews per co-operating household. Considering response data from previous years, it was estimated that there would be an average of 1.5 interviews per co-operating households in each local authority.

2) Allocation of the target interviews and associated estimate of co-operating households to local authority strata proportionate to population.

3) The response rate assumptions for local authorities for 2024 were then estimated based on the variation across local authorities in response to the 2018, 2019 and 2023 face-to-face surveys.

4) The final step was to estimate the level of ineligible addresses. As for previous survey years, the estimates were calculated at local authority level and based on the average level of ineligible addresses from previous years of SHeS, SHS and the SCJS.

Table 2 shows the number of selected addresses used for the main sample in 2024.

Table 2: Selected addresses issued by strata in 2024 – main sample

Sample strata	Addresses for main sample
Aberdeen City	267
Aberdeenshire	295
Angus	211
Argyll & Bute	228
Clackmannanshire	189
Dumfries & Galloway	205
Dundee City	240
East Ayrshire	211
East Dunbartonshire	226
East Lothian	208
East Renfrewshire	207
Edinburgh, City of	680
Eilean Siar	195
Falkirk	203
Fife	508
Glasgow City	851
Highland	309
Inverclyde	241
Midlothian	214
Moray	191
North Ayrshire	205
North Lanarkshire	479
Orkney Islands	187
Perth & Kinross	221
Renfrewshire	244
Scottish Borders	179
Shetland Islands	178
South Ayrshire	234
South Lanarkshire	431
Stirling	219
West Dunbartonshire	242

West Lothian	233
Total	**8,931**

1.2.4 Child boost sample

For the 2024 survey, 2,031 child interviews were required. It was estimated that the main sample would provide 1,026 child interviews, therefore, to reach the target number of child interviews, a child boost sample was required to yield a further 1,005 interviews.

The child boost sample was linked to health records via the Community Health Index (CHI) to identify households with children. This significantly improved the sample efficiency and response levels. This linkage was carried out by the CHI Linkage (CHILi) Indexing Team at Public Health Scotland.

Table 3: Target annual child interviews, 2024, by Health Board

	Expected child interviews from main sample	Target child interviews from boost	Total target child interviews
Ayrshire and Arran	75	70	145
Borders	25	21	46
Dumfries and Galloway	25	27	52
Fife	54	71	125
Forth Valley	75	60	135
Grampian	97	110	207
Greater Glasgow and Clyde	219	216	435
Highland	60	59	119
Lanarkshire	97	131	228
Lothian	149	163	312
Orkney	25	0	25
Shetland	25	0	25
Tayside	75	77	152
Western Isles	25	0	25
Total	**1,026**	**1,005**	**2,031**

The process for calculating the number of addresses to select for the child boost sample was as follows:

1) The child boost target of 1,005 child interviews was allocated proportionally to local authorities based on the child (under 16) population. If the number expected from the child boost was less than 10, then the local authority boost target was set to zero.

Table 3 shows the child interview targets for the main sample and child boost sample by Health Board.

2) The number of co-operating households with children required in each Health Board for the child boost sample was estimated using the performance of the child boost samples in the surveys between 2013 and 2015.

3) For the child boost, CHI linkage was performed to identify addresses where health records indicated that a child was resident. It was assumed the CHI linking would identify 20% of sampled households as having a child resident. An additional assumption of 64% accuracy of the CHI records was included to allow for cases where health records may not be up-to-date or households had moved.

4) The assumptions made on ineligible addresses for the main sample were applied to the address calculations for the child boost sample.

The total numbers of addresses issued for the child boost sample are shown in Table 4.

Table 4: Selected addresses issued by strata in 2024 – Child Boost

Sample strata	Addresses for child boost
Aberdeen City	82
Aberdeenshire	106
Angus	51
Argyll & Bute	29
Clackmannanshire	22
Dumfries & Galloway	45
Dundee City	52
East Ayrshire	52
East Dunbartonshire	51
East Lothian	45
East Renfrewshire	47
Edinburgh, City of	184
Eilean Siar	0
Falkirk	73
Fife	174
Glasgow City	268
Highland	105
Inverclyde	34
Midlothian	45
Moray	26
North Ayrshire	60
North Lanarkshire	176
Orkney Islands	0
Perth & Kinross	59
Renfrewshire	81
Scottish Borders	42
Shetland Islands	0
South Ayrshire	53
South Lanarkshire	153
Stirling	39
West Dunbartonshire	40
West Lothian	94
Total	**2,288**

1.2.5 Sample Selection

The Royal Mail's small user Postcode Address File (PAF) was used as the sample frame for the address selection. The advantages of using the PAF are as follows:

- It has previously been used as the sample frame for Scottish Government surveys so previously recorded levels of ineligible addresses can be used to inform assumptions for the 2024 sample design.
- It has excellent coverage of addresses in Scotland.
- The small user version excludes the majority of businesses.

The PAF does still include a number of ineligible addresses, such as small businesses, second homes, holiday rental accommodation and vacant properties. A review of the previous performance of individual surveys found that they each recorded fairly consistent levels of ineligible address for each local authority. This meant that robust assumptions could be made for the expected levels of ineligible addresses in the sample size calculations.

As the samples for the SHS, SHeS and SCJS have all been selected by the Scottish Government since 2012, addresses selected for any of the surveys are removed from the sample frame so that they cannot be re-sampled for another survey. This helps to reduce respondent burden. The addresses are removed from the sample frame for a minimum of four years.

The sample design was implemented in three stages:

1. All primary sampling units (data zones on the islands, intermediate geographies elsewhere) were randomly allocated to one of four sets. One of these sets will be used in each year of fieldwork. This means that the sample is drawn from one quarter of PSUs each year. The sets were updated ahead of the 2021 sampling and this ensures that over four years of fieldwork (2021 to 2024) all addresses will have a non-zero probability of selection.

Table 5: Primary sampling units selected in 2024 sample

Health Board	PSUs in 2024 Sample	Total PSUs
Ayrshire and Arran	23	93
Borders	8	30
Dumfries and Galloway	10	40
Fife	26	104
Forth Valley	19	78
Grampian	33	132
Greater Glasgow and Clyde	65	257
Highland	19	79
Lanarkshire	40	160
Lothian	48	192
Orkney	8	29
Shetland	7	30
Tayside	23	92
Western Isles	9	36
Total	**338**	**1,352**

2. The required numbers of addresses for the main and child boost samples gave an overall total of addresses to sample for each stratum (local authorities). The required number of addresses for each stratum was then sampled from the sample frame of addresses in active PSUs. Systematic random sampling was used with addresses within PSUs ordered by urban-rural classification, mean SIMD rank, SIMD rank and postcode.

3. Once the overall sample was selected, a proportion of the main sample addresses were randomly allocated to the biological module. One quarter of the target main adult sample was required to complete the biological module. To guard against a lower response rate to the different elements of the biological module, and to correct for inaccurate response assumptions in previous years, a proportion higher than the required one quarter of the adult sample (33% in 2024) were allocated to the biological module.

1.2.6 Selecting individuals within households

For the main sample, all adults aged 16 and over in responding households were eligible for interview. To ease respondent burden, for child interviews for both the main and the child boost samples a maximum of two children were interviewed at each household. If a household contained more than two children, then two were randomly selected for interview.

1.2.7 Selecting households at addresses with multiple dwellings

A small number of addresses have only one entry in the Postcode Address File (PAF) but contain multiple dwelling units. Such addresses are identified in the PAF by the Multiple Occupancy Indicator (MOI). To ensure that households within MOI addresses had the same probability of selection as other households, the likelihood of selecting addresses was increased in proportion to the MOI. At addresses with more than one dwelling unit fieldworkers have a programme to randomly select the household at which interviews should be sought. There are generally a few cases were the MOI on the PAF is inconsistent with the actual number of dwelling units. When this occurred, the fieldworkers recorded the information and a correction was made through the survey weighting.

1.3 Topic coverage

1.3.1 Introduction

Topics covered in surveys from 2024 onwards were agreed following a content review carried out in 2022[2]. Many of the topics and questions included in earlier years of the survey were included again to continue the time series. The 2024 survey included the same rotating topics as the 2022 survey (see section 1.3.3) with the addition of new modules in the self-completion questionnaires on eating behaviours and feelings related to food that could be indicative of a possible eating disorder and menopause/perimenopause. As with previous years, the 2024 survey had a focus on cardiovascular disease (CVD) and its associated risk factors.

A report on the outcome of a content review of the survey outlines key changes to be made to the survey from 2024 onwards and other topics which would be considered if space became available.

1.3.2 Documentation

Copies of all the documents used in data collection are included in the supporting documents section of the technical report. A summary of the main interview content and the content of the biological module is provided below.

1.3.3 Main interview

Information was collected at both the household and individual level. The content of the individual level interviews for all participants is summarised below. The topics a participant was asked depended both on their age and the sample type to which their address had been allocated. The age criteria for each topic are included in brackets following the topic name.

Participants aged 16 and above were also invited to complete an online recall using Intake24 (https://intake24.org/). Respondents who consented to take part in Intake24 were invited to undertake dietary recalls on two separate occasions where they input details of their food and beverage consumption for the previous day. Two recalls, rather than a single recall, were requested to get a better understanding of an individual's typical diet.

Participants were asked to provide verbal consent for Intake24, an online 24-hour dietary tool, and this was recorded in CAPI. Respondents were also given a leaflet with some key information about Intake24. Those who agreed were invited to complete two dietary recalls, either independently or via a phone call with the NatCen Telephone Unit. Further information about Intake24 is provided in sections 1.4.3, 1.6.5 and in chapter 2 of this report.

No dietary data was collected for children in 2024 due to a separate Intake24 survey being undertaken with children on behalf of Food Standards Scotland in 2023/2024. Information on child fruit and vegetable consumption will be included in the 2025 survey.

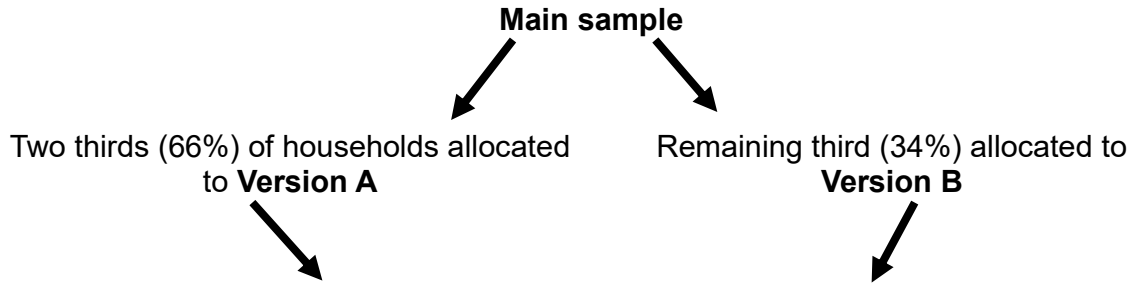
Four different self-completion booklets were administered depending on the age of the participant. The booklet for young adults aged 16-17 included questions on smoking and drinking behaviour (instead of these being asked as part of the CAPI interview) and interviewers also had the option of administering this young adults' self-completion to those aged 18-19 if they felt that it would be more appropriate.

Standardised interviewer-administered height and weight measurements were included as part of in-home interviews in 2024. For interviews conducted by telephone, no height and weight measurements or biological measures could be taken. Participants were asked to estimate their own height and weight during these interviews.

As highlighted previously, a sub-sample (around 33%) of main sample addresses, adults (aged 16 and over) were selected to complete the biological module. Since 2012, specially trained interviewers have been collecting the measurements and samples which were collected by nurses in earlier years (1995 to 2011). This was not possible in 2021 when interviews were administered by telephone, therefore, no

objective biological measurements were collected that year. The measurements were reintroduced gradually in 2022 as the panel of suitably trained and accredited interviewers was built back up again.

Figure 2: Overview of main sample interviews



One adult per household answers:
Household questionnaire including household composition

Each eligible participating individual in **each** household answers:

Main questionnaire (relevant age range in brackets)

- General health (0+)
- Unpaid caring (4+)
- Respiratory (16+)
- General cardiovascular disease (16+)
- Asthma (0+)
- COVID-19 (0+)
- Physical activity (2-15, 16+)
- Sedentary activity (2-15, 16+)
- Smoking (18+)
- Passive smoking (0+)
- Drinking (18+)
- Dental health (16+)
- Employment and economic activity (16+)
- Education (16+)
- Ethnic background, religion and country of birth (0+)

Height and weight measurements (2+)

One of the self-completion booklets below according to age:

Adult self-completion (18+)

- Mental wellbeing (WEMWBS, GHQ-12)
- Loneliness
- Menopause/perimenopause
- Eating behaviours and feelings related to food that could be indicative of a possible eating disorder
- Food insecurity
- Sexual orientation
- Sex/trans status
- Veteran status

Young adult self-completion (16-17)

- Mental wellbeing (WEMWBS, GHQ-12)
- Loneliness
- Menopause/perimenopause
- Eating behaviours and feelings related to food that could be indicative of a possible eating disorder
- Alcohol
- Smoking
- Food insecurity
- Sexual orientation
- Sex/trans status
- Veteran status

Self-completion for 13-15 year olds

- Mental wellbeing (WEMWBS, GHQ-12)

Self-completion for parents of 4-12 years olds

- Strengths and difficulties questionnaire (SDQ)

Version A questions (included in main questionnaire)

- Respiratory symptoms (16+)
- Motivations and barriers to physical activity (2+)

Version B questions (included in main questionnaire)

- Prescribed medicines

Version B questions (included in adult and young adult self-completions)

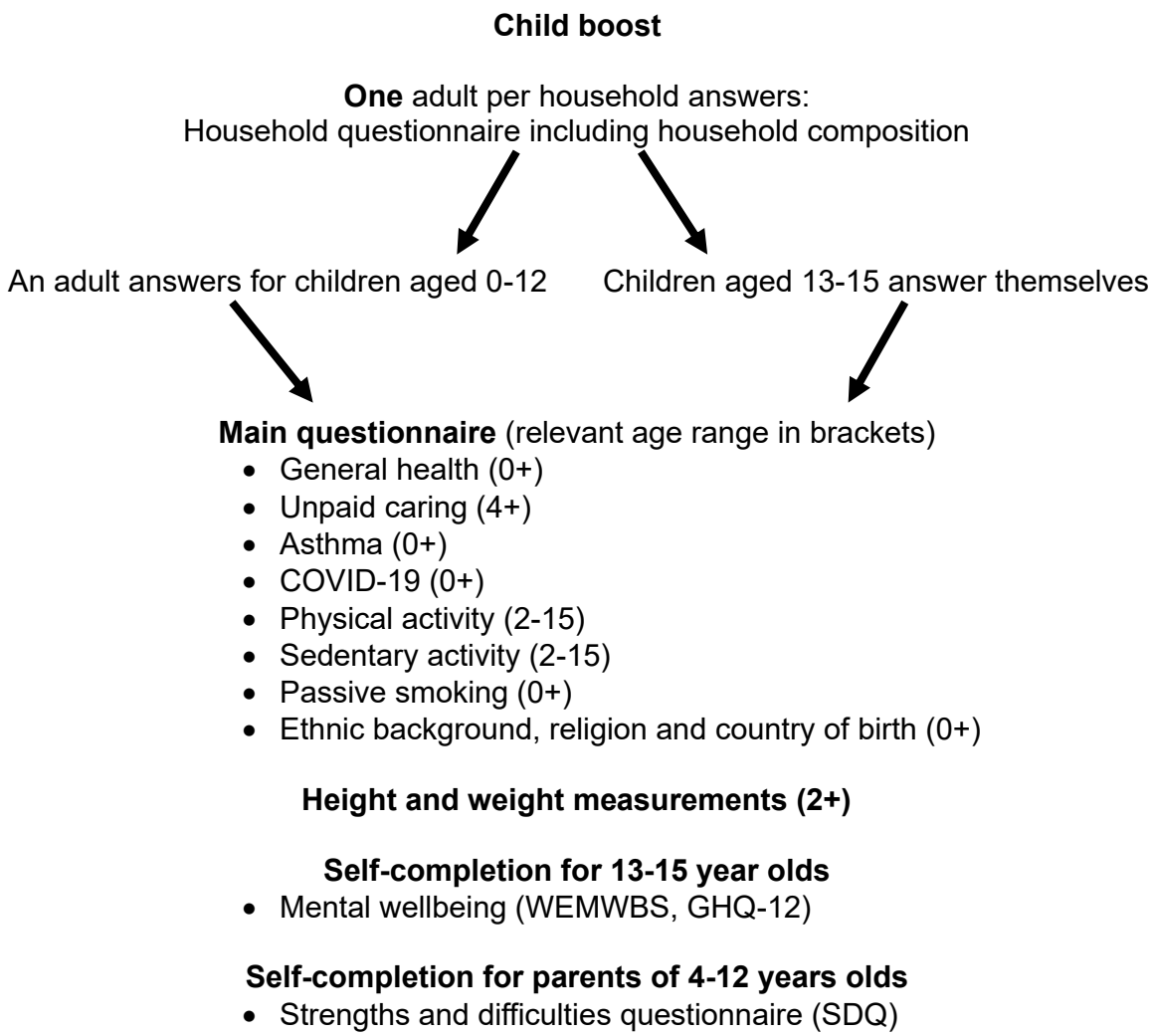
- Depression and anxiety(16+)
- Self-harm (16+)
- Attempted suicide (16+)

Biological measurements (16+)

- Waist circumference
- Blood pressure
- Saliva samples

- Intake24 (16+)

Figure 3: Overview of child boost interview



A significant number of changes were made to the questionnaire content in advance of the 2024 survey based on the content review that took place in Summer 2022, with a summary of responses published in September 2024[3].

The full wording of all questions used in 2024 can be found in the questionnaire documentation included in the supporting documents section of the technical report.

1.4 Fieldwork procedures

1.4.1 Advance letters

Each sampled address was sent an advance letter that introduced the survey and to let the resident know that an interviewer would be calling to seek permission to interview. A number of versions of the advance letter were used in 2024; one for the main version A addresses, one for

main version B addresses (with the biological module), and one for child boost addresses. A copy of the survey leaflet was included with every advance letter. The survey leaflet introduced the survey, described its purpose in more detail and included some summary findings from previous surveys.

For copies of the advance letters and survey leaflet, see the documents listed in Appendix A.

1.4.2 Making contact

Initial contact for both samples was made via the advance letter. Interviewers then visited respondents' homes to attempt to gain agreement to participate in the survey. At initial contact, the interviewer established the number of dwelling units (DUs) and/or households (HHs) at an address and made any necessary selections (see Section 1.2.7).

In the main sample, interviewers attempted to interview all adults (up to a maximum of ten) and up to two children aged 0-15 (see Section 1.2) from the household. At child boost sample households, interviewers first screened for children aged 0-15. In those households where children were present up to two children were randomly selected for interview. Interviewers obtained the verbal consent of both the parent/guardian and the child before commencing the interview.

1.4.3 Collecting data

Interviewers used computer assisted personal (CAPI) interviewing for interviews done in-home and computer assisted telephone interviewing (CATI) for the telephone interviews.

At each co-operating eligible household (across all sample types), the interviewer first completed a household questionnaire, with information collected from the household reference person[4] or their partner wherever possible. This questionnaire obtained basic information (including date of birth and relationship to other household members) about all members of the household, regardless of age and whether they were eligible to take part in the interview. The computer assisted personal/telephone interviewing (CAPI) program then created individual questionnaires for each eligible participant in the household.

Where possible an individual interview was then conducted with all eligible adults and up to two children in a household. In order to reduce the amount of time spent in the home, interviews could be carried out concurrently.

In addition to an advance letter and general survey leaflet, participants were also given a more detailed leaflet describing the contents and

purpose of the interview, and what will happen to information they provide (including a link to the survey Privacy Notice).

A separate version of this leaflet was used for children in both main and child boost households. Parents at child boost addresses were also provided with a leaflet containing background information on the survey. Copies of all the participant leaflets used in the survey are included in Appendix A.

Intake24 dietary recalls were completed via a link sent directly to participants within minutes of giving consent. The first recall was scheduled for the same day as the interview. The second recall was completed within seven days of the initial recall. For participants who requested assistance to complete the recalls the interviewer collected a phone number and arranged an appointment date and time for the first recall. This information was saved on a secure server with restricted access for the NatCen Telephone Unit. After the first recall was completed, the date for the second recall was arranged between the respondent and NatCen Telephone Unit interviewer.

1.4.4 Interviewing and measuring children

Children aged 13-15 were interviewed directly by interviewers, after verbal consent had been obtained from both the child and their parent or guardian. Interviewers were instructed to ensure that the child's parent or guardian was present throughout the interview. Information about younger children (aged 0-12) was collected directly from a parent or guardian. Whenever possible, younger children were present while their parent or guardian answered questions about their health. This was partly because the interviewer had to take the child's height and weight measurements (where possible), but it also ensured that the child could contribute information where appropriate (for example, about physical activity done during school time).

1.4.5 Feedback to participants

If participants wished, interviewers recorded their height and weight measurements within their information leaflet. Participants kept the information leaflet and thus had a record of their height and weight, if they wished.

Participants eligible for the biological module were given an additional document, the biological measurement record card. If participants had their waist measurement and blood pressure taken, then interviewers recorded their results on this card (if the participant wished). As before, participants could keep this measurement record card and thus had a note of their measurements.

For the biological module, interviewers were issued with a set of guidelines to follow when commenting on participants' blood pressure readings:

- If a participant's blood pressure was low, they were informed of symptoms to look out for and advised to contact their GP if symptoms persisted.
- If the participant's blood pressure was mildly raised, they were instructed to advise the participant to contact their GP within 3 months.
- If the participant's blood pressure was raised, they were instructed to advise the participant to contact their GP within 2-3 weeks.
- Finally, if the participant's blood pressure reading was considerably raised, interviewers advised the participant to visit their GP within 5 days and interviewers were instructed to contact the survey doctor at the earliest opportunity. The survey doctor would then phone the participant and advise them to contact their GP as soon as possible.

Participants who participated in Intake24 were offered generalised dietary feedback based on their recalls, either online (by email or as a PDF) or they could request a printed version to be sent to them.

1.5 Fieldwork quality control and ethical clearance

1.5.1 Training interviewers

Interviewers new to SHeS were fully briefed on the survey's content and procedures. Interviewers were supervised by an interviewer supervisor during the early stages of their work to ensure that interviews were administered correctly, and protocols were followed.

Interviewers that had worked on SHeS in previous years attended a refresher briefing ahead of the launch of the new survey year and were refreshed on any additional in-home processes when this was introduced. This ensured that they were aware of changes to survey content and procedures for 2024.

Interviewers interested in administering the biological module were initially screened for suitability. Minimum competency levels were set and only interviewers that met the set criteria were invited to training and accreditation sessions.

Full sets of written instructions, covering both survey procedures and measurement protocols, were provided to interviewers (measurement protocols are available on request from ScotCen).

1.5.2 Checking interviewer and measurement quality

A large number of quality control measures were built into the survey at the data collection stage and thereafter, to monitor the quality of interviewer performance.

Quality checks were carried out at 10% of productive households. These recalls checked with the participants that interviewers had followed the correct survey procedures when conducting the interview.

In addition to the above quality checking procedure, the computer program used by interviewers had in-built soft checks (which can be suppressed) and hard checks (which cannot be suppressed) associated with particular interview questions. When uncommon or unlikely answers were entered, or answers outside a predetermined range, these checks were triggered and appear as a warning message on the interviewers' laptop. The interviewer is either encouraged to double-check the entered response (a soft-check) or asked to change it (a hard-check). For example, when young children were weighed by having an adult hold them; the weight of the adult on their own was entered into the computer followed by the combined weight of the infant and adult. A hard check was used to ensure that the weight entered for the adult alone did not exceed the weight of the infant and adult combined.

Soft-checks were similar to hard-checks, however they could be suppressed. For example, soft-checks were applied to height measurements; if an interviewer entered a respondent's height to be in excess of 1.93 metres (6 feet 3 inches), a message appeared asking the interviewer to confirm that this entry was correct. The interviewer could suppress the soft-check once they had confirmed that the height entry was not a mistake.

1.5.3 Ethical clearance

Ethical approval for the 2024 survey, as for previous years, was obtained from the Health and Care Research Ethics Committee for Wales (REC reference number: 17/WA/0371).

1.6 Survey response

1.6.1 Introduction

This section presents the fieldwork outcomes for the sampled addresses. Survey response is an important indicator of survey quality as non-response can introduce bias into survey estimates. Standardised outcome codes (based on an updated version of those published in Lynn et al, 2001[5]) for survey fieldwork were applied across the SHeS, SHS and SCJS. This enables consistent reporting of

fieldwork performance and effective comparison of performance between the surveys.

Fieldwork challenges encountered during 2024 fieldwork impacted on sample coverage. As a result, 2% of addresses were not allocated to an interviewer due to capacity issues with bio trained interviewers and an additional 4% of addresses were allocated but not worked.

1.6.2 Household response

Tables 1.1a and 1.1b show a detailed breakdown of the SHeS response for sampled addresses in 2024. Addresses with unknown eligibility have been allocated as eligible and ineligible proportional to the levels of eligibility for the remainder of the sample. This approach provides a conservative estimate of the response rate as it estimates a high proportion of eligible cases amongst addresses with unknown eligibility.

At each selected household in the main sample, all adults and a maximum of two children were eligible for interview. When considering the household response rate, households classed as “responding” were those where at least one eligible person opted-in/consented to interview and was interviewed. The tables show that for the main sample, 37.0% of eligible households were classed as responding (40.7% excluding addresses not covered).

In the child boost CHI-screened sample, 72.5% of issued addresses were deemed eligible and interviews were conducted at 44.4% of these households.

Table 1.2a shows that across Heath Boards, the percentage of the sample households where at least one eligible person was interviewed ranged from 27.8% (Greater Glasgow & Clyde) to 80.9% (Shetland Islands). Fully cooperating households were those where all eligible individuals were interviewed. This varied between 21.8% in Greater Glasgow & Clyde to 69.8% in the Shetland Islands. The definition of a fully cooperating household changed in 2012 and is therefore not comparable with fully cooperating figures prior to this.

Table 1.2b shows the household response rate for eligible addresses in the child boost sample by Health Board. This varied from 32.2% (Lanarkshire) to 70.0% (Grampian). For most Health Boards, the figure for fully productive households matched that for at least one eligible person being interviewed and thus the range varied in the same manner (32.2% in Lanarkshire to 69.4% in Grampian). Please note the small base sizes for some health boards.

Table 1.3a shows that across Local Authorities, the percentage of combined main sample households where at least one eligible person was interviewed ranged from 15.2% (Inverclyde) to 72.5% (Shetland

Islands). Fully cooperating households varied between 13.0% (Inverclyde) and 62.5% (Shetland Islands).

Table 1.3b shows that across Local Authorities, the percentage of child boost households where at least one eligible child was interviewed ranged from 14.3% (Glasgow City) to 77.1% (Aberdeenshire). Figures were almost identical for fully cooperating households. Again, the small base sizes should be noted. In addition, a small number of Local Authorities had a higher proportion of addresses that were not covered than others.

Tables 1.1a – 1.3b

1.6.3 Individual response for adults

Overall, there were 4,591 adult responses to SHeS 2024.

The adult response rate in 2024 was calculated based on the number of eligible households. This was undertaken by dividing the number of individual adult interviews by the number of eligible adults in productive households. The total estimated number of adults from sampled addresses eligible for interview is referred to as the “set” sample. For 2024, the set sample of was 5,230.

Table 1.9 shows that the age distribution of adult respondents was generally older than the population as a whole. For males, 56% of main respondents were aged 55 or older compared with 41% of the male population as a whole. There were similar differences for females, with 54% of female respondents aged 55 or older compared with 42% of the female population as a whole. **Tables 1.4a and 1.9**

1.6.4 Individual response for children (0-15)

Interviews were undertaken with 1,986 children aged 0 to 15, with 1,156 of these taking place as part of the CHI-screened child boost.

In order to calculate the response rate for children, the number of eligible children in participating households was calculated. Tables 1.4a and 1.4b show that the overall response rate for children in the main sample and the child boost sample were similarly high (95.0% for children in the main sample and 99.6% for the child boost sample).

Tables 1.4a and b

1.6.5 Intake24 response

A total of 2,200 SHeS adult participants aged 16 and over completed at least one dietary recall, with 1,796 completing both dietary recalls (82%). Completion of at least one dietary recall generally increased with age, with 69% of those who completed any recalls aged 45 and over. Three-quarters of those who completed at least one dietary recall were in the three least deprived SIMD quintiles.

Table 1.10

1.7 Weighting the data

1.7.1 Introduction

This section presents information on the weighting procedures applied to the survey data. Since 2012, the weighting for SHeS has been undertaken by the Scottish Government rather than the survey contractor (as had previously been the case), but the methodology applied was largely consistent with that of the 2008 to 2011 sweeps of the survey. The procedures for the implementation of the weighting methodology were developed by the Scottish Government working with the Methodology Advisory Service at the Office for National Statistics[6].

To undertake the calibration weighting, the ReGenesees Package for R was used. Within this, to execute the calibration, a raking function was implemented.

1.7.2 Main adult weights

The main adult weight is applicable to analysis of questions asked of all adults. There were six steps to calculating the overall adult weights. These were as follows:

1) Address selection weights (w1)

The address selection weights were calculated to compensate for unequal probabilities of selection of addresses in different survey strata. For the main sample, there were 32 strata (one for each local authority).

$$\mathrm{w1} = \frac{\text{Number of PAF addresses in the stratum}}{\text{Number of addresses selected in the stratum}}$$

2) Dwelling unit selection weights (w2)

The Multiple Occupancy Indicator (MOI) for the PAF was used to ensure that if there were multiple dwelling units at a single address point then they would have the same selection probability as individual addresses. However, there are likely to have been some cases where the MOI was incorrect. The following correction was applied where this was the case:

$$\mathrm{w2} = \frac{\text{Recorded dwelling units at the address}}{\text{PAF MOI for the address}}$$

W2 was trimmed to a minimum of 0.67 and a maximum of 3.

3) Household selection weights (w3)

Similarly to w2, within a very small number of dwelling units,

fieldworkers usually find multiple households, of which only one is selected for participation. The following correction was applied for multiple households:

$$w3 = \text{Number of households within dwelling unit}$$

W3 was trimmed to a maximum of 3.

4) Calibrated household weights (w4)

The three selection weights were combined (w1*w2*w3) before the household calibration stage. This combined weight was applied to the survey data to act as entry weights for the calibration. The execution of the calibration step then modified the entry weights so that the weighted total of all members of responding households matched the population totals for Health Boards, Scotland-level population totals for age/sex breakdown, and the population within each SIMD quintile. The population totals that were used were the National Records of Scotland's (NRS) mid-2022 estimates for private households.

5) Adult non-response weights (w5)

All adults within selected households were eligible for interview, but within responding households not all individuals completed an interview. The profiles of household members that did not complete the interview were different from those that did. Information on all individuals within responding households was available through information gathered as part of the household interview. This allowed the differential response rates for individuals within households to be modelled using logistic regression to calculate a probability of responding based on their profiles. The logistic regression was only applicable for households containing more than one adult since households consisting of only one adult either responded to the household and individual interviews or did not respond at all.

The following variables were considered for inclusion in the model:

- Health Board
- Age/sex
- Number of adults in the household
- Employment status of household reference person
- Presence of a smoker in the household
- Marital status
- Tenure
- Urban/rural classification
- Access to a car
- Located within SIMD15 area
- Frequency of eating meals together
- SIMD quintile

Through running backwards and forwards selection procedures for the logistic regression the following variables were included in the final model:

- Health Board
- Age/sex
- Number of adults in the household
- Located within SIMD15 area
- Marital status
- SIMD quintile
- Access to a car

The final logistic regression model was then used to calculate the probability of response for all individuals that did respond. The adult non-response weight (w5) was then calculated as the reciprocal of this probability:

$$w5 = \frac{1}{\text{Probability of individual's response}}$$

W5 was trimmed to a maximum of 4. For households of only one adult, the non-response weight was one.

6) Individual calibration and final adult weight (int24wt)

The household (w4) and non-response (w5) were combined (w4*w5) and applied to the survey data prior to the final stage of calibration weighting which matched weighted totals for the survey data to the NRS 2022 mid-year population estimates for Health Boards, age/sex distribution at Scotland level and age/sex distribution for the Glasgow and Greater Clyde Health Board shown in the tables below.

Table 6: 2022 Mid-year population estimates for private households in Scotland by Health Board

Health Board	Adults	Children	Total
Ayrshire & Arran	303,040	58,357	361,397
Borders	97,549	18,064	115,613
Dumfries & Galloway	121,954	22,026	143,980
Fife	301,284	61,441	362,725
Forth Valley	246,151	50,106	296,257
Grampian	468,643	97,183	565,826
Greater Glasgow & Clyde	958,850	191,097	1,149,947
Highland	266,490	49,428	315,918
Lanarkshire	548,548	115,267	663,815
Lothian	731,459	146,772	878,231
Orkney	18,360	3,444	21,804
Shetland	18,738	4,112	22,850
Tayside	338,886	65,245	404,131
Western Isles	21,874	3,945	25,819
Total	**4,441,826**	**886,487**	**5,328,313**

Table 7: 2022 Mid-year population estimates for private households in Scotland by SIMD Quintile

SIMD Quintile	Total population
1 – 20% most deprived data zones	1,038,755
2	1,037,595
3	1,046,051
4	1,135,445
5 – 20% least deprived data zones	1,070,467
Total	**5,328,313**

Table 8: 2022 Mid-year population estimates for private households in Scotland by age group

Age group	Male	Female	Total
0-4	126,442	119,800	246,242
5-9	143,707	136,499	280,206
10-15	184,016	176,023	360,039
16-24	262,304	261,527	523,831
25-34	331,065	350,840	681,905
35-44	328,852	350,535	679,387
45-54	343,547	367,236	710,783
55-64	377,229	401,128	778,357
65-74	285,051	309,997	595,048
75+	204,748	267,767	472,515
Total	**2,586,961**	**2,741,352**	**5,328,313**

1.7.3 Biological module weights

A similar process was applied to derive the weights for the biological module. The steps are outlined below.

1) Address selection weight (bw1)

New address selection weights were calculated using the same process as described for w1.

2) Dwelling unit (w2) and household selection weights (w3)

The dwelling unit and household selection weights from the main adult weight were applied as above.

3) Calibrated household weight (bw4)

The three selection weights were combined (bw1*w2*w3) and applied to the survey data before the household calibration was run so that survey data matched the population totals for Health Boards, Scotland-level age/sex breakdowns, and the population within SIMD15 areas.

4) Adjustment for biological module selection (bw5)

33% of the main sample was allocated to the biological module. To incorporate this probability of selection, a correction was applied to the calibrated household weight (bw4). The correction was:

$$\text{bw5} = \frac{(\text{Number of PAF addresses in the stratum}) \ / \ (\text{Stratum selected addresses for bio mod})}{\text{bw4}}$$

5) Application of adult non-response (w5)

For within household non-response, the non-response weight (w5) calculated for all households was also applicable for the biological module.

6) Non-response weight for biological module interview

Not all adults who responded to the main section of the interview responded to the biological module. Information collected for the respondent in the main interview and household interview was used to calculate the likelihood of responding to the biological module and was modelled with logistic regression.

The following variables were considered for inclusion in the model:

- Health Board
- Age/sex
- Number of adults in the household
- Employment status of household reference person
- Presence of a smoker in the household
- Marital status
- Tenure
- Urban/rural classification
- Access to a car
- Located within SIMD15 area
- Frequency of eating meals together
- Self-assessed general health
- Whether done gardening/DIY/building work in the past 4 weeks
- Whether has longstanding illness
- Highest achieved qualification
- Level of physical activity
- Economic activity (including if retired)
- Ever had high blood pressure
- Whether smokes cigarettes or drinks nowadays
- Number of natural teeth
- Whether done any housework in past 4 weeks

Through running backwards and forwards selection procedures for the logistic regression the following variables were included in the final model:

- Health Board
- Age/sex
- Number of adults in the household
- Located within SIMD15 area
- Marital status
- Frequency of eating meals together
- Presence of a smoker in the household
- Access to a car
- Highest achieved qualification
- Whether done any housework in past 4 weeks
- Whether done gardening/DIY/building work in the past 4 weeks

The final logistic regression model was then used to calculate the probability of response for all individuals that did respond. The adult non-response weight (w5) was then calculated as the reciprocal of this probability:

$$\text{bw6} = \frac{1}{\text{Probability of individual's response to the bio module}}$$

The top 1% of bw6 was trimmed.

7) Final calibration for biological module (bio24wt)

The household (bw4), biological sample correction (bw5) and adult non-response (w5), and biological non-response (bw6) weights were combined (bw4*bw5*w5*bw6) and applied to the survey data.

For the final stage of biological module weighting, the weighted totals for the survey data were calibrated to match the NRS 2022 mid-year population estimates for private households for Health Boards and age/sex distribution at Scotland level. However, due to the low sample size for the module several categories had to be collapsed. In terms of Health Boards, all areas except for Grampian, Greater Glasgow and Clyde, Lanarkshire and Lothian were grouped together. For the age groups, the youngest two age groups were combined.

1.7.4 Adult version A weights

A weight titled “Version A” was calculated for the adult respondents in the main sample that were not selected for the biological module. These weights are for analysis of questions included in the version A rotating module which are only asked of respondents in households not selected for the biological module. The following steps were followed to derive the weight:

1) Address selection weight (bw1)

As derived in the first step of the biological module weight.

2) Dwelling unit (w2) and household selection weights (w3)

The dwelling unit and household selection weights from the main adult weight were applied as above.

3) Calibrated household weight (bw4)

As derived for the biological module.

4) Adult non-response weight (w5)

For within household non-response, the non-response weight (w5) calculated for all households was also applicable for the biological module.

5) Final calibration for Version A weight (vera24wt)

The household (bw4) and adult non-response (w5) weights were combined (bw4*w5) and applied to the survey data. As was the case with the main adult weight and biological module weight, the weighted totals for the survey data were calibrated to match the NRS 2022 mid-year population estimates for private households for Health Boards, age/sex distribution at Scotland level.

1.7.5 Overall child weights

An overall child weight was derived for child responses from the main sample and from the child boost combined. Separate logistic regression non-response weights were not required for the child samples as the response rate for children within cooperating households was sufficiently high. The weighting steps are shown below. Steps (1) and (2) followed the same process as described in 1.7.2 above.

1) Address selection weight for main sample and child boost combined (cw1)

2) Dwelling unit (cw2) and household (cw3) selection weights

3) Selection of children within each household (cw4)

A maximum of two children were eligible for interview in each household. To ensure that children in larger households were not under-represented in the final sample the following child selection weight was calculated for households with more than two children to compensate for the probability of selection:

$$\mathrm{cw4} = \frac{\text{Number of children in the household}}{2}$$

For households with two or fewer children cw4=1.

4) Calibration for child interview weight (cint24wt)

The address selection (cw1), dwelling unit (cw2), household (cw3) and child selection weights (cw4) were combined (cw1*cw2*cw3*cw4) and applied to the survey data. The weighted totals for the survey data were calibrated to match the NRS 2022 mid-year population estimates for private households for Health Boards, age/sex distribution at Scotland level.

1.7.6 Child version A weights

A weight was calculated for the child respondents in the main sample in households allocated to the version A sample. These weights are for analysis of questions included in the version A rotating module. (cvera24wt).

1.7.7 Child main sample weights

Weights were also created specifically for within household analysis, comparing children's characteristics with those of their parents. As data were only collected with respect to both children and adults in the main sample, these weights were only created for children at main sample addresses. They were created in a similar fashion to that described for the whole of the overall child weights (cmint24wt).

1.7.8 Intake24 weights

1) Selection and SHeS non-response

The basis for the Intake24 adult weight was the main adult weight (int24wt), which adjusts for the probability of selection and non-response to the survey. This weight was rescaled to a mean of one for all adult respondents eligible for the Intake24 survey.

2) Intake24 non-response weight

Not all of the adults that were invited to take part in the Intake24 survey responded. Using the information collected for the respondent in the main interview and household interview, the likelihood of responding to the Intake24 survey was modelled with logistic regression.

Through running backwards and forwards selection procedures for the logistic regression the following variables were included in the final model for response to the Intake24 survey:

- Health Board
- Age/sex
- Highest achieved qualification
- Whether done gardening/DIY/building work in the past 4 weeks
- Presence of a smoker in the household
- Whether done any housework in past 4 weeks
- Number of adults in the household
- Ethnic background of respondent
- Level of physical activity
- Whether smokes cigarettes
- Currently drinks alcohol
- Number of children in the household
- Access to a car
- Whether has longstanding illness
- Whether provide help or care
- Ever had high blood pressure

The final logistic regression model was then used to estimate the probability of response for all individuals that did respond to the Intake24 survey. The Intake24 non-response weight (intake24_NR) was then calculated as the reciprocal of this probability:

$$\text{intake24_NR} = \frac{1}{\text{Probability of individual's response to Intake24 survey}}$$

3) Final calibration of Intake 24 adult weights (shes_intake24_wt_sc)

The adult weight (int24wt) and non-response (intake24_NR) were combined (int24wt * intake24_NR) and applied to the data prior to the final stage of calibration weighting which matched weighted totals for the survey data to the NRS 2022 mid-year population estimates for Health Boards, age/sex distribution at Scotland level and age/sex distribution for the Glasgow and Greater Clyde Health Board.

Weight name	**Purpose of weight**
int24wt	For analysis of 2024 adult data
bio24wt	For analysis of 2024 biological module data
vera24wt	For analysis of 2024 version A adult module data
cint24wt	For analysis of 2024 child data
cvera24wt	For analysis of 2024 version A child module data
cmint24wt	For analysis of 2024 combined child data core sample only (for within household analysis)
shes_intake24_wt_sc	For analysis of 2024 Intake24 data

1.7.9 Combined weights

A number of different combinations of annual sweeps have been produced to allow the analysis of combined datasets. Due to disruption to the survey at the onset of the pandemic, the survey data collected in 2020 was published as experimental statistics and was not comparable with the time series[7]. This data has not been included in the survey trends or the combined years' analysis.

Weight name	Purpose of combined weight
int21222324wt	For analysis of 2021, 2022, 2023 and 2024 combined adult data
intsc21222324wt	For analysis of 2021, 2022, 2023 and 2024 combined adult self-completion data due to lower response to the online self-completion surveys in 2023. See the 2023 technical report chapter 1 for more information.
cint21222324wt	For analysis of 2021, 2022, 2023 and 2024 combined child data
cmint21222324wt	For analysis of 2021, 2022, 2023 and 2024 combined child data core sample only (for within household analysis)
bio21222324wt	For analysis of 2021, 2022, 2023 and 2024 combined depression, anxiety, suicide and self-harm data
int222324wt	For analysis of 2022, 2023 and 2024 combined adult data
intsc222324wt	For analysis of 2022, 2023 and 2024 combined adult self-completion data due to lower response to the online self-completion surveys in 2023. See the 2023 technical report chapter 1 for more information.
biophy222324wt	For analysis of 2022, 2023 and 2024 combined bio measurements (blood pressure, hypertension, waist circumference and saliva). Created to account for reduced bio samples taken in 2022 during recovery of the interviewer panel following the pandemic. See the 2022 technical report for more information.
bio222324wt	For analysis of 2022, 2023 and 2024 combined depression, anxiety, suicide and self-harm data
cint222324wt	For analysis of 2022, 2023 and 2024 combined child data
cmint222324wt	For analysis of 2022, 2023 and 2024 combined child data core

	sample only (for within household analysis)
int2224wt	For analysis of 2022 and 2024 combined adult data
cint2224wt	For analysis of 2022 and 2024 combined child data
vera2224wt	For analysis of 2022 and 2024 combined version A adult module data
cvera2224wt	For analysis of 2022 and 2024 combined version A child module data
cmint2224wt	For analysis of 2022 and 2024 combined child data core sample only (for within household analysis)
int2324wt	For analysis of 2023 and 2024 combined adult data
intsc2324wt	For analysis of 2023 and 2024 combined adult self-completion data
bio2324wt	For analysis of 2023 and 2024 combined depression, anxiety, suicide and self-harm data
cint2324wt	For analysis of 2023 and 2024 combined child data
cmint2324wt	For analysis of 2023 and 2024 combined child data core sample only (for within household analysis)

In each case, the calculation of the weights followed the same procedure. The pre-calibration weights which had already been calculated for the individual years (which take into account selection weighting and (except for the child weights) non-response weighting) were combined and calibrated to Health Board and age/sex 2022 population totals for private households.

1.8 Data analysis and reporting

SHeS is a cross-sectional survey of the population. It examines associations between health status, personal characteristics and behaviour. However, such associations do not necessarily imply causality. In particular, associations between current health status and current behaviour need careful interpretation, as current health may reflect past, rather than present, behaviour. Similarly, current behaviour may be influenced by advice or treatment for particular health conditions.

1.8.1 Reporting age variables

Defining age for data collection

A considerable part of the data collected in SHeS 2024 is age specific, with different questions directed to different age groups. During the interview the participant's date of birth was ascertained. For data collection purposes, a participant's age was defined as their age on their last birthday before the interview.

Age as an analysis variable

Age is a continuous variable, and an exact age variable on the data file expresses it as such (so that, for example, someone whose 24th birthday was on January 1, 2024 and was interviewed on October 1, 2024 would be classified as being aged 24.75).

The presentation of tabular data involves classifying the sample into year bands. This can be done in two ways, age at last birthday and 'rounded age', that is, rounded to the nearest integer. In this report, all references to age are age at last birthday.

Some of the adult data included in the 2024 report have been age-standardised to allow comparisons between groups after adjusting for the effects of any differences in their age distributions. Further information on age standardisation can be found in chapter 2 of this report.

1.8.2 Standard analysis breakdowns

Scottish Index of Multiple Deprivation (SIMD)

The analysis of 2024 data was based on the most recent version of the Scottish Index of Multiple Deprivation (SIMD), which can be found in the methods section of the Scottish Health Survey dashboard. It is based on 38 indicators in seven individual domains of current income, employment, housing, health, education, skills and training, geographic access to services and crime. SIMD is calculated at data zone level, enabling small pockets of deprivation to be identified. The data zones are ranked from most deprived (1) to least deprived (6,976) on the overall SIMD index. The result is a comprehensive picture of relative area deprivation across Scotland. The index was divided into quintiles for the presentation of analysis within this report. The full index is not available on the archived dataset due to concerns about its potential for identifying individual respondents or households.

1.8.3 Design effects, true standard errors and confidence intervals

SHeS 2024 used a partially clustered, stratified multi-stage sample design. In addition, weights were applied when obtaining survey estimates. One of the effects of using the complex design and weighting is that standard errors for survey estimates are generally higher than

the standard errors that would be derived from an unweighted simple random sample of the same size. The calculations of standard errors and confidence intervals shown in tables, and comments on statistical significance throughout the report, have taken the clustering, stratification and weighting into account. The ratio of the standard error of the complex sample to that of a simple random sample of the same size is known as the design factor. Put another way, the design factor (or ‘deft’) is the factor by which the standard error of an estimate from a simple random sample has to be multiplied to give the true standard error of the complex design. The true standard errors and defts for SHeS 2024 have been calculated using a Taylor Series expansion method. The deft values and true standard errors (which are themselves estimates subject to random sampling error) are used to calculated the confidence intervals presented in the survey tables and dashboard.

References and notes

1 Further information on the sample designs and the methodology used is available at: https://webarchive.nrscotland.gov.uk/3000/https://www.gov.scot/Topics/Statistics/About/SurveyDesigns201215 .

2 Further information on the 2022 Scottish Health Survey questionnaire review for the 2024 survey and beyond can be found on the Scottish Government SHeS website: https://www.gov.scot/publications/review-content-scottish-health-survey-2024-onwards/

3 *Review of the content of the Scottish Health Survey (2024 onwards): outcomes report.* Edinburgh, the Scottish Government. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2024/09/scottish-health-survey-content-review-outcomes-report/documents/scottish-health-survey---content-review-outcomes-report/scottish-health-survey---content-review-outcomes-report/govscot%3Adocument/Scottish%2BHealth%2BSurvey%2B-%2Bcontent%2Breview%2Boutcomes%2Breport.pdf

4 The household reference person (HRP) is defined as the householder (a person in whose name the property is owned or rented) with the highest income. If there is more than one householder and they have equal income, then the household reference person is the eldest.

5 Lynn, Peter, Beerten, Roeland, Laiho, Johanna and Martin, Jean 'Recommended Standard Final Outcome Categories and Standard Definitions of Response Rate for Social Surveys', Working Papers of the Institute for Social and Economic Research, paper 2001-23. Colchester: University of Essex. 2001.

6 A report on the development of the weighting procedures is available at: https://webarchive.nrscotland.gov.uk/3000/https://www.gov.scot/Topics/Statistics/About/Surveys/WeightingProjectReport

7 *Scottish Health Survey – telephone survey – August/September 2020: main report.* Edinburgh, the Scottish Government. Available at: https://www.gov.scot/publications/scottish-health-survey-telephone-survey-august-september-2020-main-report/

Chapter 2 Methods and Definitions

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2.1. General survey definitions

Age standardisation

Age standardisation has been used in some analysis in order to enable groups to be compared after adjusting for the effects of any differences in their age distributions.

When different sub-groups are compared in respect of a variable on which age has an important influence, any differences in age distributions between these sub-groups are likely to affect the observed differences in the proportions of interest.

Age standardisation was carried out, using the direct standardisation method. The standard population to which the age distribution of sub-groups was adjusted was the mid-2022 population estimates for Scotland. All age standardisation has been undertaken separately within each sex.

The age-standardised proportion p' was calculated as follows, where p_i is the age specific proportion in age group *i* and N_i is the standard population size in age group *i*:

$$p' = \frac{\sum_i N_i p_i}{\sum_i N_i}$$

Therefore p' can be viewed as a weighted mean of p_i using the weights N_i. Age standardisation was carried out using the age groups: 16-24, 25-34, 35-44, 45-54, 55-64, 65-74 and 75 and over. The variance of the standardised proportion can be estimated by:

$$var(p') = \frac{\sum_i (N_i^2 p_i q_i / n_i)}{(\sum_i N_i)^2}$$

where $q_i = 1 - p_i$.

Confidence intervals

The tables presented in the main report for 2024 contain 95% confidence intervals (CIs). These represent the upper and lower values between which it is statistically probable that a percentage or mean reported will fall between, showing the variation around these results. Confidence intervals help to interpret how precise a result is.

Clusters
A cluster sampling approach was used whereby addresses across Scotland were divided into smaller groups (or clusters) before then using a random sample selection approach to select a sample to approach for the survey.

Household

A household was defined as one person or a group of people who have the accommodation as their only or main residence and who either share at least one meal a day or share the living accommodation.

Household Reference Person (HRP)

The HRP is defined as the householder (a person in whose name the property is owned or rented) with the highest income. If there is more than one householder and they have equal income, then the household reference person is the oldest.

Local Authority
32 elected councils make up the Scottish Local Government, which are referred to as Local Authorities.

Mean

Most means in this report are **arithmetic means** (the sum of the values for cases divided by the number of cases).

NHS Health Board

The National Health Service (NHS) in Scotland is divided up into 14 geographically based local NHS Boards and a number of National Special Health Boards. Health Boards in this report refers to the 14 local NHS Boards.

Percentile

The value of a distribution which partitions the cases into groups of a specified size. For example, the 20^{th} percentile is the value of the distribution where 20 percent of the cases have values below the 20^{th} percentile and 80 percent have values above it. The 50^{th} percentile is the median.

Primary sampling unit
A primary sampling unit (PSU) is the first stage of the sampling process. All primary sampling units (data zones on the islands, intermediate geographies elsewhere) in Scotland were randomly allocated to one of four sets. One of these sets is used in each year of fieldwork. This means that the sample is drawn from one quarter of PSUs each year.

P-value

A p value is the probability of the observed result occurring due to chance alone. A p value of less than 5% is conventionally taken to indicate a statistically significant result ($p<0.05$). It should be noted that the p value is dependent on

the sample size, so that with large samples differences or associations which are very small may still be statistically significant. Results should therefore be assessed on the magnitude of the differences or associations as well as on the p value itself. The p values used in the analysis for this report take into account the clustered sampling design of the survey.

Quintile

Quintiles are percentiles which divide a distribution into fifths, i.e., the 20th, 40th, 60th and 80th percentiles.

Sample

The survey sample represent a proportion of the whole population living in Scotland. It is not possible to survey every household in Scotland, therefore, a proportion of addresses are selected, or sampled, each year in such a way as to be as representative of the whole population as possible. See chapter 1 of the technical report for more information on the sampling approach used.

Scottish Index of Multiple Deprivation (SIMD)

The SIMD is the Scottish Government's official measure of area based multiple deprivation. It is based on 37 indicators across 7 individual domains of current income, employment, housing, health, education, skills and training and geographic access to services and telecommunications. SIMD is calculated at data zone level, enabling small pockets of deprivation to be identified. The data zones are ranked from most deprived (1) to least deprived (6,505) on the overall SIMD index. The result is a comprehensive picture of relative area deprivation across Scotland.

This report uses:

- SIMD 2006 for 2008 data
- SIMD 2009 for 2009-2011 data
- SIMD 2012 for 2012-2015 data
- SIMD 2016 for 2016-2018 data
- SIMD 2020 for 2019 and 2021- 2024 data (see Scottish Index of Multiple Deprivation 2020).

Breakdowns by SIMD for earlier years are available in the SHeS dashboard.

Self-completion booklet

A portion of the survey questions included in SHeS are asked via a self-completion booklet, including some questions that could be viewed as more sensitive. These paper booklets were handed to respondents who completed them without interviewer assistance (unless this was requested). The booklets were returned to the interviewer before leaving the household.

Significance testing

Where differences in relation to a particular outcome between two subgroups, such as males and females, are highlighted in the main report, the differences can be considered statistically significant, unless otherwise stated.

Statistical significance is calculated using logistic regression to provide a **p-value** based on a two-tailed significance test. One-tailed tests are used when the difference can only be in one direction. Two-tailed tests should always be used when the difference can theoretically be in either direction. For example, even though previous research has shown a higher prevalence of hazardous levels of alcohol consumption among males than among females, and we may expect this to be true in the most recent survey, a two-tailed test is used to confirm the difference.

Unweighted bases

The unweighted bases presented in the report tables provide the number of individuals upon which the data in the table is based. This is the number of people that were interviewed as part of SHeS and provided a valid answer to the particular question or set of questions. The unweighted bases show the number of people interviewed in various subgroups including sex, age and Scottish Index of Multiple Deprivation.

Weighting

While SHeS is designed to have as representative a sample as possible, it is not possible to obtain a fully representative sample as participation is on a voluntary basis. Therefore, statistical adjustments are undertaken to ensure that the data is representative of the population of Scotland, according to the most up-to-date population estimates. For more information on the weighting approach used, see chapter 1 of the technical report.

Weighted bases

The weighted bases are adjusted versions of the unweighted bases which involves calculating a weight for each individual so that their representation in the sample reflects their representation in the general population of Scotland living in private households. Categories within the table can be combined by using the weighted bases to calculate weighted averages of the relevant categories.

2.2. Chapter definitions

Note – The questionnaire and self-completion booklets are all available in the supporting documents section accompanying this publication. Unless otherwise stated the questions outlined below are included in the main questionnaire.

Due to space limitations, not all questions included in the 2024 questionnaire are included in the annual report. This is noted in the relevant sections below where applicable.

2.2.1 Chapter 1 – Mental health and wellbeing

Eating behaviours and feelings related to food that could be indicative of a possible eating disorder

The five-item SCOFF questionnaire: a new screening tool for eating disorders - PMC[1], which assesses the possible presence of eating disorders and has been validated for use in the general adult population, was included in SHeS for the first time in 2024. The same approach was adopted as was used in the 2007 Adult Psychiatric Morbidity Survey (APMS)[2] and the 2019 Health Survey for England (HSE)[3] which amended the wording slightly to include the timeframe of 'last year' and amended the order of the questions. A score of 2+ on the SCOFF questionnaire indicates a possible eating disorder.

A follow-up question that was included in the APMS and HSE, which asked whether feelings about food interfered with aspects of daily life such as work or social life, was also included in SHeS.

These questions are asked of all adults aged 16+ and were added to the adult and young-adult self-completion booklets with a short introduction to explain their context.

General Health Questionnaire (GHQ-12)

GHQ-12[4] is a scale designed to detect possible psychiatric morbidity in the general population. GHQ-12 is a widely used standard measure of mental distress and mental ill-health consisting of 12 questions on concentration abilities, sleeping patterns, self-esteem, stress, despair, depression, and confidence in the previous few weeks. Responses to each of the GHQ-12 items are scored, with one point allocated each time a particular feeling or type of behaviour is reported to have been experienced 'more than usual' or 'much more than usual' over the previous few weeks.

These scores are combined to create an overall score of between zero and twelve. A score of four or more (referred to as a high GHQ-12 score) has been used here to indicate the presence of a possible psychiatric disorder. A score of zero on the GHQ-12 questionnaire can, in contrast, be considered to be an indicator of psychological wellbeing. GHQ-12 measures deviations from people's usual functioning in the

previous few weeks and therefore cannot be used to detect chronic conditions.

These questions are asked of all adults aged 16+ and are included in the adult and young-adult self-completion booklets.

Loneliness

A question was included in the adult and young adult self-completion booklets to measure levels of loneliness experienced in the week prior to being interviewed, with five answer options ranging from ‘none or almost none of the time’ to ‘all or almost all of the time’. This differs from the question used prior to 2021 where the period asked about was two weeks.

Revised clinical interview schedule (CIS-R)

Depression and anxiety

Details on symptoms of depression and anxiety are collected via a standardised instrument, the CIS-R[5]. The CIS-R is a well-established tool for measuring the prevalence of mental disorders. The complete CIS-R comprises 14 sections, each covering a type of mental health symptom and asks about presence of symptoms in the week preceding the interview. Prevalence of two of these mental illnesses - depression and anxiety - were introduced to the Scottish Health Survey in 2008. Given the potentially sensitive nature of these topics, they were included in the nurse interview part of the survey prior to 2012[6]. Since 2012 the questions have been included in the biological module where they are asked of adults aged 16+ in the self-completion . The change in mode of data collection may have impacted response, and comparisons of 2016/2017 figures and onwards with pre-2012 figures should be interpreted with caution. There is a possibility that any observed changes in prevalence across this period may reflect the change in mode rather than a real change in the population.

Questions on depression cover a range of symptoms, including feelings of being sad, miserable, or depressed, and taking less of an interest and getting less enjoyment out of things than usual. Questions on anxiety cover feelings of anxiety, nervousness, and tension, as well as phobias, and the symptoms associated with these.

Suicide attempts and self-harm

In addition to being asked about symptoms of depression and anxiety, participants were also asked whether they had ever attempted suicide.

Those who said yes were asked if this was in ‘the last week, in the last month in the last year or at some other time?’ Note that this question is likely to underestimate the prevalence of very recent attempts, as people might be less likely to agree to take part in a survey immediately

after a traumatic life event such as this. Furthermore, suicide attempts will only be captured in a survey among people who do not die by suicide.

Participants are also asked whether they have ever deliberately harmed themselves in any way but not with the intention of taking their own life. Those who said that they had self-harmed were also asked if this was 'in the last week, in the last month, last year or at some other time'.

Since 2012 these questions have been answered via self-completion as part of the biological module. Prior to 2012 they were administered in the nurse interview, and any changes over time need to be interpreted with caution due to the change in mode.

Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS)

The WEMWBS was developed by researchers at the Universities of Warwick and Edinburgh, with funding provided by NHS Health Scotland, to enable the measurement of mental wellbeing of adults in the UK. It was adapted from a 40 item scale originally developed in New Zealand, the Affectometer 2. The WEMWBS scale comprises 14 positively worded statements with a five item scale ranging from '1 - None of the time' to '5 - All of the time'. The lowest score possible is therefore 14 and the highest is 70; mean scores are presented in the report. The 14 items are designed to assess positive affect (optimism, cheerfulness, relaxation); and satisfying interpersonal relationships and positive functioning (energy, clear thinking, self-acceptance, personal development, mastery and autonomy)[7].

The scale was not designed to categorise individuals according to level of mental wellbeing, so cut-off points have not been developed[8].

Strengths and difficulties questionnaire (SDQ)

The child Strengths and Difficulties Questionnaire (SDQ) aims to measure behavioural, emotional and relationship difficulties in children. It asks about 25 attributes which are used to devise a total SDQ score and scores for 5 sub-scales related to emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems and prosocial behaviour.

The SDQ was included in the 2024 survey questionnaire but it is not included in the annual report.

2.2.2 Chapter 2 – General health, cardiovascular conditions and caring

Cardiovascular conditions

Any cardiovascular disease (CVD)

Participants were classified as having 'any CVD' if they reported ever having any of the following conditions confirmed by a doctor or other healthcare professional: angina, heart attack, stroke, heart murmur, abnormal heart rhythm, or 'other heart trouble'[9]. Participants were also asked whether they had experienced the conditions in the previous 12 months.

It is important to note that no attempt was made to verify these self-reported diagnoses objectively. It is, therefore, possible that some misclassification may have occurred because some participants may not have remembered (or not remembered correctly, or not known about) diagnoses made by their doctor or other healthcare professional.

Any CVD condition or diabetes

A summary measure of the following conditions: angina, heart attack, stroke, heart murmur, abnormal heart rhythm or diabetes, is presented in the tables as 'any CVD condition or diabetes'.

Blood pressure/hypertension

Participants were defined as having self-reported doctor-diagnosed hypertension if they stated during the interview that they had been told by a doctor or other healthcare professional that they had high blood pressure.

Diabetes

Participants were classified as having diabetes if they reported a confirmed diagnosis by a doctor or other healthcare professional. Females whose diabetes occurred only during pregnancy were excluded from the classification. In 2018, a new question was introduced asking participants to report if they had been told they had Type 1 or Type 2 diabetes. Prior to 2018 no distinction was made between Type 1 and Type 2 diabetes in the interview.

Participants with doctor/healthcare professional diagnosis of diabetes were asked if they managed their condition with insulin and if they did, if they used an insulin pump.

Ischaemic heart disease (IHD)

IHD is also known as coronary heart disease. Participants were classified as having IHD if they reported ever having angina, a heart attack or heart failure diagnosed by a doctor or other healthcare professional.

IHD or Stroke

A summary measure of the two conditions is presented in the tables as 'IHD or stroke'.

Stroke

Participants were classified as having a stroke if they reported ever having had a stroke confirmed by a doctor or other healthcare professional.

Long-term conditions & limiting long-term conditions

Long-term conditions were defined as a physical or mental health condition or illness lasting or expected to last 12 months or more. The wording of this question changed in 2012 and is now aligned with the harmonised questions for Scottish Government surveys. Long-term conditions were coded into categories defined in the International Classification of Diseases (ICD), but it should be noted that the ICD morbidity and mortality statistics are coded by clinicians using the codes for diseases, whereas SHeS asks respondents to self-report if they have any of these conditions. A long-term condition was defined as limiting if the respondent reported that it limited their activities in any way.

In 2024, a new question on whether any reported long-term condition has an impact on any of the following areas; vision, hearing, mobility, dexterity, learning or understanding or concentrating, memory, mental health, stamina or breathing or fatigue, socially or behaviourally, other was added.

Self-assessed general health

Each year, participants aged 13 and over are asked to rate their health in general with answer options ranging from ‘very good’ to ‘very bad’. For children under the age of 13 the question is answered by the parent or guardian completing the interview on their behalf.

Unpaid caring

Unpaid caring is defined for the purposes of this survey as looking after or giving any regular help or support to family members, friends, neighbours or others because of either long-term physical, mental ill-health, disability; or problems related to old age, apart from anything done as part of paid employment.

Participants aged 4+ (parents respond on behalf of children aged 4-12 years old) are asked the unpaid caring questions. Those reporting to be unpaid carers are asked follow-up questions about who they provide care for, how much time they spend caring, the impact of caring on employment and any support they receive as a carer.

2.2.3 Chapter 3 – Perimenopause and menopause

If applicable, participants were asked questions about perimenopause and menopause. These questions were included in the SHeS questionnaire for the first time in 2024.

Menopause refers to the time when menstrual periods stop due to loss of hormones produced by the ovaries. Menopause usually occurs between the ages of 45 and 55, but it can happen earlier. Perimenopause refers to the time leading up to the menopause, and is when an individual begins to experience fluctuations in hormone levels and may start experiencing menopausal symptoms along with changes to their menstrual cycle.

Questions covered menopause and perimenopause symptoms, early menopause and causes, symptom management, medical treatments, contact with health professionals and reasons for not seeking help.

2.2.4 Chapter 4 – Respiratory

Asthma

Participants (including parents of children aged 0-12, and children themselves aged 13-15) were asked if a doctor or other healthcare professional had ever told them they had asthma. This question was asked in the 1998, 2003, 2008 and 2010 surveys, and has been included every year since 2012. No objective measures were used to confirm these reported diagnoses.

Participants were also asked about wheezing or whistling in the chest in the last 12 months. This question was unintentionally excluded from the 2023 survey and therefore no data is available for this question for that year.

Chronic Obstructive Pulmonary Disease (COPD)

COPD is defined by the World Health Organisation as ‘a pulmonary disease characterised by chronic obstruction lung airflow that interferes with normal breathing and is not fully reversible’. It is associated with symptoms and clinical signs that in the past have been called ‘chronic bronchitis’ and ‘emphysema,’ including regular cough (at least three consecutive months of the year) and production of phlegm.

Each year since 2008, adult participants have been asked if they had ever had COPD, chronic bronchitis or emphysema confirmed by a doctor or other healthcare professional . No objective measures were used to confirm these reported diagnoses. Those who reported doctor-diagnosed COPD were also asked what treatment or advice they had received.

Long COVID

Questions asked whether participants had had or thought they had had COVID-19 and how long their symptoms lasted. Long COVID was defined as currently experiencing symptoms more than 4 weeks after they first had COVID-19 that were not explained by something else.

It should be noted that due to changes in the question wording, the long-COVID data is not equivalent with that calculated and reported in the 2022 report, which reported on ever having had long covid. However, figures are comparable with those reported in the 2021 and 2023 reports.

Obstructive sleep apnoea

Sleep apnoea is a respiratory condition characterised by pauses or shallow breathing during sleep[10]. It is linked to other health problems including hypertension and heart disease.

Participants were asked if they had ever had sleep apnoea confirmed by a doctor or other healthcare professional and whether they had experienced sleep apnoea in the previous 12 months. These questions were included in the SHeS questionnaire for the first time in 2024.

2.2.5 Chapter 5 – Dental Health

Data on dental health is collected from adults aged 16+. In addition to collecting data on the number of natural teeth and presence of pain, a list of answer options from which participants can select as many as apply is used to collect data on issues they may be having with their mouth, teeth or dentures.

2.2.6 Chapter 6 – Diet and Food insecurity

Diet

Intake24

Intake24, an online 24-hour dietary tool, was first introduced as a means of collecting and analysing data on adult dietary intakes for the 2021 survey. This replaced previous methods of obtaining adult dietary data in SHeS and was repeated in 2024.

Intake24 was developed by Newcastle University, originally with funding from Food Standards Scotland and is licenced under the Open Government Licence. The tool is now maintained and developed in collaboration by Cambridge University (UK), Monash University (Australia) and Newcastle University (UK). The version of Intake24 used for SHeS (UK Locale, System Version 4, 2023) was provided and adapted by the University of Cambridge, based on the original, with technical advisory input from Newcastle University. Information about the development of the tool, reports and publications, as well as a demo of the tool, can be found on the Intake24 website.

Participants aged 16+ were introduced to Intake24 by their interviewer. Following their interview, participants were sent a secure URL via text

or email and logged into Intake24 on their computer, laptop, tablet or smartphone. Participants who did not have internet access or who did not feel confidence completing the dietary recalls independently could request assistance. This was provided by the NatCen Telephone Unit who carried out assisted dietary recalls over the telephone.

Participants were asked to record in Intake24 everything they ate and drank the previous day. Intake24 includes an embedded database of foods with linked portion sizes and corresponding nutrient composition data taken from the National Diet and Nutrition Survey[11] Nutrient Databank from which dietary intakes are automatically calculated. Participants are asked to select, as far as possible, their foods and drinks from the food list provided in Intake24. If they cannot find an exact match for the food consumed the tool prompts them to choose the closest matching item where possible. If the participant still cannot find a suitable match for their food they can report this as a missing food. The majority of foods in Intake24 have a range of portion-size photo images that the participant can review and select the image closest to the amount they consumed. If there is no photo, there is the option to report portion size as household measures such as individual items, different spoon sizes, or small, medium or large servings. For drinks, there are images of cups and glasses with a slider to indicate volume or photos of bottles and cans.

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, and checks for large time gaps between eating occasions. Intake24 includes a custom spell checker which works to correct both phonetic misspellings and typing errors in the free text to enable comprehensive search functionality.

Other features of the system include:

- A video tutorial on how to complete a recall
- Contextual help buttons
- A telephone help request function, enabling the research team to contact respondents to talk them through issues they may be experiencing

For SHeS 2024, after each eating occasion, participants were asked to record where they had bought or obtained most of the food for that meal or snack in order to differentiate food and drink from the household grocery shop from that obtained from out of home sources such as restaurants and takeaways and ‘food on the go’. At the end of each dietary recall, questions prompted participants to record if their intake was typical for that day (and if not, the reason why), any special diet, and details of any dietary supplements taken.

Food and portion size codes are automatically assigned within Intake24 allowing the system to generate nutrient output at the individual food level. The raw Intake24 output was imported into a bespoke database to facilitate data checks and to assign foods reported as missing to an appropriate food code and portion size, using the original free text search term and missing food details provided by the participant. In the first few months of data collection, recalls were monitored to enable a count of the number with:

- 9 or fewer food or drink items
- 3 or fewer eating or drinking occasions
- completion time of under 3 minutes
- very low calorie intake (less than 400kcal) or very high (more than 4,000kcal)

The purpose of the measures was to indicate where there may have been issues related to data collection that required further investigation and to provide a set of checks that could be used to assess the tool's performance against other UK surveys using Intake24.

At the end of the survey data collection, all recalls that contained less than 400kcal were reviewed. Case by case decisions were made as to whether recalls could be considered valid and complete, including, for example, checking if the respondent said they ate less than usual e.g. sickness. Four recalls were deemed to be incomplete and these recalls were removed from the dataset.

Boxplots were generated to review portion sizes and to identify any extreme outliers within each food group. Extreme outliers were identified from the boxplots as individual data points separate from the box and whiskers since they were more than 3 x IQR (Inter-quartile range: 75th percentile-25th percentile) from the nearest quartile for that intake (either the 25th or 75th percentile). These were examined on a case-by-case basis and reviewed in the context of the participant's overall consumption. Portion sizes which were considered to be implausible, and potentially the result of errors in portion size selection, were adjusted. Adjustments were carried out in the bespoke dietary database by changing the portion code at the individual recall level.

Finally, boxplots were generated to identify any infeasible/extreme energy and nutrient values. Extreme outliers were looked at on a case-by-case basis. Extreme intakes that were considered to be the result of errors in portion size estimation or food composition in the NDB were adjusted, otherwise values were left in the dataset as they were assumed to reflect consumption by participants.

For participants who completed at least one recall, their average daily intake was calculated to enable comparisons with the Scottish Dietary Goals (SDGs). The proportion of adults meeting each SDG was also calculated.

Analysis of the Intake24 data for SHeS 2024 was undertaken using a 'usual intakes' approach, a method of estimating population habitual nutrient and food intakes that has been adopted for other research studies such as the National Diet and Nutrition Survey (NDNS)[12]. Previously (for data for 2021) nutrient and food intakes were estimated by calculating the 'day average', which simply takes the average of each daily intake for each participant, but can result in misleading estimates of the prevalence of low or high intakes since the variance of the usual group intake is inflated by day-to-day variation in individual intake. The 'usual intake' method eliminates the intra-individual variability of the data and enables more appropriate estimation of 'percentiles' or 'proportions above/below a threshold' compared with the 'day average' method[13,14]. This approach also allows for the inclusion of participants who completed a single dietary recall rather than requiring two dietary recalls which was the case for the 'day average' method used previously.

Data for 2021 has also been reanalysed using the usual intakes method and will be available on the UK Data Service archive, replacing the previous 2021 dataset.

Energy density (kcal/100g/day)

Energy density is based on the energy from foods and milk only (not the energy from other drinks).

Fibre intake

Fibre is measured by the American Association of Analytical Chemists (AOAC) methods. AOAC fibre includes resistant starch and lignin in the estimation of total fibre in addition to non-starch polysaccharides.

Free sugars intake

The definition of free sugars includes:

- All added sugars in any form
- All sugars naturally present in fruit and vegetable juices
- Purees and pastes and similar products in which the structure has been broken down
- All sugars in drinks (except for dairy-based drinks)
- Lactose and galactose added as ingredients

The sugars naturally present in milk and dairy products, fresh and most types of processed fruit and vegetables and in cereal grains, nuts and seeds are excluded from the definition[15].

Fruit and vegetable consumption

SHeS gathered data on adult fruit and vegetable consumption between 2003 and 2019 as part of the main interview. However, estimations of portions of fruit and vegetables did not include the contribution from composite dishes, both homemade dishes and manufactured products.

In 2021 and 2024 dietary recall data, adult fruit and vegetable portions were calculated after disaggregation, that is they included these foods eaten as part of composite dishes, as well as their discrete portions, to provide more accurate estimates of total amounts consumed at an individual food level. For example, carrots may be eaten as an accompaniment to a main meal but they may also be consumed as an ingredient within a stew, together with additional vegetables such as onions and celery. In both 2021 and 2024, the 'none/less than ½ portion category' includes less than half a portion.

No diet data was collected for children in 2024 due to a separate Intake24 survey being undertaken with children on behalf of Food Standards Scotland in 2023/2024. Information on child fruit and vegetable consumption will be included in the 2025 survey.

Red and red processed meat intake

Red and red processed meat after disaggregation i.e. including the contribution from composite dishes, both homemade dishes and manufactured products.

SDGs

The SDGs provide the basis for the diet that will improve and support the health of the Scottish population[16]. Reporting against the total fat, saturated fat and free sugars goals below was updated in 2024 based on the Scientific Advisory Committee on Nutrition (SACN) recommendations[17] for expressing dietary energy from macronutrients.

Calories	Reduction in calorie intake by 120 kcal per person per day, and 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.
Fruit and vegetables	Average intake of a variety of fruit and vegetables to reach at least five portions per person per day (>400g per day).
Oily fish	Oil rich fish consumption to increase to one portion (140g) per person per week.
Red meat	Average intake of red and red processed meat to be limited to around 70g per person per day. Average intake of the highest consumers of red

	and red processed meat (90g per person per day) not to increase.
Fats	Average intake of total fat to reduce to no more than 33% of energy excluding ethanol, average intake of saturated fat to reduce to no more than 10% of energy excluding ethanol and average intake of trans fatty acids to remain below 1% of energy.
Free sugars	Average intake of free sugars to not exceed 5% of total energy in adults.
Salt	Average intake of salt to reduce to 6g per day for adults.
Fibre	An increase in average consumption of the American Association of Analytical Chemists (AOAC) fibre for adults (16+) to 30g per person per day.
Total carbohydrate	Total carbohydrate to be maintained at an average population intake of approximately 50% of total energy with no more than 5% total energy from free sugars.

Food insecurity

Food insecurity is 'the inability to acquire or consume an adequate quality or sufficient quantity of food in socially acceptable ways, or the uncertainty that one will be able to do so'. In their self-completion booklet, participants aged 16+ answered three routed questions on food insecurity asking whether they had worried about running out of food, had eaten less than they should have or had actually run out of food in the last 12 months.

2.2.7 Chapter 7 – Physical Activity

Adherence to adult physical activity guidelines

The physical activity guidelines advise adults to accumulate 150 minutes of moderate activity or 75 minutes of vigorous activity per week or an equivalent combination of both, in bouts of 10 minutes or more. These guidelines are referred to as the Moderate or Vigorous Physical Activity guidelines (MVPA). To help assess adherence to this guideline, the intensity level of activities mentioned by participants was estimated.

Activities of low intensity, and activities of less than 10 minutes duration, were not included in the assessment. This allowed the calculation of a measure of whether each SHeS participant adhered to the guidelines, referred to in the text and tables as "adult summary activity levels", see the table below. A more detailed discussion of this calculation is provided in the 2012 report[18].

Adult summary activity levels[a]

Meets MVPA guidelines	Reported 150 mins/week of moderate physical activity or 75 mins vigorous physical activity, or an equivalent combination of these.
Some activity	Reported 60-149 mins/week of moderate physical activity, or 30-74 mins/week vigorous physical activity, or an equivalent combination of these.
Low activity	Reported 30-59 mins/week of moderate physical activity, or 15-29 mins/week vigorous physical activity or an equivalent combination of these.
Very low activity	Reported less than 30 mins/week of moderate physical activity, or less than 15 mins/week vigorous physical activity, or an equivalent combination of these.

[a] Only bouts of 10 minutes or more were included towards the 150 minutes per week guideline.

Adult physical activity questionnaire

The SHeS questionnaire[19] asks about four main types of physical activity:

- home-based activities (housework, gardening, building work and DIY)
- walking
- sports and exercise
- activity at work

Information is collected on the:

- time spent being active
- intensity of the activities undertaken
- frequency with which activities are performed.

Data was also collected as part of the 2024 survey regarding motivations for and barriers to increase participation in physical activity. These questions are asked on a modular basis of adult participants in core version A households.

Child Physical Activity Questionnaire

The questions on child physical activity are slightly less detailed than those for adults[20]. No information on intensity is collected (with the exception of asking those aged 13-15 about their walking pace). The questions cover:

- sports and exercise
- active play including housework and gardening
- walking

Where appropriate, data are collected and reported for physical activity undertaken at and outside of school.

Sedentary time

Data are collected for adults and children on sedentary time on weekdays and weekends. Sedentary time is calculated from questions on time spent sitting at work, watching TV/another type of screen and/or time spent sitting doing other activities such as eating a meal, reading, napping etc. Sedentary time excludes those without a limiting illness or disability who said they were sedentary for more than 14 hours a day.

UK Chief Medical Officers (CMO) Physical Activity Guidelines (2019)

Age group	Guidelines
Early years – children under 5 years	**Infants (less than 1 year):** Physical activity is recommended several times a day (the more activity the better) in a variety of ways including interactive floor-based activity, e.g. crawling. Where infants are not yet mobile, at least 30 minutes of tummy time spread across the day and while awake is recommended along with movements such as reaching and grasping, pushing and pulling themselves over independently, or rolling over; more is better. **Toddlers (1-2 years):** At least 180 minutes (3 hours) per day of physical activity of any intensity is recommended for toddlers, including active and outdoor play. **Pre-schoolers (3-4 years):** At least 180 minutes (3 hours) per day of activity is also recommended for pre-school aged children, including a variety of active and outdoor play physical activities spread throughout the day. For this age group, this should include at least 60 minutes per day of moderate-to-vigorous intensity physical activity.
Children and young people aged 5 to 18	It is recommended that children and young people in this age group engage in moderate-to-vigorous intensity physical activity for an average of at least 60 minutes per day. The activities undertaken include those undertaken in a variety of settings such as school-based physical education, active travel, after school activities, play and sporting activities. Engagement in a range of activities and intensities over the course of a week is recommended in order

	to develop movement skills, muscular fitness and bone strength. This activity should be accompanied by as minimal an amount of sedentary time as possible, with any long periods of inactivity broken up with some physical activity, even if this is light in nature.
Adults aged 19-64	Daily physical activity is recommended for both physical and mental health benefits - the more the better but any activity is encouraged. This includes activities to develop and strengthen the major muscle groups, which can be achieved through activities such as heavy gardening, carrying heavy shopping, or resistance exercise. It is recommended that muscle strengthening activities are done on at least two days a week, but any strengthening activity is better than none. On a weekly basis, adults should undertake: • at least 150 minutes (2 1/2 hours) of *moderate* intensity activity (such as brisk walking or cycling) • or 75 minutes of *vigorous* intensity activity (such as running) • or even shorter durations of *very* vigorous intensity activity (such as sprinting or stair climbing); • or a *combination of moderate, vigorous and very vigorous* intensity activity. Sedentary time should be minimized as far as possible, breaking this up with at least light physical activity.
Adults aged 65 and over	Daily physical activity is also recommended for older adults for the maintenance of good physical and mental health, wellbeing, and social functioning. Even light activity offers greater health benefits than being sedentary, although the more daily physical activity that is undertaken, the better. Older adults should also undertake activities aimed at improving or maintaining muscle strength, balance and flexibility on at least two days a week, either on their own or combined with moderate aerobic activity. This should be accompanied by 150 minutes (two and a half hours) of moderate intensity aerobic activity, building gradually up to this where activity levels are currently lower. Those who are already regularly active can achieve these benefits through: • 75 minutes of vigorous intensity activity

	• or a combination of moderate and vigorous activity Weight-bearing activities offer additional benefit in helping to maintain bone health. Where physically able, long periods of being sedentary should be broken up with light activity, or at least with standing.

Muscle strengthening

A second summary measure was calculated, to assess whether adults are meeting the guideline to carry out activities that develop or maintain strength in the major muscle groups on at least 2 days a week.

Nine different sports (swimming, athletics, canoeing, climbing, horse riding, rowing, sailing, skiing and waterskiing) were classed as always muscle strengthening, and other sports or exercises were classed as muscle strengthening if the participant reported that the effort was enough to make the muscles feel some tension, shake or feel warm. If the participant carried out such activities for at least 10 minutes on 2 or more days a week, on average, they were deemed to meet the muscle strengthening guideline. As this only includes muscle strengthening through sporting activity, reported levels may be an underestimate.

Muscle strengthening results are presented in the SHeS dashboard.

2.2.8 Chapter 8 – Smoking

Exposure to second-hand smoke

Exposure to second-hand smoke in adults was measured by asking respondents to self-report where they have been exposed to second-hand smoke and by analysing saliva samples for cotinine. Cotinine is a metabolite of nicotine indicating levels of exposure to tobacco or tobacco smoke for those not exposed to nicotine from other sources such as vaping or nicotine replacement therapy (NRT).

Detectable salivary cotinine levels greater than 0.1ng/ml and less that 12ng/ml indicate exposure to second-hand smoke for non-smokers who do not report other nicotine use.

Exposure to second-hand smoke for children is measured by the following:

- whether there is someone who regularly smokes inside the accommodation where the child lives, and
- parents' and older children's (aged 13-15) reports of whether children are exposed to smoke at home.

Exposure to second-hand vapour

Exposure to second-hand vapour from e-cigarettes or vaping devices was measured in adults and children (aged 13-15) by asking respondents to self-report where they have been exposed to second-hand vapour, and if they have, whether it bothers them. This question was added to the SHeS questionnaire in 2024.

Nicotine Replacement Therapy (NRT)

The remedial administration of nicotine to the body by means other than tobacco, usually as part of smoking cessation. Common forms of nicotine replacement therapy include nicotine patches and nicotine gum.

Nicotine Vapour Products (Electronic cigarettes/e-cigarettes/vapes)

Electronic cigarettes or e-cigarettes are battery-powered handheld devices which heat a liquid that delivers a vapour. The vapour is then inhaled by the user, which is known as ‘vaping’. E-cigarettes typically consist of a battery, an atomiser and a cartridge containing the liquid. Earlier models, often referred to as ‘cigalikes’, were designed to closely resemble cigarettes but there is now a wide variety of product types on the market. The liquid is usually flavoured and may not contain nicotine, although in most cases e-cigarettes are used with nicotine. Unlike conventional or traditional cigarettes, they do not contain tobacco and do not involve combustion (i.e. they are not lit).

SHeS has gathered information on the use of e-cigarettes among the Scottish adult population since 2014, in response to their increased availability and high profile. The questions ask whether participants have ever used an e-cigarette as well as whether they currently use an e-cigarette. The questions about e-cigarettes were amended in 2016 to include the term ‘vaping devices’.

Smoking status

Smoking status categories reported are:

- current cigarette smoker
- ex-regular cigarette smoker
- never regular cigarette smoker
- never smoked cigarettes at all

Information on cigar and pipe use is collected in the survey but as prevalence is low these are not considered in the definition of current smoking.

Cotinine adjusted smoking status

The saliva cotinine adjustment adjusts original self-reported cigarette smoking levels by including those with cotinine levels in their saliva of

12ng/ml or above; this indicates that the individual is using nicotine either from tobacco, vaping, NRT or some other product (such as nicotine pouches). For self-reported non-smokers who report not currently using vapes or NRT products, this indicates exposure beyond what would be expected from contact with second-hand cigarette smoke and hence suggests misreporting of smoking behaviour in the main interview.

Those who stated that they currently used either vapes or NRT products but did not currently smoke were excluded from the calculation of cotinine adjusted smoking prevalence estimates. This was because it was not possible to tell whether any raised cotinine levels among this group were due to vaping and/or NRT products alone, or additionally to unreported smoking. As the 2024 survey did not ask about use of nicotine pouches, it was not possible to exclude those using these products from the analysis.

Questions on smoking behaviour

Questions on smoking have been included in SHeS since 1995. Some small changes were made to the questions in 2008 and 2012. These are outlined in the relevant annual reports[21,22]. In 2024, a question on exposure to second-hand vapour was introduced.

The current questions in the survey focus on:

- current smoking status
- frequency and pattern of current smoking
- the number of cigarettes smoked by current smokers
- exposure to second-hand smoke
- exposure to second-hand vapour
- past smoking behaviour, current and ex-smokers
- quit attempts and desire to give up smoking
- medical advice on giving up smoking
- nicotine replacement therapy (NRT) use (including questions on NRT that led to successful cessation)
- Nicotine Vapour Products (NPVs) e.g. e-cigarettes/vapes (including as part of a quit attempt)

Adults aged 20 and over were asked about their smoking behaviour during the main interview. For those aged 16 and 17, information was collected in a self-completion booklet offering more privacy and reducing the likelihood of concealing behaviour in front of other household members. Those aged 18 and 19 could answer the questions either during the interview or via the self-completion booklet, at the interviewer's discretion.

The self-completion questions were largely similar to those asked in the interview. However, given the age of the participants completing the self-completion questionnaire, questions on past smoking behaviour, desire to give up smoking and medical advice to stop smoking were excluded.

2.2.9 Chapter 9 – Alcohol

Calculating alcohol consumption

The guidelines on lower risk drinking are expressed in terms of units of alcohol consumed. Detailed information on both the volume of alcohol drunk in a typical week and on the heaviest drinking day in the week preceding the survey was collected from participants. The volumes reported were not validated. In the UK, a standard unit of alcohol is 10 millilitres or around 8 grams of ethanol (pure alcohol). In this chapter, alcohol consumption is reported in terms of units of alcohol.

There are numerous challenges associated with calculating units at a population level, not least of which are the variability of alcohol strengths and the fact that these have changed over time. The table below outlines how the volumes of alcohol reported in the survey were converted into units (the 2008 report provides full information about how this process has changed over time)[23]. Those who drank bottled or canned beer, lager, stout or cider were asked in detail about what they drank, and this information was used to estimate the amount in pints.

Alcohol unit conversion factors

Type of drink	Volume reported	Unit conversion factor
Normal strength beer, lager, stout, cider, shandy (less than 6% Alcohol By Volume (ABV)	Half pint	1.0
	Can or bottle	Amount in pints multiplied by 2.5
	Small can (size unknown)	1.5
	Large can / bottle (size unknown)	2.0
Strong beer, lager, stout, cider, shandy (6% ABV or more)	Half pint	2.0
	Can or bottle	Amount in pints multiplied by 4
	Small can (size unknown)	2.0
	Large can / bottle (size unknown)	3.0
Wine (including champagne and prosecco)	250ml glass	3.0
	175ml glass	2.0
	125ml glass	1.5
	750ml bottle	1.5 x 6
Sherry, vermouth and other fortified wines	Glass	1.0
Spirits	Glass (single measure)	1.0
Alcopops	Small can or bottle	1.5
	Large (700ml) bottle	3.5

Questions on alcohol

Questions about drinking alcohol have been included in SHeS since its inception in 1995. Questions are asked either face-to-face via the interviewer or included in the self-completion booklet if they are deemed too sensitive for a face-to-face interview (e.g. if being interviewed with a parent). All those aged 16-17 years are asked about their alcohol consumption via the self-completion booklet, as are some of those aged 18-19 years, at the interviewers' discretion. The way in which alcohol consumption is estimated in the survey was changed significantly in 2008. A detailed discussion of those revisions can be found in the chapter on alcohol consumption in the 2008 report[24].

UK Chief Medical Officers' (CMO) Alcohol Guidelines

The UK CMO alcohol guidelines consist of three recommendations:

- a weekly guideline on regular drinking;
- advice on single episodes of drinking; and
- a guideline on pregnancy and drinking

According to the weekly guideline, adults are safest not to regularly drink more than 14 units per week, to keep health risks from drinking alcohol to a low level. If you do drink as much as 14 units a week, it is best to spread this evenly over three days or more. On a single episode of drinking, advice is to limit the total amount drunk on any occasion, drink more slowly, drink with food and alternate with water. The guideline on drinking and pregnancy, or planning a pregnancy, advises that the safest approach is not to drink alcohol at all[25].

Weekly consumption

Participants (aged 16 years and over) were asked preliminary questions to determine whether they drank alcohol at all. For those who reported that they drank, these were followed by further questions on how often during the past 12 months they had drunk each of six different types of alcoholic drink:

- normal strength beer, lager, stout, cider, and shandy
- strong beer, lager, stout, and cider
- spirits and liqueurs
- sherry and martini
- wine
- alcoholic soft drinks (alcopops)

From these questions, the average number of days per week the participant had drunk each type of drink was estimated. A follow-up question asked how much of each drink type they had usually drunk on each occasion. These data were converted into units of alcohol and multiplied by the amount they said they usually drank on any one day[26].

2.2.10 Chapter 10 – Obesity

Body Mass Index (BMI)

BMI is a widely accepted measure that allows for differences in weight due to height. It is defined as weight (kg)/square of height (m^2). This has been used as a measure of obesity in SHeS since its inception in 1995. BMI has some limitations and does not, for example, distinguish between mass due to body fat and mass due to muscular physique[27].

In 2024, standardised height and weight measurements were largely administered by an interviewer in-home. For the small proportion of interviews conducted by telephone, participants provided estimated measurements.

For adults, both interviewer-administered and self-reported measures have been used to calculate estimated BMI. The self-reported data has been adjusted using adjustment factors based on a study of data from the Health Survey for England (HSE) and Active Lives Surveys which

found that, on average, participants overestimated their height and underestimated their weight[28].

Based on their BMI (calculated from self-reported height and weight), adult participants were classified into the following groups based on the World Health Organisation (WHO) classification[29]:

BMI (kg/m^2)	Description
Less than 18.5	Underweight
18.5 to less than 25	Normal
25 to less than 30	Overweight, excluding obesity
30 to less than 40	Obesity, excluding morbid obesity
40+	Morbid obesity

The child BMI data included in the report and data tables is based only on those with interviewer administered measurements. Based on their BMI, child participants were classified into the following groups based on the World Health Organisation (WHO) classification.

Although the BMI calculation method is the same, there are no fixed BMI cut-off points defining overweight and obesity in children. Instead, overweight and obesity are defined using several other methods including age and sex specific BMI cut-off points or BMI percentile cut-offs based on reference populations.

Children can be classified into the following groups:

BMI (percentile)	Description
Above 2nd and below 85th	Within healthy range
At or below 2nd, at or above 85th	Outwith healthy range
At or above 85th, below 95th	At risk of overweight
At or above 95th	At risk of obesity

Waist Circumference

Waist circumference is a measure of deposition of abdominal fat. It is measured during the biological module. A raised waist circumference has been defined as more than 102cm in males and more than 88cm in females. In 2022, it was only possible to collect accurate information for waist circumference (WC) for a proportion of the version B sample interviews; therefore, some caution when making comparisons to 2022 due to the reduced sample size is advised.

2.3. A note about bases for males and females in the 2024 tables

From 2022, a question on participant's sex has been included in the survey self-completion questionnaires for adults in addition to the usual approach of the household reference person providing this information for everyone in the household as part of the main CAPI interview.

Where the respondent completed a self-completion questionnaire, their response to the sex question here took precedence over the CAPI data. However, in the self-completion questionnaire, the sex question included the option of 'prefer not to say'. In addition, respondents could choose not to answer the question. Any such cases where the sex data was missing or 'prefer not to say' had been selected are not included in the breakdowns for males and females in the data tables but are included in the 'All adults' totals. As such, base numbers for all adults may be greater than the sum of the male and female base numbers where these are reported separately.

For children, sex is provided by the household reference person. In cases where the sex question has not been answered the data is not included in the breakdowns for males and females in the data tables but are included in the 'All children' totals. As such, base numbers for all children may be greater than the sum of the males and females base numbers where these are reported separately.

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[3] HSE 2019 eating disorders

[4] Goldberg, D and Williams, PA (1988). *A User's Guide to the General Health Questionnaire*. Windsor: NFER-Nelson.

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[6] The nurse interview is conducted with one adult at a time, whereas the main interview can be conducted concurrently with up to four household members present. It was therefore easier to ensure that these questions could be answered in confidence. Nurses were also thought to be better placed to handle very sensitive topics such as these than interviewers conducting a general health survey who would have required additional specialist briefing. A leaflet with various help lines was handed to all participants in the nurse visit. From 2012, these questions have been included in the biological module of the survey, conducted by specially trained interviewers, and will be completed by participants using a self-completion computer assisted questionnaire.

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[8] See: https://warwick.ac.uk/services/innovations/wemwbs/faq/

[9] Diabetes and high blood pressure are not included in the definition of 'any CVD condition' as they are risk factors for CVD.

[10] See: https://www.asthmaandlung.org.uk/conditions/obstructive-sleep-apnoea-osa/what-obstructive-sleep-apnoea-osa

[11] See: https://doc.ukdataservice.ac.uk/doc/8956/mrdoc/pdf/8956_ndns_ndb_pre1_user_guide.pdf

[12] See https://www.gov.uk/government/publications/evaluation-of-changes-in-dietary-methodology-in-ndns-stage-3/evaluation-of-changes-in-dietary-methodology-in-the-ndns-stage-3

[13] See: National Cancer Institute Diet Assessment Primer, US Government (https://dietassessmentprimer.cancer.gov/profiles/recall/processing.html)

[14] See: National Cancer Institute Division of Cancer Control and Population Sciences, US Government, https://epi.grants.cancer.gov/diet/usualintakes/method.html)).

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[20] The questions on child physical activity included in SHeS since 1998 are based on the 1997 Health Survey for England (HSE) children's physical activity module.

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[25] See: https://www.drinkaware.co.uk/alcohol-facts/alcoholic-drinks-units/latest-uk-alcohol-unit-guidance/

[26] For participants aged 16 and 17, details on alcohol consumption were collected as part of a special smoking and drinking self-completion questionnaire. Some aged 18 and 19 also completed the self-completion if the interviewer felt it was appropriate. For all other adult participants, the information was collected as part of the face-to-face interview. The method of estimating consumption follows that originally developed for use in the General Household Survey and is also used in the Health Survey for England. For six types of alcoholic drink (normal strength beer/lager/cider/shandy, strong beer/lager/cider, spirits/liqueurs, fortified wines, wine, and alcoholic soft drinks), participants were asked about how often they had drunk each one in the past twelve months, and how much they had usually drunk on any one day. The amount given to the latter question was converted into units of alcohol, with a unit equal to half a pint of normal strength beer/lager/cider/alcoholic soft drink, a single measure of spirits, one glass of wine, or one small glass of fortified wine. A half pint of strong beer/lager/cider was equal to 1.5 units. The number of units was then multiplied by the frequency to give an estimate of weekly consumption of each type of drink. The frequency multipliers were:

Drinking frequency	Multiplying factor
Almost every day	7.0
5 or 6 times a week	5.5
3 or 4 times a week	3.5
Once or twice a week	1.5
Once or twice a month	0.375
One every couple months	0.115
Once or twice a year	0.029

The separate consumption figures for each type of drink were rounded to two decimal places and then added together to give an overall weekly consumption figure.

[27] Romero-Corral, A. et al (2008). Accuracy of body mass index in diagnosing obesity in the adult general population. International Journal of Obesity, 32: 959–966.

[28] See https://fingertips.phe.org.uk/documents/2.12%20Adult%20excess%20weight%20method%20details%202015-16.docx

[29] These cut-offs differ to those used in the previous surveys. In 1995 and 1998 the normal weight range was defined as 20-25 kg/m^2, in 2003 it was changed to 18.5-25 kg/m^2. From 2008 onwards the ranges are defined as set out below. This brings the definition in line with WHO recommendations. The impact of the change of definition is very marginal as very few people have a BMI measurement that is exactly 18.5, 25, 30 or 40 kg/m^2.

	2003	**2008 onwards**
Underweight	18.5 or under	Less than 18.5
Normal weight	Over 18.5 – 25	18.5 to less than 25
Overweight	Over 25 – 30	25 to less than 30
Obese	Over 30 – 40	30 to less than 40
Morbidly obese	Over 40	40+

Chapter 3 Quality Control of Saliva Analytes

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3.1. Introduction and key conclusions

This section describes the assay of analytes for the 2024 Scottish Health Survey (SHeS) biological samples and the quality control and quality assessment procedures that were carried out during the survey period. Details of procedures used in the collection, processing and transportation of the specimens are available on request from ScotCen Social Research.

The overall conclusion for the data provided in this chapter is that methods and equipment used for the measurement of saliva analytes produced internal quality control (IQC) within expected limits. The results of the analyses for the saliva cotinine and anabasine levels were acceptable for SHeS 2024.

3.2. Analysing laboratories

As in previous years, the saliva samples were initially sent to the Royal Victoria Infirmary (RVI) in Newcastle upon Tyne where they were checked for correct identification and stored prior to dispatch to ACM Global Laboratories in York. ACM conducted the analysis of salivary cotinine and anabasine.

3.3. Samples collected

A saliva sample was obtained from participants aged 16 and over. Saliva samples were collected for analysis of cotinine (a metabolite of nicotine that shows recent exposure to tobacco smoke) and anabasine (present in trace amounts in tobacco smoke, and can be used as an indicator of a person's exposure to tobacco smoke). A saliva collection tube was used for this purpose. Participants were also offered the option to provide the saliva sample using a dental roll that they could saturate with their saliva before it was placed in the tube. The saliva tube was then labelled and packaged ready for dispatch.

3.4. Methodology

Saliva samples received at the RVI were checked for correct identification, assigned a laboratory accession number, and stored at 4°C. Samples were checked for details and despatched fortnightly in polythene bags (20 samples per bag) by courier for overnight delivery to ACM Global Laboratories, where the cotinine and anabasine analysis was carried out. This laboratory specialises in accurate measurement of low levels of cotinine and anabasine and therefore takes special precautions to ensure no contamination by environmental tobacco smoke occurs. Additionally, control blanks are included in each analysis batch and assessed on a batch by batch basis Control blanks consist of blank

surrogate saliva, interferences in these are quantified and are deemed acceptable if less than 20% of the lower limit of quantitation (LLOQ).

The method of analysis used since the 2009 SHeS study is high performance liquid chromatography coupled to tandem mass spectrometry with multiple reaction monitoring (LC-MS/MS), replacing the gas chromatography nitrogen phosphorous detection (GC-NPD) method used in earlier SHeS studies[1]. Prior to 2024 (excluding 2020 and 2021 when no samples were taken), analysis was undertaken using a three-stage method. Samples were divided for analysis into batches of self-reported smokers and non-smokers and analysed either using a method with a high calibration range, 1.00 to 750 ng/mL for the self-reported smokers, or low calibration range 0.100 to 50.0 ng/mL for the non-smokers If any of the samples from self-reported smokers gave a result below 1.00 ng/mL on initial analysis they were repeated in a low range batch. Similarly, if any of the non-smoker samples gave a result above 50 ng/mL then they were repeated in a high range batch. Samples from self-reported smokers are analysed for anabasine within the range 0.100 – 10.0 ng/mL. Sample from non-smokers that produced a cotinine concentration >10.0 ng/mL were then also analysed for anabasine. The high range cotinine method and anabasine method had a validated dilution factor of 5 enabling quantitation up to 2500 ng/mL and 40.0 ng/mL for the respective analytes.

A new single-stage method was developed for analysis of the 2024 samples. This method quantifies cotinine between 0.100 – 500 ng/mL and anabasine between 0.100 – 15.0 ng/mL, samples with a concentration above these ranges were re-assayed with a dilution. A 10-fold dilution was successfully validated enabling cotinine quantitation up to 2000 ng/mL and anabasine up to 60.0 ng/mL. This approach suitably covered the ranges quantified by the three previous methods.

All methods were validated before use.

3.5. Internal quality control (IQA)

ACM ran 8 calibration standards in duplicate (16 in total) for each batch of samples that were analysed. 6 quality control (QC) samples, two each at a set concentration to represent low, medium and high levels for the calibration range being used, were also analysed with each analytical batch. For the results from any analytical batch to be acceptable, four out of the six QCs must have a bias of no greater than ±20.0% with at least one from each QC level being within these acceptance criteria, and 75% of the calibration standards must have a bias of no greater than ±20% except at the lower limit of quantification where the bias must be no greater than ±25%. For batches including diluted samples, a dilution QC at a concentration above the analytical range was included in

[1] Bernert JT, Jacob III P, Holiday DB et al. *Interlaboratory comparability of serum cotinine measurements at smoker and nonsmoker concentration levels: A round robin study.* Nicotine Tob Res. 2009;11:1458-66.

triplicate and diluted 10-fold prior to analysis, at least two of the three diluted QCs had to have a bias of no greater than ±20%.

Appendix A Participant Fieldwork Documents

1	Advance Letter – Version A (Core Non-Bio)
2	Advance Letter – Version B (Core Bio)
3	Advance Letter - Child Boost
4	IB Samples Consent Booklet
5	IB Info Leaflet on Measurements MRC
6	Info Leaflet Adults – Version A (Core Non-Bio)
7	Info Leaflet Adults – Version B (Core Bio)
8	Info Leaflet Children
9	Info Leaflet Parents for Child Boost
10	Interviewer Calling Card
11	Survey Leaflet
12	Self-Completion Cover Letter
13	ScotCen Self-completion reminder letter
14	Showcards
15	Thank You Letter Proxy
16	Thank You Letter
17	Thank You Email
18	Useful Contacts Leaflet
19	Useful Contacts Leaflet for Children
20	Language translations card
21	Intake24 Leaflet