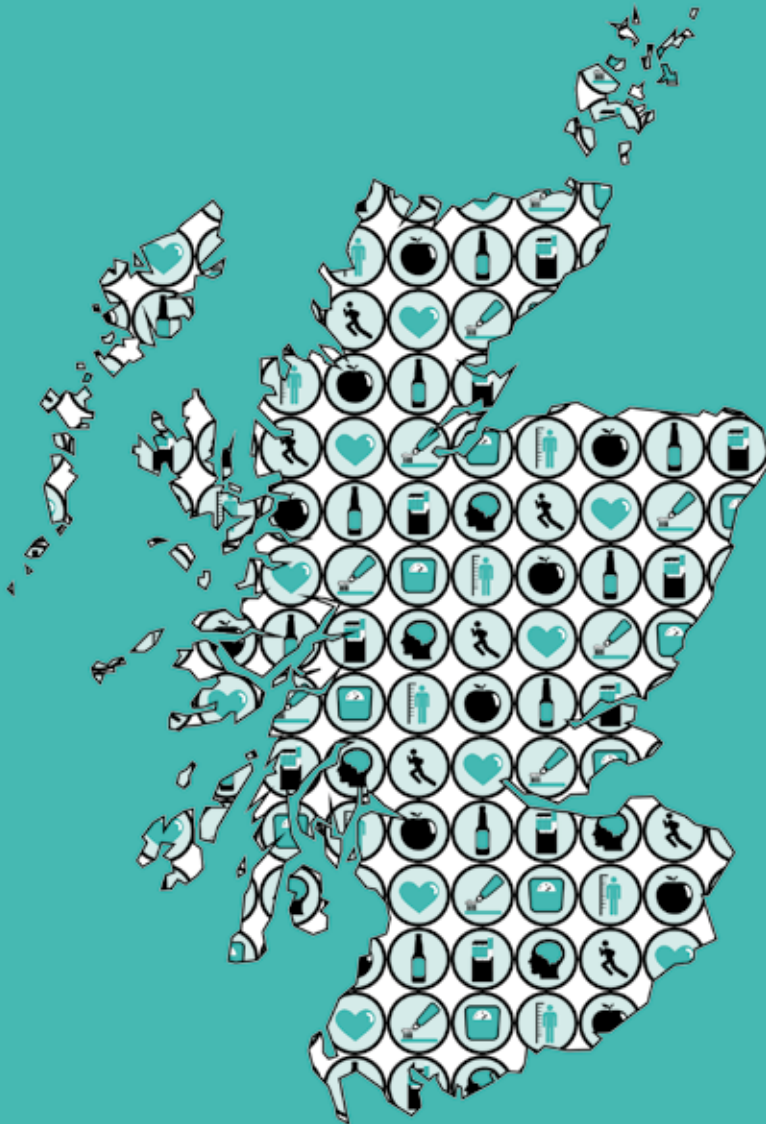




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The Scottish Health Survey

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A National Statistics Publication for Scotland

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Chapter 1

Methodology and Response

CHAPTER 1: METHODOLOGY AND RESPONSE

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1.1 INTRODUCTION

1.1.1 The Scottish Health Survey series

The Scottish Health Survey (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 2018-2021 surveys are being conducted by ScotGen Social Research in collaboration with the Office for National statistics (ONS), the Social and Public Health Sciences Unit (MRC/CSO SPHSU) at the University of Glasgow, the Centre for Population Health Sciences at the University of Edinburgh and the Public Health Nutrition Research Group at the University of Aberdeen¹.

1.1.2 Aims of the Scottish Health Survey

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 and the rest of Britain.
- 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 year, the survey consists of a set of core questions and measurements (height and weight measurements and, if applicable, a measure of blood pressure and waist circumference, and analysis of a saliva sample), plus modules of questions on specific health conditions.

As with the earlier surveys in the series, the principal focus of the 2018-2021 surveys remains cardiovascular disease (CVD) and related risk factors. CVD is one of the leading contributors to the global disease burden. Its main components are ischaemic heart disease (IHD) and stroke. Coronary heart disease (CHD) continues to be one of the leading causes of death in Scotland with 6,615 deaths in 2018 where it was the underlying cause².

The SHeS series now has trend data going back 24 years and providing this time series is an important function of the survey.

1.1.3 Key changes to the survey methodology in 2012

A number of changes to the survey methodology were introduced following the 2011 Scottish Government review of Scotland's major household surveys. The key changes to SHeS introduced in 2012 were:

- Sample of addresses drawn by the Scottish Government.
- Inclusion of a set of harmonised core questions asked across the three major Scottish Government household surveys³.
- Reduction in the achieved sample size.
- Discontinuation of a module of questions on Knowledge, Attitudes and Motivations (KAM) to health.
- Introduction of interviewer administered biological samples and measurements to replace the nurse interview.

These changes are discussed in greater detail in the Scottish Health Survey 2012: Volume 2 Technical Report⁴ and in the Scottish Health Survey Questionnaire Review Report 2012-2015⁵.

1.1.4 Key changes to the survey methodology in 2018

A number of changes were introduced in light of the 2017 Scottish Government review of the Scottish Surveys Core Questions⁶, and following the 2016 Scottish Government consultation on the Scottish Health Survey questionnaire content⁷ which was published in Spring 2017. The key changes implemented in 2018 for the 2018-2021 surveys include:

- Increased sample size allowing for analysis at Local Authority level by 2021.
- Removal of local police force, contraception and cosmetic procedures questions.
- Removal of urine sample from the biological module.
- A number of modules will no longer appear in the questionnaire each year, but will appear approximately every 2 years: gambling, problem drinking, dental health services, parental history, respiratory health, CPR training and use of health services.
- New questions introduced asked about satisfaction with key public services, Nicotine Replacement Therapy (NRT), asthma, type of diabetes and gender identity.

These changes are discussed in greater detail in section 1.3 below and also in the Scottish Health Survey Report of Questionnaire Changes from 2018⁸. The final questionnaire documentation for 2018 can be found in Appendix A of the Scottish Health Survey 2018 Technical Report⁹.

1.1.5 The 2019 survey

The 2019 Scottish Health Survey was designed to provide data at national level about the population living in private households in Scotland. The survey covered all ages.

The sample size for the 2019 survey increased by approximately 31% compared with the 2012-2017 surveys. ScotCen Social Research enlisted the Office for National Statistics (ONS) to assist with the interviewing for the duration of the 2018-2021 contract. As a result, ONS were allocated approximately 30% of the sampled addresses.

An initial sample of 11,691 addresses was drawn from the Postcode Address File (PAF) in 2019. These addresses comprised four sample types: main (core) sample with biological measures, main (core) sample without biological measures, child boost screening sample, and Health Board boost sample. Fife opted to boost the number of adults (16+) interviewed in their area in 2019.

Additional sample (398 addresses) was drawn and introduced in the second half of 2019 in order to boost the main (core) sample.

The 11,691 addresses were grouped into 569 interviewer assignments, with around 47 assignments being issued to interviewers each month between January and December 2019. The additional reserve sample addresses were grouped into 8 new assignments, with some of these addresses added to existing interview assignments.

The table overleaf shows the total number of addresses (mainstage and additional) drawn for each sample type and the people eligible for interview within each sample type.

Table 1: Number of addresses and people eligible for interview, 2019

Sample type	Number of addresses issued in 2019	Eligible for interview
Main (core non-bio)	4,307	Max of 10 adults (age 16+) and 2 children (age 0-15)
Main (core bio)	2,144	Max of 10 adults (age 16+) and 2 children (age 0-15) with only adults eligible to take part in the bio module
Child boost	5,425	Only households containing children aged 0-15 were eligible to participate (up to two children at these households were eligible to be interviewed)
Health Board boost	213	Adults only (age 16+) (Max of 10)
<i>Total</i>	<i>12,089</i>	

Data collection involved a main computer assisted interview (CAI), a paper self-completion questionnaire, height and weight measurements and, if applicable, adults also completed the biological module. The main core sample (including the additional sample) consisted of 6,451 addresses, 2,144 of which were allocated to the biological module sample. At the biological module addresses, all adults (16+) that participated in the main interview were eligible to take part in the biological module. Only interviewers that were specially trained in administering biological measures and samples were allocated to work on these addresses.

1.1.6 The 2019 SHeS annual report

The 2019 report consists of two volumes, published as a set under 'The Scottish Health Survey 2019'. Volume 1 presents results for adults and children on a variety of health topics. This report (Volume 2) provides methodological information and survey documentation. Both volumes are available on the Scottish Government's website along with a short summary report of the key findings from the 2019 survey (<https://www.gov.scot/collections/scottish-health-survey>) Supplementary web tables are also available on this website. These provide a large number of breakdowns by age group, deprivation, income and limiting long-term conditions. An interactive app is also available presenting key indicators for Scotland, NHS Boards and local authority areas.

1.1.7 Comparisons with previous surveys in the SHeS series

In the 2019 report comparisons are made with data collected earlier in the series (1998-2018 for children and 2003-2018 for adults). Having such an extensive trend period makes it possible to comment on

whether any changes in health behaviours identified between years were real or an instance of sample fluctuation.

In addition, this report includes analysis from a number of combined datasets: one for the years 2016 to 2019 combined, one for the years 2018 and 2019 combined to aid analysis of small subsamples of the population, and one for the years 2017 and 2019 for the analysis of 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. For example, questions on anxiety and depression are only asked as part of the biological sample and so result in a small sample size annually. Tables in the report indicate whether the figures presented are based on a single year's data or combined data across survey years.

1.1.8 Health Board 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. Analysis of the 2016 to 2019 data by NHS Health Board and by local authority for those authorities where the sample size is large enough is published at the same time as this report, and is available on the SHeS website (<https://www.gov.scot/collections/scottish-health-survey>) Health Boards with larger samples may be able to analyse data at their Health Board 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. Going forwards, 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 to 2015, 2013 to 2016, 2014 to 2017, 2015 to 2018 or 2016 to 2019.

1.1.9 Local authority level analysis

From 2018 onwards, the SHeS sample has been designed to be representative of adults at local authority level following four years of data collection. Thus, the data will be representative of adults at local authority level from 2021. Until then, the data remains representative at Health Board level as discussed above. The exception to this are those local authorities where the sample size is large enough before four years of data have been collected.

1.1.10 Access to SHeS data

Data from the 2019 survey will be deposited at the UK Data Service along with a combined 2016-2019 dataset, a combined 2017/2019 dataset and a combined 2018/2019 dataset. Datasets from earlier years in the series are also deposited here (www.ukdataservice.ac.uk).

1.2 SAMPLE DESIGN

1.2.1 Requirements

The sample specification for the 2019 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) as part of a survey efficiency project and to allow the samples of the three surveys to be pooled for further analysis¹⁰.

There were three elements to the SHeS sample in 2019:

- 1) Main adult sample - to allow annual reporting of Scotland level results and results at Health Board level at the end of four-year cycles (e.g. 2016-2019). This required an annual interview target of 5,112 adults for Scotland as a whole and a minimum of 125 for each local authority. There was an additional requirement for a minimum of 1,000 adults to complete each biological measure each year.
- 2) Child sample boost – 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.
- 3) Health Board boosts – in 2019, Fife Health Board commissioned a boost to increase the number of adult interviews in their Board area. Fife Health Board specified a target of 185 additional interviews.

1.2.2 Sample design and assumptions

For all three elements a two-stage clustered sample design with intermediate geographies randomly selected at the first stage and address points at the second stage, was used. 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. This means that over four years of fieldwork all IGs are included in the sample and the combined 2016-2019 sample will be un-clustered. 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 sample size for Scotland was 5,112 adults with a minimum local authority sample size of 125 adults. These sample sizes were the minimum required to allow effective reporting of Scotland-level results annually and Health Board results at the end of the four-year cycle. An iterative approach was taken to efficiently allocate the sample across all Health Boards. 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 2.

Table 2: SHeS target annual adult interviews, 2019, 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 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. Based on response data from the surveys between 2012 and 2015, it was estimated that for Greater Glasgow and Clyde there would be 1.45 interviews per co-operating household, with 1.5 interviews in all other Health Boards.
- 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 2019 were then based on the weighted average of responses for 2015, 2016 and 2017.

- 4) The final step was to estimate the level of ineligible addresses. 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 5 shows the number of selected addresses for the main sample in 2019.

1.2.4 Child boost sample

For the 2019 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 process for calculating the number of addresses to select for the child boost sample was as follows:

- 1) The child boost sample 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. The following table shows the target sample sizes for the main sample and child boost sample by Health Board.

Table 3: Target annual child interviews, 2019, by Health Board

	Expected child interviews from main sample	Child interviews from boost	Total 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

- 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) To estimate the proportion of child-less households, data from child boost samples between 2012 and 2015 was used. As there was little variation across different areas a Scotland level estimate of households without children (80%) was used.
- 4) Analysis of survey response to the child boost samples in the 2008 and 2009 surveys found that the response rate was consistently higher for the child boost than the main sample. Therefore, for each Local Authority area, the estimated response rates for the child boost sample were set at 6% higher than the main sample response rate.
- 5) 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 selected for the child boost sample are shown in Table 5.

1.2.5 Health Board Boost samples

Each year individual Health Boards are given the opportunity to fund a boost sample to enable them to boost the number of adult interviews in their Board area. For the 2019 survey, Fife opted to boost the main sample in their areas. The following table shows the target sample size for each of the boosts.

Table 4: Target sample for Health Board Boosts in 2019

Health Board	Target interviews for boost
Fife	185

As the main sample was selected before boost areas were confirmed, boost samples were supplementary to the main sample. Fife Health Board requested that the combined main sample and boost sample was equally distributed across its three Community Health Partnership areas. This required an extra level of stratification for Fife before the process above could be followed. For the boost samples, and for samples drawn to addresses shortfalls over the four-year period, the same active PSUs as the main sample were used.

Table 5: Selected addresses by strata in 2019

Sample strata	Main sample (inc. additional)	Health Board boost	Child boost	Total sample
Aberdeen City	222	0	217	439
Aberdeenshire	200	0	257	457
Angus	150	0	102	252
Argyll & Bute	185	0	85	270
Clackmannanshire	160	0	58	218
Dumfries & Galloway	168	0	138	306
Dundee City	172	0	139	311
East Ayrshire	124	0	109	233
East Dunbartonshire	156	0	101	257
East Lothian	158	0	121	279
East Renfrewshire	171	0	110	281
Edinburgh, City of	492	0	507	999
Eilean Siar	146	0	0	146
Falkirk	178	0	168	346
Fife	312	213	372	897
Glasgow City	560	0	602	1,162
Highland	206	0	240	446
Inverclyde	175	0	82	257
Midlothian	156	0	106	262
Moray	146	0	87	233
North Ayrshire	134	0	128	262
North Lanarkshire	324	0	398	722
Orkney Islands	129	0	0	129
Perth & Kinross	166	0	141	307
Renfrewshire	212	0	195	407
Scottish Borders	146	0	112	258
Shetland Islands	143	0	0	143
South Ayrshire	154	0	96	250
South Lanarkshire	283	0	335	618
Stirling	154	0	87	241
West Dunbartonshire	199	0	106	305
West Lothian	170	0	226	396
Total	6,451	213	5,425	12,089

1.2.6 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 2019 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 specified in Section 1.2 was implemented in three stages:

1. All primary sampling units (data zones on the islands, intermediate geographies elsewhere) were randomly allocated to one of the four years of fieldwork. This meant that the sample was drawn from one quarter of PSUs each year and ensured that over four years (2016 to 2019) of fieldwork all addresses had a non-zero probability of selection. One quarter of target adult sample was required to complete the biological module. To make fieldwork more efficient, rather than randomly allocating addresses from the entire survey to the module, each year PSUs were allocated to the biological module and all selected addresses within those PSUs were eligible for the biological interview. 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 PSUs (33% in 2019) were allocated to the biological module.

Table 6: Primary sampling units selected in 2019

Health Board	PSUs in 2019 Sample	Total PSUs
Ayrshire and Arran	23	92
Borders	8	29
Dumfries and Galloway	9	35
Fife	26	103
Forth Valley	19	74
Grampian	32	128
Greater Glasgow and Clyde	64	273
Highland	19	76
Lanarkshire	39	137
Lothian	44	177
Orkney	7	27
Shetland	8	30
Tayside	23	90
Western Isles	9	36
Total	330	1,307

2. The required numbers of addresses for the main and child boost samples were combined to give an overall total of addresses to sample for each stratum (local authorities plus Lanarkshire's split). The overall 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, SIMD rank and postcode.
3. Once the overall sample was selected, each address was randomly allocated to the main or the child boost sample.

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 the 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 where 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.

1.2.8 Selecting individuals within households

For both the main and Health Board boost samples all adults aged 16 and over in responding households were selected 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.

1.3 TOPIC COVERAGE

1.3.1 Introduction

Topics covered in the 2018 to 2021 surveys were agreed following a consultation carried out in 2017¹¹. Many of the topics and questions included in earlier years of the survey were included again to continue the time series. The 2019 survey included the same rotating topics as the 2017 and 2015 surveys (see sections 1.3.3 and 1.3.4). As with previous years, the 2019 survey had a focus on cardiovascular disease (CVD) and its associated risk factors.

The outcome of a public consultation about the content of the survey from 2018 is available from <http://www.gov.scot/Resource/0053/00537370.pdf>. This report outlines the key changes that have been made or will be made to the 2018-2021 surveys.

1.3.2 Documentation

Copies of all the documents used in data collection are included in Appendix A. Full copies of the questionnaire documentation used in the main interview and biological module are also included in Appendix A. Protocols for taking measurements (height, weight, waist circumference and blood pressure) and collecting biological samples (saliva) are available on request from ScotGen Social Research. 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. Table 7 below summarises the content of the individual level interviews for all participants. 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.

Table 7: Content of the 2019 Interview

CORE SAMPLE – Main interview outline	
Version A	Version B
Household questionnaire including household composition	
General health (0+) including use of CVD services (0+)	
General CVD (16+)	
Asthma (0+)	
Physical activity adults (16+) and children (2-15)	
Sedentary activity adults (16+) and children (2-15)	
Eating habits children (2-15)	
Fruit and veg consumption (2+)	
Vitamins and supplements (0+)	
Smoking and Drinking (16+) [16-19 in a self-completion]	
Passive smoking (0+)	
Dental health (16+)	
Dental services (16+)	
CPR training (16+)	
Discrimination and harassment (16+)	
Stress at work (16+)	
Economic activity (16+)	
Education (16+)	
Ethnic background, religion and country of birth (0+)	
Parental history (16+)	
Family health (16+)	
Self-completions (13+ & parents of 4-12 yr olds)	
Height (2+) and Weight (2+)	
Data linkage & follow-up research consents (0+)	
-	Biological module (16+)

Version A households accounted for 67% of the main (core) sample. At these households the questionnaire included the core questions and the questions included in the Version A rotating module. In 2019, the topics included in the Version A rotating module were: dental services, discrimination and harassment, stress at work, parental history and family health.

Version B households accounted for the remaining 33% of the main (core) sample. At these addresses, participants were only asked the core questions during the main interview, with participating adults (aged 16+) also eligible to complete the biological measures module.

A significant number of changes were made to the questionnaire content in advance of the 2018 survey based on the consultation that took place in Autumn 2016 and was published in Spring 2017¹². These changes are discussed below and in the Scottish Health Survey: Report of Questionnaire Changes from 2018¹³.

In 2018, a number of modules were made less frequent and will no longer be asked on an annual basis in the main interview but will be asked biennially instead. These questions include those on family health and parental history, CPR training and use of health services.

There were also a few new questions added to the main interview in 2018. These include a question for those who have used a form of Nicotine Replacement Therapy (NRT) to aid smoking cessation, two questions concerning asthma; firstly, school absence due to asthma and secondly, treatment received for asthma, a question establishing whether respondents with diabetes have Type 1 or Type 2, and finally questions on respondents' satisfaction with local services (for example local health services, local schools, refuse collection, public transport, council libraries, etc.).

A number of small amendments were also made to survey questions in 2018 (for example, updates to education qualifications). For full details of these please see the Scottish Health Survey: Report of Questionnaire Changes from 2018⁸.

Significant changes were made to the child physical activity questions in 2017. These changes were designed to measure the activity guidelines of being physically active for at least 60 minutes per day for each day of the week (children aged 5 and over). This involved amending the questions. Previously, children were asked for the *number* of days on which they did physical activity and for the *average* amount of time this was for overall. The revised questions ask *which* days they did physical activity and the amount of time spent on *each* of those days (more information is provided in the Physical Activity chapter of the Main Report). These questions remained as they were for 2018.

Analysis of the 2017 data showed that it was not possible to derive a variable which would allow comparison between 2017 data (using the revised questions) and previous years of data (using the previous questions). For this reason, there is no trend analysis for children's physical activity in 2017 or 2018. The question module used prior to 2017 was reinstated in the 2019 survey and is reported in the Scottish Health Survey 2019: Volume 1 report.

The full question wording of all the questions used in 2019 can be found in Appendix A.

1.3.4 Self-completion questionnaire

Participants aged 13 and over and parents of participants aged between 4 and 12 were asked to fill in a self-completion booklet during the interview. In all, four different booklets were administered. The version completed was dependent 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). Interviewers also had the option of using this young adults booklet for those aged 18-19 if they felt that it would be more appropriate for them to answer the questions in this format rather than face to face (e.g. they might be more likely to give more honest answers than in the face to face interview when other household members including parents may be present).

For 2018, a number of questions were removed from the self-completion booklet and will occur less frequently from 2018 onwards. Questions on contraception and cosmetic procedures were removed indefinitely from both the young adult and adult self-completion. Questions on problem drinking and gambling will be asked less frequently, with problem drinking questions asked biennially and gambling questions asked every few years.

In 2018, a new question was added to the self-completion booklet. This question concerned gender identity and allowed for the expression of non-binary gender identities. This question was added to both the young adult and adult self-completion booklets. For the wording of the questions in full, see the adult or young adult self-completion booklet listed in Appendix A.

Paper questionnaire booklets contained the following topics in the 2019 survey:

Adults	General Health Questionnaire (GHQ12), Warwick Edinburgh Mental Well-being scale (WEMWBS), food insecurity, problem drinking (AUDIT), adverse childhood experiences (ACEs), social capital, loneliness, sexual orientation, and gender identity.
Young adults	Smoking (including use of e-cigarettes), drinking, problem drinking (AUDIT), GHQ12, WEMWBS, food insecurity, adverse childhood experiences (ACEs), social capital, loneliness, sexual orientation and gender identity.
13-15 year olds	GHQ12 and WEMWBS.

Parents of 4-12 year olds Strengths and Difficulties questionnaire (SDQ) (designed to detect behavioural, emotional and relationship difficulties in children).

1.3.5 Height and weight

Interviewers measured the height and weight of all participants aged 2 and over, with their consent. Protocols for taking height and weight measures are available on request from ScotCen Social Research.

1.3.6 Biological module

As highlighted previously, a sub-sample (around 33%) of main core 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 previous years (1995 to 2011).

Since the same interviewer administered the main interview and the biological module, the latter could be completed either immediately after the main interview or on a separate occasion.

From 2018, urine is no longer collected as part of the biological module. The rest of the biological remained the same as previous years.

As part of the biological module, participants were asked whether they used any medicines, pills, syrups, ointments, puffers or injections prescribed to them by a doctor or nurse. If participants had answered yes to questions in the main interview about taking medication for high blood pressure, a heart condition or stroke then they would be asked to give the names of the drugs to the interviewer. This information is used to interpret blood pressure readings. Following these questions, interviewers took blood pressure and waist circumference measurements from participants taking part in the biological module.

Participants were also asked about current smoking behaviours and whether they currently used Nicotine Replacement Therapies (NRT). This information is used to interpret the analysis of salivary cotinine. Written agreement was sought to take samples of saliva for the analysis of cotinine (a derivative of nicotine and indicative of passive smoking).

Finally, participants were asked a set of questions about depression, anxiety, suicide attempts and self-harm (taken from the Adult Psychiatric Morbidity Survey) in computer assisted self-interviewing (CASI) format whereby the participant answered the questions themselves using the interviewer's laptop.

See Table 8 for a complete outline of the biological module.

Table 8: Content of the 2019 Biological Module

Outline of the Biological Module (age 16+)
Prescribed medicines (if has heart condition, high blood pressure or has had stroke)
Blood pressure
Waist measurement
Smoking status and use of nicotine replacement therapy
Saliva sample
Depression, anxiety, suicide attempts and self-harm

1.4 FIELDWORK PROCEDURES

1.4.1 Advance letters

Each sampled address was sent an advance letter that introduced the survey and 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 2019; one for the core version A and Health Board boost addresses, one for core version B addresses (with the biological module), and one for child boost addresses. There was a version of each of these letters for each organisation conducting interviews (ScotCen Social Research and ONS). 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

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).

The interviewer then attempted to make contact with each household. In the main sample they 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. For Health Board boost sample households, interviewers attempted to interview a maximum of ten adults. Children were not eligible for interview at Health Board boost addresses.

1.4.3 Collecting data

Interviewers used computer assisted interviewing (CAI).

At each co-operating eligible household (across all sample types), the interviewer first completed a household questionnaire, with information collected from the household reference person¹⁴ 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 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 children in a household. In order to reduce the amount of time spent in the home, interviews could be carried out concurrently, with the program allowing up to four participants to be interviewed in a single session.

Height and weight measurements were usually obtained towards the end of the interview, although could be conducted at any time during the last half of the interview.

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 Privacy Notice on the Scottish Government's website). Adults in households eligible for the biological module were given a longer version of this leaflet, providing information about the measurements and samples being taken.

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. Adults at Health Board boost addresses received an amended version of the adult leaflet. Copies of all the participant leaflets used in the survey are included in Appendix A.

1.4.4 Introducing the biological module

Only a sub-sample of adults in the main sample were selected to take part in the biological module. At the end of the individual interview, adult participants in Version B addresses were given a measurement record card which included additional information about the measurements and samples collected in the biological module. Wherever possible, interviewers would complete the module directly after the main interview to minimise attrition. If this was not possible then the interviewer would arrange to go back at a convenient time to complete the module and take the measurements and samples. The module included the measurements described in Section 1.3.6. Written consent was

obtained from participants before the saliva sample was taken. The consent statement is included in Appendix A.

1.4.5 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 in the home 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, but it also ensured that the child could contribute information where appropriate (for example, about physical activity done during school time).

1.4.6 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 the participant's blood pressure was mildly raised, they were instructed to advise the participant to contact their GP within 2 months. If the participant's blood pressure was moderately raised, they were instructed to advise the participant to contact their GP within 2 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.

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. They were also trained and accredited in taking height and weight measurements. Interviewers were accompanied by an interviewer supervisor during the early stages of their work to ensure that interviews were administered correctly, and protocols were

followed. Interviewers are supervised in field every year following a successful launch.

Interviewers that had worked on SHeS in previous years attended a refresher briefing ahead of the launch of the new survey year. This refresher briefing informed participants of changes to survey content and procedures for 2019. Interviewers were also re-accredited to take height and weight measurements by the research team.

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.

Training to administer the biological module took place over two days. At the end of the training session interviewers were accredited in administering each of the measurements and samples and were only able to work on the module if they passed this accreditation process.

Interviewers were accompanied by a nurse supervisor (with previous experience working on the survey) on their initial biological module visit. They are also supervised in the field annually by an experienced survey nurse to ensure they are administering the measurements and samples in line with SHeS protocols. Interviewers are reaccredited annually for the biological module by the research team and survey nurses at the refresher briefings.

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

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.

Recalls 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 recall 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 2019 survey 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, 2001¹⁵) 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.

1.6.2 Household response

Table 1.1 shows a detailed breakdown of the SHeS response for all sampled addresses in 2019. 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 was interviewed. The table shows that for the combined main and Health Board boost sample, 55.6% of eligible households were classed as responding, and with all individual interviews complete at 44.5% of households.

For the child boost sample 75.5% of households were ineligible as they did not contain any children under the age of 16. For eligible households 67.4% were classed as responding, with all individual interviews complete at 66.9% of households.

Table 1.2 shows that across Health Boards, the percentage of households where at least one eligible person was interviewed ranged from 50% (Greater Glasgow and Clyde) to 66% (Borders and Shetland Islands). Fully cooperating households were those where all eligible individuals were interviewed, all height and weight measured and, if eligible, completed the biological module. This varied between 30% in Lanarkshire to 46% in Grampian. 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 that across Local Authorities, the percentage of households where at least one eligible person was interviewed ranged from 43% (West Dunbartonshire) to 68% (Clackmannanshire). Fully cooperating households varied between 27% (Perth and Kinross and Dunbartonshire) and 50% (Aberdeen City).

Table 1.3 shows the household response rate for eligible addresses in the child boost sample by NHS board. This varied from 54% (Borders and Tayside) to 81% (Grampian and Dumfries and Galloway). Note that some of the bases for child boost response rates were low (for example 22 eligible households in the Dumfries & Galloway).

Table 1.3b shows the household response rate for eligible addresses in the child boost sample by Local Authority. This varied from 42% (Angus) to 100% (South Ayrshire). Note that the bases for child boost response rates were particularly low in a number of areas (for example 12 eligible households in Angus, Moray and South Ayrshire).

Tables 1.1-1.3b

1.6.3 Individual response for adults

Overall there were 4,903 adult responses to SHeS 2019 with 1,281 responses to the biological module, detailed in Table 1.4.

In order to calculate the adult response rate, since all adults in households were eligible for interview, the number of adults in non-responding households had to be estimated to calculate the total number of adults in all households. This was undertaken by calculating the average number of men and women per household for responding households and non-responding households (where information on the composition is known) and applying this to the households where nothing is known. The total estimated number of adults from sampled addresses eligible for interview is referred to as the “set” sample. For 2019, the set sample for men was 4,698 and for women was 5,324.

Table 1.4 shows the adult response rate broken down by gender. The adult response rate was 46% for men, 52% for women and 49% overall. In responding households (those households where at least one interview was completed) additional information on respondents allowed the consideration of response to stages of the survey by gender and age group. This is shown in Tables 1.5 and 1.6. For both men and women, the younger age groups were found to have a lower response

rate (60% for men aged 16 to 24 and 69% for women aged 16 to 24) than older age groups (92% or higher response rate for men over 65 and 96% or higher for women over 65).

As part of the biological module, respondents were asked to have their waist and blood pressure measured and to provide a saliva sample. Almost all individuals completing the biological module interview allowed the waist and blood pressure measurements to be taken and provided a saliva sample. Of those eligible for the biological module (including non-responders to the main interview in participating households), 36% of men participated in the module (34% provided waist measurements, 34% blood pressure measurements and 33% a saliva sample), as did 42% of women (39% with waist measurements, 39% blood pressure and 38% saliva) (Table 1.4).

Table 1.9 shows that men are under-represented in the SHeS sample compared to NRS population estimates as they made up 44% of the sample but 48% of the population. Younger age groups were also under-represented in the SHeS sample when compared to NRS population estimates. In particular, men and women under 35 were under-represented. Conversely, men and women over 55 were over-represented in the sample.

Tables 1.4-1.6, Table 1.9

1.6.4 Individual response for children (0-15)

Interviews were undertaken with 1,978 children aged 0 to 15, with 942 interviews taking place as part of the main sample and 1,036 as part of the child boost.

As was the case with the adult sample, in order to calculate the response rate for children, the number of eligible children in selected households (the “set” sample) had to be estimated. This was done by assuming that, for both the main sample and the child boost sample, the non-responding and responding households contained the same average number of children.

Table 1.7 shows that overall response rates for the main sample and child boost sample were similar for boys and girls (50% and 52% respectively in the main sample, and 68% and 66% respectively for the child boost sample).

Child response rates have also been calculated for children in responding households. Table 1.8 shows that response rates were highest among children aged under 11 years (95-99% for boys and 98-100% for girls), however, the response rate for children aged 11 to 15 was slightly lower at 90% for boys and 91% for girls.

Tables 1.7-1.8

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 Statistics¹⁶.

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

1.7.2 Main adult weights

The main adult weight is applicable for all adults interviewed as part of the main sample and the Health Board boosts. 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 with the Health Board boost there were 36 strata overall (one for each local authority, an extra stratum for the Lanarkshires and two extra strata in Fife as a result of the boost). The address selection weight for each stratum was calculated as:

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

2) Dwelling unit selection weights (w2)

As stated in Section 1.2.7, the 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 were some cases where the MOI was incorrect. The following correction was applied where this was the case:

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

With w2 trimmed to a maximum of 3.

3) Household selection weights (w3)

Similarly, within a very small number of dwelling units, fieldworkers found multiple households, of which only one was selected for

participation in the SHeS. The following correction was applied for multiple households:

w_3 = Number of households within dwelling unit

With w_3 trimmed to a maximum of 3.

4) Calibrated household weights (w_4)

The three selection weights were combined ($w_1 * w_2 * w_3$) 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 SIMD15 areas. The population totals that were used were the National Records of Scotland's (NRS) mid-2018 estimates for private households.

5) Adult non-response weights (w_5)

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

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
- Access to a car
- Frequency of eating meals together
- Urban/rural classification

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:

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

For households of only one adult the non-response weight was one.

6) Individual calibration and final adult weight (int18wt)

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 2018 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.

Table 9: 2018 Mid-year population estimates for private households in Scotland by Health Board

Health Board	Adults	Children	Total
Ayrshire & Arran	304,304	61,399	365,703
Borders	95,143	18,994	114,137
Dumfries & Galloway	123,603	23,359	146,962
Fife	299,690	64,327	364,017
Forth Valley	246,835	52,443	299,278
Grampian	471,887	99,721	571,608
Greater Glasgow & Clyde	954,011	196,671	1,150,682
Highland	262,603	52,027	314,630
Lanarkshire	535,640	118,131	653,771
Lothian	727,282	150,252	877,534
Orkney	18,456	3,499	21,955
Shetland	18,670	4,159	22,829
Tayside	337,741	67,260	405,001
Western Isles	22,161	4,317	26,478
Total	4,418,026	916,559	5,334,585

Total figures might not be exact due to rounding

Table 10: 2018 Mid-year population estimates for private households in Scotland by SIMD15 indicator

SIMD15	Total population
15% most deprived data zones	778,005
All other data zones	4,556,580
Total	5,334,585

Total figures might not be exact due to rounding

Table 11: 2018 Mid-year population estimates for private households in Scotland by age group

Age group	Male	Female	Total
0-4	142,039	133,936	275,975
5-9	153,263	146,862	300,125
10-15	174,050	166,409	340,459
16-24	276,165	266,233	542,398
25-34	358,544	370,751	729,295
35-44	321,490	337,731	659,221
45-54	373,345	401,051	774,396
55-64	348,977	370,116	719,093
65-74	270,877	295,852	566,729
75+	178,876	248,018	426,894
Total	2,597,626	2,736,959	5,334,585

1.7.3 Biological module weights

A similar process was applied to derive the weights for the biological module. This is outlined below.

1) Address selection weight (bw1)

New address selection weights were calculated using the same process as described for w1 but with the Health Board boost addresses excluded.

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 breakdown, 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:

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

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 the adults that responded to the main section of the interview responded to the biological module. Using the information collected for the respondent in the main interview and household interview the likelihood of responding to the biological module 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
- Frequency of eating meals together
- Self-assessed general health
- Gardening/DIY/building work in past 4 weeks
- Any physical activity in past 4 weeks
- Any housework in past 4 weeks
- Economic activity (working/retired/sick)
- Marital status
- Tenure
- Urban/rural classification
- Access to a car
- Located within SIMD15 area
- Long-term illness or disability
- Highest qualification held
- Ever had high blood pressure
- Current smoker
- Currently drink alcohol
- Number of natural teeth

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

- Health Board
- Age/sex
- Number of adults in the household
- Located within SIMD15 area
- Any housework in past 4 weeks
- Current smoker
- Economic activity (working/retired/sick)
- Employment status of Household reference person

The final logistic regression model was then used to estimate the probability of response for all individuals that did respond to the biological module. The biological module non-response weight (bw6) was then calculated as the reciprocal of this probability:

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

7) Final calibration for biological module (bio18_wt)

The household (bw4), biological sample correction (bw5), 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 2018 mid-year population estimates for private households for Health Boards, age/sex distribution at Scotland level. However, due to the low sample size for the module a number of the categories had to be collapsed. In terms of Health Boards, all areas except for Grampian, Greater Glasgow and Clyde, Highland, and Lanarkshire were grouped together. For the age groups, the lowest two age groups were combined as were the highest two age groups.

1.7.4 Non-biological module weights (Version A)

A weight titled "Version A" was calculated for the individual respondents in the main sample that were not selected for the biological module. This consisted of the main sample without the Health Board boost sample. 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 (verA1618wt)

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 2018 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:

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

For households with two or fewer children $cw4=1$.

- 4) Calibration for child interview weight (cint18wt)

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 2018 mid-year population estimates for private households for Health Boards, age/sex distribution at Scotland level.

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 core sample, these weights were only created for children at core sample addresses. They were created in a similar fashion to that described for the whole of the overall child weights.

1.7.6 Combined weights

A number of different combinations of annual sweeps have been produced to allow the analysis of combined datasets.

The weights provided for combined years of data are:

Weight name	Purpose of combined weight
int16171819wt	For analysis of 2016, 2017, 2018 and 2019 combined adult data
cint16171819wt	For analysis of 2016, 2017, 2018 and 2019 combined child data
cmint16171819wt	For analysis of 2016, 2017, 2018 and 2019 combined child data core sample only (for within household analysis)
bio16171819wt	For analysis of 2016, 2017, 2018 and 2019 combined biological data (not urine)
int1819wt	For analysis of 2018 and 2019 combined adult data
int1719wt	For analysis of 2017 and 2019 combined adult data
cint1819wt	For analysis of 2018 and 2019 combined child data
cint1719wt	For analysis of 2017 and 2019 combined child data
cmint1719wt	For analysis of 2017 and 2019 combined child data core sample only (for within household analysis)
bio1819wt	For analysis of 2018 and 2019 combined biological data (not urine)
vera1719wt	For analysis of 2017 and 2019 combined version A adult module data
cvera1719wt	For analysis of 2017 and 2019 combined version A child module data

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 2018 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 2019 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, 2019 and was interviewed on October 1, 2019 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.

Age standardisation

Some of the adult data included in the 2019 report have been age-standardised to allow comparisons between groups after adjusting for the effects of any differences in their age distributions. If data reported have been age-standardised this is highlighted in the title to the table or chart. 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.

It should be noted that all analyses in the report are presented separately for men and women and on most occasions data for all adults are also presented. All age standardisation has been undertaken separately within each sex, expressing male data to the overall male population and female data to the overall female population. When comparing data for the two sexes, it should be remembered that no age standardisation has been introduced to remove the effects of the sexes' different age distributions.

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-year 2018 household population estimates for Scotland. 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 :

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:

where $q_i = 1 - p_i$.

1.8.2 Standard analysis breakdowns

Scottish Index of Multiple Deprivation (SIMD)

The analysis of 2019 data was based on the most recent version of the Scottish Index of Multiple Deprivation (SIMD), published in 2020¹⁷. 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 and true standard errors

SHeS 2019 used a 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 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 2019 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 shown in Tables 1.10 to 1.17 for selected survey estimates presented in the main report.

Tables 1.10 - 1.17

References and notes

- 1 The 1995 and 1998 surveys were carried out by the Joint Health Surveys Unit of the National Centre for Social Research (NatCen Social Research) and the Department of Epidemiology and Public Health University College London Medical School (UCL). The MRC Social and Public Health Sciences Unit at the University of Glasgow (MRC SPHSU) joined the consortium in 2003. ScotCen Social Research (a branch of NatCen Social Research), UCL and MRC SPHSU conducted the 2008-2011 surveys after a decision was made to carry out the survey annually.
- 2 Information Services Division (2020). Scottish Heart Disease Statistics. Available from: <https://beta.isdscotland.org/find-publications-and-data/conditions-and-diseases/heart-disease-and-blood-vessels/heart-disease-statistics/>
- 3 See: <https://www2.gov.scot/Topics/Statistics/About/Surveys/SSCQ/SSCQ2014>
- 4 Corbett, J., Davidson, M., Dowling, S., Hinchliffe S. and Rutherford, L. (2013). Chapter 1: Methodology and response. In Rutherford, L., Hinchliffe, S. and Sharp, C. (eds.) Scottish Health Survey 2012 – Volume 2: Technical Report. Edinburgh: Scottish Government. <https://www.gov.scot/publications/scottish-health-survey-2012-volume-2-technical-report/>
- 5 Scottish Health Survey Questionnaire Review Report 2012-2015. Available from <https://www2.gov.scot/Topics/Statistics/Browse/Health/scottish-health-survey/questionnairereviewreport>
- 6 Scottish Surveys Core Questions 2018-2021 Questionnaire Review: Consultation Outcome Report (2017). Available from <https://www.gov.scot/publications/scottish-surveys-core-questions-2017/>
- 7 Questionnaire Content of the Scottish Health Survey (2017): Consultation Analysis Report. Available from <https://www.gov.scot/publications/questionnaire-content-scottish-health-survey-consultation-analysis-report-april-2017/>
- 8 Scottish Health Survey: Report of Questionnaire Changes from 2018. Available from: <https://www.gov.scot/publications/scottish-health-survey-report-questionnaire-changes-2018/>.
- 9 Dean, L and McLean, J (eds). The Scottish Health Survey 2018 edition: Volume 2: technical report. Edinburgh: Scottish Government Available from: <https://www.gov.scot/publications/scottish-health-survey-2018-volume-2-technical-report/>
- 10 Further information on the sample designs and the methodology used is available here: <https://www2.gov.scot/Topics/Statistics/About/SurveyDesigns201215>
- 11 Further information on the 2011 Scottish Health Survey questionnaire review for the 2012-2015 surveys can be found on the Scottish Government SHeS website: <https://www2.gov.scot/Topics/Statistics/Browse/Health/scottish-health-survey/questionnairereviewreport>
- 12 Questionnaire Content of the Scottish Health Survey (2017): Consultation Analysis Report. Available from <https://consult.gov.scot/population-health/scottish-health-survey/>
- 13 Further information on the 2017 Scottish Health Survey questionnaire review for the 2018-2021 survey can be found on the Scottish Government website: <http://www.gov.scot/Resource/0053/00537370.pdf>
- 14 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.
- 15 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.

- ¹⁶ A report on the development of the weighting procedures is available here:
<https://www2.gov.scot/Topics/Statistics/About/Surveys/WeightingProjectReport>
- ¹⁷ Where time series SIMD data are presented, the appropriate version of the SIMD is used for each year. More details are provided within the main report and at
<https://www.gov.scot/publications/?term=SIMD&cat=filter&publicationTypes=statistics&page=1>

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The tables can be found on the technical report page under supporting files:
<https://www.gov.scot/publications/scottish-health-survey-2019-volume-2-technical-report/>.



Chapter 2

Quality Control of Saliva Analytes

CHAPTER 2: QUALITY CONTROL OF SALIVA ANALYTES

Julie Day, Mira Doig & Vicky Wilson

2.1 INTRODUCTION AND KEY CONCLUSIONS

This section describes the assay of analytes for the 2019 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) and external quality assessment (EQA) results within expected limits. The results of the analyses for the saliva cotinine levels were acceptable for SHeS 2019.

2.2 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 ABS Laboratories in Welwyn Garden City, Hertfordshire. ABS Laboratories conducted the analysis of salivary cotinine.

2.3 SAMPLES COLLECTED

2.3.1 Urine samples

In previous years a mid-flow spot urine sample was obtained from participants. Following the Scottish Government's consultation on the questionnaire content of SHeS¹, it was decided that urine sampling should be removed from the survey from 2018. As a result, no urine samples were collected in 2019.

See the Scottish Health Survey 2017: Volume 2 Technical Report² for further details on urine sampling.

2.3.2 Saliva samples

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). 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.

2.4 METHODOLOGY

2.4.1 Laboratory procedures for saliva sample analyses

All analyses were carried out according to Standard Operating Procedures by analysts in a MHRA Good Laboratory and Good Clinical Practice (GLP & GCP) accredited laboratory. All work is reviewed by the Laboratory & QA Manager.

A schedule of Planned Preventative Maintenance was used for each item of analytical equipment. These plans were carried out jointly by the manufacturers and the laboratories' staff. Records were kept of when maintenance was due and carried out.

2.4.2 Saliva sample analytical methods and equipment

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 ABS Laboratories, where cotinine analysis was carried out. This laboratory specialises in accurate measurement of low levels of cotinine and therefore takes special precautions to ensure no contamination by environmental tobacco smoke occurs.

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 studies³. The sample preparation prior to LC-MS/MS was liquid/liquid extraction. 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 to 750 ng/mL for the self-reported smokers, or low calibration range 0.1 to 50 ng/mL for the non-smokers. A Tomtec Quadra was used to allow for the automation of some of the sample preparation. All methods were validated before use. If any of the samples from self-reported smokers gave a result below 1 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.

2.5 INTERNAL QUALITY CONTROL (IQC)

2.5.1 Explanation of IQC

The purpose of internal quality control (IQC) is to ensure reliability of an analytical run. IQC also helps to identify, and prevent the release of, any errors in an analytical run. IQC is also used to monitor trends over time.

For each analyte or group of analytes, the laboratory obtains a supply of quality control materials, usually at more than one concentration of

analyte. Target (mean) values and target standard deviations (SD) are assigned for each analyte. Target assignment includes evaluation of values obtained by the laboratory from replicate measurements (over several runs) in conjunction with target values provided by manufacturers of IQC materials, if available. The standard deviation and the coefficient of variation (CV) are measures of imprecision and are presented in the tables. IQC values are assessed against an acceptable range and samples are re-analysed if any of the Westgard rules have been violated^{4,5,6}. Internal quality assessment results are available from ScotCen Social Research upon request.

2.5.2 Saliva samples

ABS laboratories ran 16 non-zero calibration standards for each batch of the low range assay (0.1-50 ng/mL) or high range assays (1-750 ng/mL). Six 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 $\pm 15\%$ 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 $\pm 15\%$ except at the lower limit of quantification where the bias must be no greater than $\pm 20\%$.

2.6 EXTERNAL QUALITY ASSESSMENT (EQA)

External quality assessment (EQA) permits comparison of results between laboratories measuring the same analyte. An EQA scheme for an analyte or group of analytes distributes aliquots of the same samples to participating laboratories, which are blind to the concentration of the analytes. The usual practice is to participate in a scheme for a full year during which samples are distributed at regular frequency (monthly or bimonthly for example); the number of samples in each distribution and the frequency differ between schemes.

There was no external quality control scheme available in 2019 for saliva cotinine analysis but ABS Laboratories participates in inter-laboratory split analyses to ensure comparable results. The latest International inter-laboratory study was published in 2009³.

References and notes

- ¹ Questionnaire Content of the Scottish Health Survey (2017): Consultation Analysis Report. Available from <https://consult.gov.scot/population-health/scottish-health-survey/>
- ² Scottish Health Survey 2017: Volume 2 Technical Report. Available from <https://www.gov.scot/publications/scottish-health-survey-2017-volume-2-technical-report/>
- ³ 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.
- ⁴ Westgard rules are a statistical approach to evaluation of day-to-day analytical performance. The Westgard multirule quality control procedure uses five different control rules to judge the acceptability of an analytical run (rather than the single criterion or single set of control limits used by single-rule quality control systems, such as a Levey-Jennings chart with control limits set as either the mean plus or minus 2 standard deviations or the mean plus or minus 3 standard deviations). Westgard rules are generally used with two or four control measurements per run. This means they are appropriate when two different control materials are measured once or twice per material, which is the case in many chemistry applications. Some alternative control rules are more suitable when three control materials are analysed, which is common for applications in haematology. More detail is available at www.westgard.com/mltirule.htm#westgard
- ⁵ Westgard JO, Barry PL, Hunt MR, Groth T. *A multi-rule Shewhart chart for quality control in clinical chemistry*. *Clin Chem.* 1981;27:493-501.
- ⁶ Westgard JO, Klee GG. Quality Management. Chapter 16 in Burtis C (ed.). *Fundamentals of Clinical Chemistry*. 4th edition. Philadelphia: WB Saunders Company, 1996, pp.211-23.

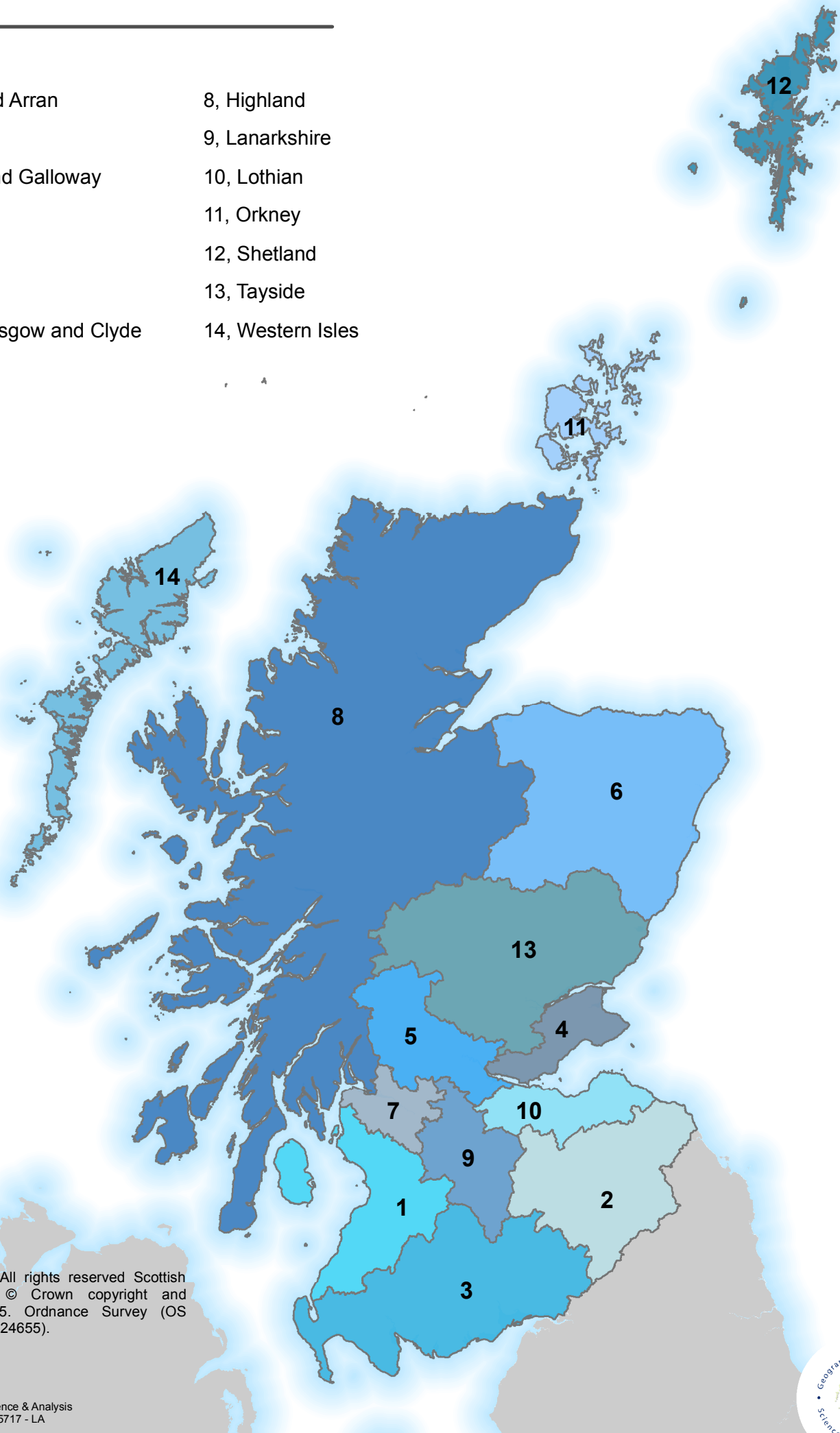


Appendix B:

NHS Health Board Areas

NHS Health Board Areas

- | | |
|------------------------------|-------------------|
| 1, Ayrshire and Arran | 8, Highland |
| 2, Borders | 9, Lanarkshire |
| 3, Dumfries and Galloway | 10, Lothian |
| 4, Fife | 11, Orkney |
| 5, Forth Valley | 12, Shetland |
| 6, Grampian | 13, Tayside |
| 7, Greater Glasgow and Clyde | 14, Western Isles |



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Scottish Government GI Science & Analysis Team, November 2015, Job 5717 - LA





Appendix C:

Glossary

APPENDIX C: GLOSSARY

This glossary explains terms used in the report, other than those fully described in particular chapters.

Adverse Childhood Experiences (ACEs) ACEs can be defined as stressful or traumatic experiences and events that occur during childhood (between 0 and 18 years of age). The questions used on SHeS are similar to those used in the original English 2014 and Welsh 2015 ACE surveys but without the questions on physical and emotional neglect. Additionally, to reflect the introduction of legislation related to smacking in Scotland, the words 'This does not include gentle smacking for punishment' used in the Welsh and English studies were removed from the question 'How often did a parent or adult in your home ever hit, beat, kick or physically hurt you in any way?'.

For questions with a yes/no answer option, the answer 'yes' constitutes an ACE. For questions with never, once or twice, sometimes, often or very often, the answer 'once or twice' or more constitutes an ACE. This differs slightly from the Welsh and English surveys in one respect. In the Welsh and English surveys for the question 'How often did a parent or adult in your home ever swear at you, insult you, or put you down?', twice or more constituted an ACE. For sexual abuse, the two questions asked have been combined into a single ACE where a response of 'once or twice' to either or both of the questions constitutes an ACE. Only those who provided answers to all of the questions were included in the analysis.

Age standardisation

Age standardisation has been used 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-2018 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:

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

where $q_i = 1 - p_i$.

Anthropometric measurement

See **Body mass index**.

Arithmetic mean

See **Mean**.

Alcohol Use Disorders Identification Test (AUDIT)

The AUDIT questionnaire was primarily designed to screen for levels of alcohol dependency or high-risk use. In line with the World Health Organisation guidelines on using the tool, responses to each of the ten AUDIT questions were assigned values of between 0 and 4. Scores for the ten questions were summed to form a scale, from 0 to 40, of alcohol use.

Bases

See **Unweighted bases, Weighted bases**.

Blood pressure

Systolic (SBP) and diastolic (DBP) blood pressure were measured using a standard method. In adults, high blood pressure is defined as SBP ≥ 140 mmHg or DBP ≥ 90 mmHg or on antihypertensive drugs.

Body mass index (BMI)

Weight in kg divided by the square of height in metres. Adults (aged 16 and over) can be classified into the following BMI groups:

<i>BMI (kg/m²)</i>	<i>Description</i>
Less than 18.5	Underweight
18.5 to less than 25	Normal
25 to less than 30	Overweight
30 to less than 40	Obese
40 and above	Morbidly obese

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:

<i>Percentile cut-off</i>	<i>Description</i>
At or below 2nd percentile	At risk of underweight
Above 2nd percentile and below 85th percentile	Healthy weight
At or above 85th percentile and below 95th percentile	At risk of overweight
At or above 95th percentile	At risk of obesity

Cardiovascular Disease (CVD)

Participants were classified as having CVD if they reported ever having any of the following conditions diagnosed by a doctor: angina, heart attack, stroke, heart murmur, irregular heart rhythm, 'other heart trouble'. For the purpose of this report, participants were classified as having a particular condition only if they reported that the diagnosis was confirmed by a doctor. No attempt was made to assess these self-reported diagnoses objectively. There is therefore the possibility that some misclassification may have occurred, because some participants may not have remembered (or not remembered correctly) the diagnosis made by their doctor.

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.

Clinical Interview Schedule-Revised (CIS-R)

See **Revised Clinical Interview Schedule**.

Cotinine

Cotinine is a metabolite of nicotine. It is one of several biological markers that are indicators of smoking. In this survey, it was measured in saliva. It has a half-life in the body of between 16 and 20 hours, which means that it will detect regular smoking (or other tobacco use such as chewing) but may not detect occasional use if the last occasion was several days ago. Anyone with a salivary cotinine level of 12 nanograms per millilitre or more was judged highly likely to be a tobacco user. Saliva samples were collected as part of the biological module.

Mean cotinine levels among non-smokers were calculated using the Tobit regression analysis method (see later).

Cardiopulmonary Resuscitation (CPR)	CPR is an emergency procedure that combines chest compressions with artificial ventilation in an effort to manually preserve brain function in a person who is in cardiac arrest.
Diastolic blood	When measuring blood pressure the diastolic arterial pressure is the lowest pressure at the resting phase of the cardiac cycle. See also Blood pressure, Systolic blood pressure .
Electronic cigarettes	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). The questions about e-cigarettes were amended in 2016 to include the term 'vaping devices'.
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'. Respondents answered three routed questions on food insecurity asking whether they had <i>worried about</i> running out of food, had <i>eaten less</i> than they should have or had <i>actually run out of food</i> in the last 12 months.
Frankfort plane	The Frankfort Plane is an imaginary line passing through the external ear canal and across the top of the lower bone of the eye socket, immediately under the eye. Informants' heads are positioned with the Frankfort Plane in a horizontal position when height is measured using a stadiometer as a means of ensuring that, as far as possible, the measurements taken are standardised.
General Health Questionnaire-12 (GHQ-12)	The GHQ-12 is a scale designed to detect possible psychiatric morbidity in the general population. It was administered to informants aged 13 and above. The questionnaire contains 12 questions about the informant's general level of happiness, depression, anxiety and sleep disturbance over the past four weeks. Responses to these items are scored, with one point given each time a particular feeling or type of behaviour was reported to have been experienced 'more than usual' or 'much more than usual' over the past 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 in this report to indicate the presence of a possible psychiatric disorder.

Reference: Goldberg D, Williams PA. *User's Guide to the General Health Questionnaire*. NFER-NELSON, 1988.

Geometric mean

The geometric mean is a measure of central tendency. It is sometimes preferable to the arithmetic mean, since it takes account of positive skewness in a distribution. An arithmetic mean is calculated by summing the values for all cases and dividing by the number of cases in the set. The geometric mean is instead calculated by multiplying the values for all cases and taking the *n*th root, where *n* is the number of cases in the set. For example, a dataset with two cases would use the square root, for three cases the cube root would be used, and so on. The geometric mean of 2 and 10 is 4.5 ($2 \times 10 = 20$, $\sqrt{20} = 4.5$). Geometric means can only be calculated for positive numbers so zero values need to be handled before geometric means are calculated. See also **Mean**.

Health risk category

Health risk category is derived from BMI and waist circumference. BMI is derived from height and weight data collected in the main interview and waist circumference measurements are collected in the biological module. These measures are used in combination to estimate the proportion of adults who fall into each of the risk categories listed in the table below.

BMI Classification	'High' WC Men WC 94-102cm Women WC 80-88cm	'Very high' WC Men WC >102cm Women WC >88cm
Normal weight (BMI 18.5 - <25(kg/m ²))	-	-
Overweight (BMI 25 - <30(kg/m ²))	Increased	High
Obese		
I - Mild (BMI 30 - <35(kg/m ²))	High	Very high
II - Moderate (BMI 35 - <40(kg/m ²))	Very high	Very high
III - Extreme (BMI 40+(kg/m ²))	Extremely high	Extremely high

Reference: Scottish Intercollegiate Guidelines Network Management of Obesity – A National Clinical Guideline. SIGN guideline no. 115. Edinburgh: SIGN, 2010.

High blood pressure

See **Blood pressure**.

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.
Hypertension	See Blood pressure.
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.
Loneliness	A question was included in the adult and young adult self-completion questionnaires to measure levels of loneliness experienced in the two weeks prior to being interviewed, with five answer options ranging from 'all of the time' to 'never'.
Long-term conditions & limiting long-term conditions	<p>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 all large Scottish Government surveys.</p> <p>Long-term conditions were coded into categories defined in the International Classification of Diseases (ICD), but it should be noted that the ICD is used mostly to classify conditions according to the cause, whereas SHeS classifies according to the reported symptoms. A long-term condition was defined as limiting if the respondent reported that it limited their activities in any way.</p>
Mean	Most means in this report are Arithmetic means (the sum of the values for cases divided by the number of cases).
Median	The value of a distribution which divides it into two equal parts such that half the cases have values below the median and half the cases have values above the median.
Morbid obesity	See Body mass index .
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 (See Volume 2: Appendix B).
Nicotine Replacement	The remedial administration of nicotine to the body by means other than tobacco, usually as part of smoking cessation.

Therapy (NRT)	Common forms of nicotine replacement therapy are nicotine patches and nicotine gum.
Obesity	See Body mass index .
Overweight	See Body mass index .
Percentile	The value of a distribution which partitions the cases into groups of a specified size. For example, the 20th percentile is the value of the distribution where 20 percent of the cases have values below the 20th percentile and 80 percent have values above it. The 50th percentile is the median.
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 given in this report take into account the clustered sampling design of the survey. See also Significance testing .
Quintile	Quintiles are percentiles which divide a distribution into fifths, i.e., the 20th, 40th, 60th and 80th percentiles.
Raised waist circumference	See Waist circumference .
Revised Clinical Interview Schedule (CIS-R)	<p>Details on symptoms of depression and anxiety are collected via a standardised instrument, the CIS-R. 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 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, and in the computer-assisted self-completion part of the biological module from 2012 to 2019.</p> <p>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.</p>

References:

Lewis, G. & Pelosi, A. J. (1990). Manual of the Revised Clinical Interview Schedule CIS–R. London: Institute of Psychiatry;
Lewis G, Pelosi AJ, Araya R, Dunn G. (1992) Measuring psychiatric disorder in the community; a standardised assessment for use by lay interviewers. *Psychological Medicine*; 22, 465-486.

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 (6505) on the overall SIMD index. The result is a comprehensive picture of relative area deprivation across Scotland.

This report uses the SIMD 2020 for the 2019 data (see <https://www.gov.scot/publications/?term=SIMD&cat=filter&publicationTypes=statistics&page=1>) and the SIMD 2016 for the 2016, 2017 and 2018 data.

Significance testing

Where differences in relation to a particular outcome between two subgroups, such as men and women, are highlighted in volume 1 of this 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 men than among women, and we may expect this to be true in the most recent survey, a two-tailed test is used to confirm the difference.

Social capital

Social capital encompasses aspects of social connectedness via friend and kinship networks, trust in others, the ability to draw on support from others, as well as a sense of connectedness to places through involvement in the local community and the ability to influence local decisions.

Standard deviation

The standard deviation is a measure of the extent to which the values within a set of data are dispersed from, or close to, the mean value. In a normally distributed set of data 68% of the cases will lie within one standard deviation of the mean, 95%

within two standard deviations and 99% will be within 3 standard deviations. For example, for a mean value of 50 with a standard deviation of 5, 95% of values will lie within the range 40-60.

Standard error	The standard error is a variance estimate that measures the amount of uncertainty (as a result of sampling error) associated with a survey statistic. All data presented in this report in the form of means are presented with their associated standard errors (with the exception of the WEMWBS scores which are also presented with their standard deviations). Confidence intervals are calculated from the standard error; therefore the larger the standard error, the wider the confidence interval will be.
Standard error of the mean	See Standard error .
Standardisation	In this report, standardisation refers to standardisation (or 'adjustment') by age (see Age standardisation).
Systolic blood pressure	When measuring blood pressure, the systolic arterial pressure is pressure defined as the peak pressure in the arteries, which occurs near the beginning of the cardiac cycle. See also Blood pressure, Diastolic blood pressure .
Tobit regression	This method assumes that the distribution of cotinine values below the level of detection follows the same pattern as those above the method of detection. Thus, as the mean levels of cotinine among those with a cotinine level of between 0.1 ng/mL and 12 ng/mL (the level at which someone is deemed to be a cotinine-validated smoker) fall, so too do the assumed mean levels of those with a cotinine level of below 0.1 mg/mL ²⁸ . Because of this change in method, figures presented in the 2019 report differ from those presented in the 2017 report.
Unit of alcohol	Alcohol consumption is reported in terms of units of alcohol. A unit of alcohol is 8 gms or 10ml of ethanol (pure alcohol). See Chapter 4 of volume 1 of this Report for a full explanation of how reported volumes of different alcoholic drinks were converted into units.
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 the 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 gender, age and SIMD.

Waist circumference

Waist circumference is a measure of deposition of abdominal fat. It was measured during the biological module. A raised waist circumference has been defined as more than 102cm in men and more than 88cm in women.

Weighted bases

See also **Unweighted 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.

Warwick-Edinburgh Mental Well-being 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 well-being 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. 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).

References:

Kammann, R. and Flett, R. (1983). *Sourcebook for measuring well-being with Affectometer 2*. Dunedin, New Zealand: Why Not? Foundation.

Information on measuring mental wellbeing using WEMWBS is available online from:

<https://warwick.ac.uk/fac/sci/med/research/platform/wemwbs>

A NATIONAL STATISTICS PUBLICATION FOR SCOTLAND

The United Kingdom Statistics Authority has designated the Scottish Health Survey as National Statistics in January 2010, in accordance with the Statistics and Registration Service Act 2007 and signifying compliance with the Code of Practice for Official Statistics.

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How to access background or source data

The data collected for the Scottish Health Survey:

are made available via the UK Data Service

may be made available on request, subject to consideration of legal and ethical factors. Please contact scottishealthsurvey@gov.scot for further information.

Further breakdowns of the data:

are available via the Scottish Health Survey website

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