

**Collection of biomarkers using nurses,
interviewers, and participants: The design of
IP12**

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Non-technical summary

Understanding Society: the UK Household Longitudinal Study (UKHLS) is a longitudinal annual survey of households and individuals living in the UK, which began in 2009. The overall purpose of *Understanding Society* is to provide high quality longitudinal data about subjects such as health, work, education, income, family, and social life. The *Understanding Society* Innovation Panel (IP) is sample of around 1500-2000 households and is used as a test-bed for innovative ways of collecting data and for developing new areas of research. Experiments on the IP inform the design of the main UKHLS survey as well as provide methodological learning more generally.

Biomarker and clinical data were collected by nurses from participants of the *Understanding Society* study in waves 2 and 3 (2010-2012). This data collection would be greatly enhanced by a re-collection of biomarker data to enable researchers to examine changes over time. However, repeat collection of biomarker data in *Understanding Society* using a nurse has become difficult for two reasons. Firstly nurse-administered data collection on a sample to size of *Understanding Society* is prohibitively expensive and secondly there is a move away from face-to-face data collection to web-based data collection in the study more generally. This results in a need to develop alternate methods to collect biomarker data from participants, such that data are comparable to those collected in earlier waves of the study but also remain novel and at the forefront of biosocial research.

The Health IP (IP12) was used to conduct a large-scale feasibility study to investigate whether participant-led collection of bio-measures (including biological samples) could produce comparable high-quality data to that collected via the gold standard (i.e., nurses). Participants were randomly allocated to three groups: traditional nurse data collection, data collection by social interviewer, and by a web survey with participant-led sample collection. Across each group we collect anthropometric measures (height and weight), clinical measures (blood pressure) and biological samples (dried blood spots and hair samples) to compare the uptake, compliance, quality, and cost of different approaches. Understanding effective ways of collecting biomeasures by participants will create a valuable learning resource for *Understanding Society* and other biosocial surveys.

This paper describes the design of IP12, and covers the mode allocation, the participant communications and use of incentives, and the interview process itself. The outcomes of the IP12 fieldwork are described in the User Guide for the data.¹

¹ <https://www.understandingsociety.ac.uk/documentation/innovation-panel/user-guide>

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Abstract: The twelfth wave of the Innovation Panel (IP12) focused on the collection of biomarkers. The sample was allocated to three groups: (1) nurses conducted the annual interview and collected a range of biomarkers; (2) social interviewers carried out the survey and collected a limited set of biomarkers; and (3) sample members were invited to complete an interview online. For groups 2 and 3 the kit required to collect biomarkers was supplied, and the biological samples posted back to ISER by the participants. This paper describes the design of IP12, and the protocols used to collect the biomarkers.

Keywords: survey modes, nurses, biomarkers, experimental.

JEL classification: C83, C93.

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Introduction

Understanding Society: the UK Household Longitudinal Study (UKHLS) is a longitudinal social survey of households and individuals living in the UK (Buck and McFall, 2011). The survey began data collection in January 2009 and participants are interviewed annually, with the 13th round of data collection about to start in January 2021. The survey is designed and managed by the Institute for Social and Economic Research (ISER) at the University of Essex. The Principal Investigator of the study is Professor Michaela Benzeval. Survey fieldwork is currently carried out by Kantar and NatCen Social Research (NatCen). The survey is funded by the Economic and Social Research Council (ESRC), and anonymised data are always shared with broader research community via the UK Data Archive.

The *Understanding Society* Innovation Panel (IP) is sample of around 1500-2000 households and is used as a testbed for innovative ways of collecting data and for developing new areas of research. The sample was originally a stratified and clustered probability sample of residential households in Great Britain (Lynn, 2009). Participants in the IP sample have already been recruited (at wave 1 of the study) and have been interviewed in previous years. The sample for the IP in Wave 1 consisted of 2,760 addresses in 120 areas (PSUs) across Britain, south of the Caledonian Canal (Burton et al, 2008). Everyone resident at the address, including children, were defined as original sample members and are followed throughout the life of the study. During the fourth wave (2011), seventh wave (2014), tenth wave (2017) and eleventh wave (2018) of the IP, refreshment samples were added to increase the number of households. The IP currently comprises of approximately 2000 households (4041 adults and 333 children).

The purpose of the IP is to enable methodological research, primarily to conduct methods testing for the main stage of the survey. Participants are, on the whole, asked the same questions using the same procedures as the main survey. However, the IP also includes experiments and methodological tests designed to develop and evaluate methodologies and new content for longitudinal survey research. These include comparison of different incentive types on response rate, testing of different question formats to inform design at the main stage, and the use of different modes of interview. Experiments are carried out, and questions,

procedures and methods are tested and used in a context similar to the main *Understanding Society* survey in order to make that testbed as realistic as possible. Anonymised data from the IP is available to academics and researchers for both methodological and substantive research via the UK Data Archive.

Biomarker and clinical data were collected by nurses from participants of the *Understanding Society* study in waves 2 and 3 (2010-2012) (McFall et al., 2012; McFall et al., 2014; Benzeval et al., 2014). This data collection would be greatly enhanced by a re-collection of biomarker data to enable researchers to examine changes in them over time. However, repeat collection of biomarker data in *Understanding Society* using a nurse has become difficult for two reasons. Firstly nurse-administered data collection on a sample to size of *Understanding Society* is prohibitively expensive and secondly there is a move away from face-to-face data collection to web-based data collection in the study more generally. This results in a need to develop alternate methods to collect biomarker data from participants, such that data are comparable to those collected in earlier waves of the study but also remain novel and at the forefront of biosocial research. Further, methods used to collect biomarker data in medical research settings may not be appropriate to collection from population representative studies that are geographically widely dispersed such as *Understanding Society*.

We wished to use the Health IP (IP12), to conduct a large-scale feasibility study to administer participant-led collection of bio-measures (including biological samples). The overarching aim was to test whether participants would and could collect high quality biomeasures and samples that would be comparable to those collected by the ‘gold standard’ (nurses). From a data quality perspective, we were concerned with the response and biases in it - overall and for individual measures - as well as the validity of individual measures.

Participants were randomly allocated to three groups: a web survey with participants providing their own sample collection; data collection by social interviewer who also gave kit to the participant to collect their own sample; and a traditional nurse data collection.

Interviewers and nurses used Computer-Assisted Personal Interviewing (CAPI) to interview participants face-to-face. Across each group we collect anthropometric measures (height and weight), clinical measures (blood pressure, (BP)) and biological samples (dried blood spots and hair samples) to compare the uptake, compliance, quality, and cost of different approaches. For anthropometric and BP, we included experiments of different ways of self-reporting measures. Collection of hair and dried blood spots would enable measurement of

analytes that overlap with those collected at the main-stage Waves 2 and 3. Providing feedback from these analytes was randomised to determine the influence of feedback on an individual's decision to participate in such studies.

The purpose of this working paper is to describe the fieldwork design we implemented overall and for each specific biomeasure to share learning about effective ways of collecting biomeasures by participants for *Understanding Society* and other biosocial surveys.

IP12 Design Overview

This section of the paper describes the design of IP12, and covers the mode allocation, the participant communications and use of incentives, and the interview process itself. The IP sample was randomly split into one of three equally sized groups: 1) participant-led web mode, 2) interviewer-led mode and 3) nurse-led mode. Group selection was done at household level (all sample members in a household were allocated to the same mode). The overall study design for IP12 has been summarised below in Tables 1 and 2 which summarises the specific measures and treatments in each group for adults and children respectively. More detail about each experiment and measure is then provided in the remainder of this protocol. As part of the development phase, the protocols that were used in the two self-collecting groups (participant-led and interviewer-led) were tried and tested by participants in a pre-pilot study (conducted May 2018) and were designed based on participants' feedback.

Table 1: Adult participants (aged 16 and above)

	WEB-MODE	INTERVIEWER MODE	NURSE MODE
	Biological samples collection kit posted following completion of online questionnaire	Biological samples collection kit left behind following interview	Nurse collects all biological samples
EXPERIMENT			
1. Questionnaire	Participant-led Online	Interviewer-led CAPI	Nurse-led CAPI
2. Audio recording of specific sections of the interview	Not applicable	With consent Audio recording triggered by interviewer via CAPI	With consent Audio recording triggered by nurse via CAPI
3. Blood pressure	Blood pressure self-measurement & reporting results No additional blood pressure measurement	Blood pressure self-measurement & reporting results Additional blood pressure measurement taken by interviewer during interview – with consent	Blood pressure self-measurement & reporting results Additional blood pressure measurement taken by nurse during interview – with consent
4. Physical measures	Not taken	Height and weight measured by interviewer – with consent	Height and weight measured by nurse – with consent
5. Peripheral blood sample	Not taken	Not taken	Peripheral blood sample collected – with consent
6. Dried blood spots	DBS kit sent to participant – with consent 1 DBS collection card collected by participant - and returned to ISER	DBS kits left with participant - with consent. 1 DBS collection card collected by participant - and returned to ISER	1 DBS collection card collected by nurse, with consent – and returned to ISER by participant
7. Hair	Hair collected by participant – with consent – and returned to ISER	Hair collected by participant – with consent – and returned to ISER	Hair collected by nurse – with consent – and returned to ISER by nurse
8. Feedback of selected blood test results	Randomly selected half of participants sent selected blood test results, with consent.	Randomly selected half of participants sent selected blood test results, with consent.	Randomly selected half of participants sent selected blood test results, with consent.
9. Assessment of the participant experience (follow-up survey)	Participants invited to take part in a follow-up survey about why they did or did not participate, and how processes could be improved.		

Table 2: Child participants (aged 10-15 years old)

	WEB-MODE	INTERVIEWER MODE	NURSE MODE
EXPERIMENT			
1. Questionnaire	Youth self-completion questionnaire posted to parents/guardians for children age 10-15. Implied parental and child consent by returning the completed questionnaire (stated on document).	Youth self-completion questionnaire given to parents/guardians for children age 10-15. Implied parental and child consent by returning the completed questionnaire (stated on document).	Youth self-completion questionnaire given to parents/guardians for children age 10-15. Implied parental and child consent by returning the completed questionnaire (stated on document).
2. Hair	Hair collected by parent/guardian of participant age 10-15	Hair collected by parent/guardian of participant age 10-15	Hair collected by nurse for children age 10-15

Sample

To be included in the overall IP study a person must have been part of a household that took part in one or more previous surveys as part of the IP sample, reside in England, Scotland or Wales, and speak English or Welsh. The sample for the IP in wave 1 consisted of 2,760 addresses in 120 areas (PSUs) across Britain, south of the Caledonian Canal (Burton et al., 2008). Everyone resident at the address, including children, are defined as original sample members and are followed throughout the life of the study. During the fourth wave (2011), seventh wave (2014), tenth wave (2017) and eleventh wave (2018) of the IP, refreshment samples were added to increase the number of households. The IP at the start of IP12 comprised of approximately 2000 households. Within these households, all adults aged 16 and over were invited to take part in the adult interview, and all young people aged between 10 and 15 years were invited to take part in the youth questionnaire (4,041 adults and 333 children).

The IP12 sample of households was split into three groups: participant-led (web-first); interviewer-led (CAPI); and nurse-led (CAPI).

Table 3: Issued sample size

	Participant-led	Interviewer-led	Nurse-led	Total
All issued households	853	765	783	2401
All issued adults	1613	1398	1435	4446
All issued children (10-15)	132	133	143	408

Group 1: Participant-led mode

Adult sample members (aged 16 and over) were invited to complete the questionnaire online. At the end of the online questionnaire, participants were asked if they would be willing to participate in the biological sample collection part of the study. If they agreed, a kit was posted directly to them to enable them to collect hair and dried blood spot samples. Participants were provided with detailed instructions on how to collect the samples, including links to online videos, and how to return the samples, consent forms and kit to the study. Participants were offered an additional conditional £5 voucher as a token of appreciation for their time if they returned the samples. If sample members did not complete their survey online after six weeks, they were issued to interviewers, who then attempted to contact them and interview them in-person. Participants who were re-allocated to interviewers after not completing the interview online were treated the same way during the interview as those participants allocated to the interviewer-led mode (see below).

Group 2: Interviewer-led mode

Adult participants (aged 16 and over) were sent an advance letter, giving them information about the IP12 interview. They were then contacted by a face-to-face interviewer who carried out the interview using CAPI (Computer-Assisted Personal Interviewing). During the interview, the interviewer asked the participant if they were willing to let them collect some bio-measures (BP, height and weight). On completion of the interview, the interviewer introduced the additional biological sample collection aspect of the study and if participants agreed the interviewers then gave the participants the kit for hair and dried blood spot collection. Participants were provided with detailed instructions on how to collect the biological samples and return the samples and kit to the study and offered an additional conditional £5 voucher as a token of appreciation for their time if they returned the samples.

Group 3: Nurse-led mode

Adult participants (aged 16 and over) had a face-to-face interview with a nurse using CAPI (Computer-assisted personal interviewing). During the interview, the nurse asked the participant if they were willing to let them collect the bio-measures (BP, height and weight) and the biological samples (peripheral blood, dried blood spots and hair samples). The dried blood spot cards were left with participants to allow them sufficient time to dry and return the dried blood spot samples and kit to the study. Participants were offered an additional conditional £5 voucher as a token of appreciation for their time if they returned the sample.

Interviewer and nurse briefing

Interviewers who worked on IP12 had all worked on the main-stage of *Understanding Society* in the past, and most had worked on previous waves of the IP. Thus, interviewer briefings did not need to cover the basic fieldwork procedures. However, because of the additional biomeasure collection at IP12, there was additional training required around this aspect. The nurses had experience with carrying out health surveys, and so whilst they were familiar with the collection of biomeasures, they did require additional training around the fieldwork procedures used on *Understanding Society*.

The interviewer briefings lasted for two days, rather than the usual half-day used for refresher briefings for interviewers who had worked on *Understanding Society*. The first day of the briefing covered material which would have been discussed at any other IP briefing: an overview of the experiments and the rationale for why we were conducting them, the design of the study, the fieldwork documents used, and information about the audio recordings. The new content for the first day covered the procedures for measuring BP, height, and weight. Interviewers were shown how to collect these measures, and then practiced in pairs taking the measures. Interviewers were also shown the kit that would be used to take the DBS and hair samples, along with information on how the participants would have to label the samples.

On the second day, interviewers were accredited on collecting the height, weight, and BP. Each interviewer was observed carrying out these measures on another interviewer. If they made no mistakes, or only a small number of minor mistakes, they were passed. If they had made minor mistakes, these were fed back to the interviewer and they were reminded of the correct protocol. If they had made a large mistake, or more than a few minor mistakes, the interviewer did not pass and had another chance to be accredited later that second day, after having had time to review the protocols again. The second day also covered the questionnaire

topics in more detail, methods to maximise response, and some information on how to carry and handle the equipment.

The briefing for nurses took three days, with a gap between days 2 and 3 when there would be some work for the nurses to do at home before the third day. The first two days mostly covered the fieldwork procedures that the interviewers would have been familiar with. This included an introduction to *Understanding Society* and the IP. The fieldwork processes then included making contact, managing the assignments on the laptop – which required the use of an electronic contact sheet and sample management system – the different fieldwork materials, dealing with people who had moved from the household, and tips on overcoming reluctance. The second day finished with an introduction to the measures that the nurses would be taking during the interview – BP, height, weight, DBS, and hair samples. The final day for nurses included information about the experiments on IP12 and the rationale for collecting the biomeasures. Nurses were accredited to collect the health measures, in the same way that interviewers were. The health measures and collection of the DBS and hair samples were then explained in greater detail, including the consent forms that needed to be completed. The final day ended with a discussion about the carrying and handling of the equipment required, and how to access more support or guidance during fieldwork.

There were five interviewer briefings (Bristol, Derby Leeds, and two in London), and five nurse briefings (Derby, Leeds, two in London, and Manchester).

Fieldwork dates

The fieldwork for IP12 started on July 11th 2019 and finished on November 24th 2019. The participant-led (web-first) group were invited to take part in IP12 from July 11th. The web-only fieldwork was open for about six weeks, and from 24th August interviewers started to make contact with those who had not responded online, and fieldwork finished on 3rd November. Nurses started to make contact and interview their sample from 22nd July. Nurses were in the field for fifteen weeks, finishing on 3rd November. Interviewers began working on the interviewer-led sample on 8th August, and were in the field for 12.5 weeks, finishing on 3rd November.

For all three groups, during the last three weeks of fieldwork (4th - 24th November) non-responding sample members were issued to telephone interviewers who tried to contact and interview people by telephone (CATI), and non-responders in the interviewer- and nurse-led groups were invited to complete online. The telephone version of the questionnaire was

similar to the web version, without any of the within-interview physical measures, and with the interviewer asking for permission to send the bio-measure kit to the participant at the end of the interview.

Table 4: Fieldwork dates

Participant-led	Interviewer-led	Nurse-led
11 th July – 23 rd August: web-only (6 weeks)		
24 th August – 3 rd November: allocated to interviewers (10 weeks)	8 th August – 3 rd November (12.5 weeks)	22 nd July – 3 rd November (15 weeks)
4 th – 24 th November: Telephone mop-up (3 weeks)	4 th – 24 th November: Invitation to complete online plus telephone mop-up	

Contacting sample members

Sample members were sent an advance letter inviting them to participate in the interview.²

The letter included a Participant Information Sheet which gave sample members more information about the health focus of the interview, what it would involve, and any risks involved in taking part. The letter and the leaflet made it clear to sample members that participation in the study was completely voluntary. The sample member was allowed as much time as they wished to consider the information given to them, and the opportunity to question the nurse/interviewer or in the web-first group, to contact the study, prior to making a decision if they wish to participate in the study.

As noted above, new entrants to the household when identified during the household enumeration online were sent their own invitation letter containing the information leaflet. New entrants who were only identified during the nurse or interviewer completing the household enumeration would not have received an advance letter, instead the interviewer/nurse would have handed over the information leaflet.

Incentives have always been used on *Understanding Society*; for IP12 sample members were allocated to the same incentive group that they had been in the previous wave. For those adults who had taken part in IP11, the advance letters for IP12 included a £10, £20 or £30

² Participant documents are available online at
<https://www.understandingsociety.ac.uk/documentation/innovation-panel/fieldwork-documents>

Love-to-Shop unconditional gift-cards as a token of appreciation for their continued involvement in the study. For adults who had not taken part at IP11, they were promised a Love2Shop gift-card, conditional on participating at IP12. Adults in the same household were allocated to the same incentive level, so within households each adult received the same amount – either conditionally or unconditionally depending on their participation at the previous wave. In addition, around one-third of those in the web-first group were also promised an additional £10 voucher if they completed their interview in the first six weeks of fieldwork, as a bonus for early completion before the non-responders were issued to interviewers. Participants were also offered £5 vouchers to thank them for completing different tasks.

The letter for the web-first group included information on how they could access their online interview. The web-first group were also sent their invite by email, where we had an email address for the sample member. There were an additional two reminder emails and one reminder letter for the web-first group. If a new adult entrant to the household was identified during the web survey, as part of the enumeration process, they were sent an invitation letter and information leaflet which included their unique log-on details so they could access and complete the survey online.

The fieldwork period for this web-first group started on July 11th 2019, six weeks before the face-to-face interviews. At the end of that six-week ‘web only’ period, non-responding sample members in the web-first group were issued to interviewers. At this point the fieldwork for interviewers and nurses began. A week after the advance letters were dispatched for the interviewer and nurse groups, the interviewer or nurse started to telephone the sample member to schedule a visit at a day and time which is convenient to the sample member. In the event of no response by telephone, interviewers/nurses visited the household with the intention to schedule an appointment at a convenient time for the sample members.

In the nurse mode, nurses conducted all stages of fieldwork. This meant that nurses made the first contact with households (aside from an advance letter) with the intention of trying to make an appointment. Nurses were also required to make efforts to trace people who had moved. These are generally tasks undertaken by the face-to-face interviewers and so we closely monitored the progress of nurse fieldwork, in case the nurses found this part of the process difficult. We reviewed the fieldwork progress and response after five weeks of fieldwork and had the option to change the way fieldwork was conducted. We had two

contingency options for how this could be changed. In both cases, nurses would still conduct all interviewing (and collect biological samples and measures), but initial contact would be made by someone else. However, the response for nurses and interviewers was very similar and hence these contingencies were not needed.

Interview process

Data collection in all three groups took place in the participants' household. Face-to-face interviews in the nurse-led and interviewer-led groups using computer assisted personal interviews (CAPI), which included biomeasures (both) and collection of samples (nurse only). In the web group, participants completed the questionnaire online; participants could do this on a desktop, laptop, tablet or smartphone, and could be anywhere when they do this.

Questionnaires

Within each household, the first task for the participant was to complete the household enumeration which collected basic information on everyone in the household. The person in the household who was identified as the person responsible for paying bills, or their partner/spouse where applicable, then completed the household questionnaire. The household questionnaire collected information at the household level and included questions about the address, household resources and household expenditure. All eligible adults were then asked to complete an individual adult interview. Questionnaires are available online on the *Understanding Society* website.³

The adult interview included modules of questions on:

- Demographics
- Family Background
- Ethnicity and National Identity
- Religion
- Annual Events History
- Disability
- Health conditions
- Smoking
- Exercise
- Nutrition

³ <https://www.understandingsociety.ac.uk/documentation/innovation-panel/questionnaires>

- Caring
- Partnership history
- Employment
- Childcare
- Household Finances
- Self-completion health and well-being

The questionnaire length was longer than a standard IP interview because of the additional biomarker collections. Nurse interviews were longer than those carried out by interviewers, which were longer than those completed online because of the additional biomeasures. However, participants in the interviewer and web groups spent time after the interview collecting their own samples. Information on the actual questionnaire lengths is available from the IP12 Technical Report (Kantar 2020).

The parent/guardian of participants aged 10-15 years were asked if the youth self-completion questionnaire could be given to the child who was then invited to complete the questionnaire. The young person was given an unconditional £5 voucher with the youth self-completion questionnaire.

Questions relating to the following were included in the youth self-completion:

- Time spent using social media and watching TV
- Relationship with family (parents and siblings)
- Attitudes towards him/herself as a person
- How feels about different aspects of life, e.g. school, family etc
- Attitudes towards neighbourhood
- Homework
- Future educational aspirations
- Bullying at school
- Work and money
- Health and nutrition, exercise
- Smoking and alcohol use

Participants whose households were assigned to the web group and where all adults complete the questionnaire online had the youth self-completion questionnaire sent to the address by

post. They were provided with a Freepost envelope to return the questionnaire to Kantar Public.

Participants whose households are assigned to the interviewer-led or nurse-led groups had the interviewer or nurse seek parental/guardian verbal consent to hand over the self-completion questionnaire with the incentive and a blank envelope to eligible youth participants. The blank envelope was to ensure confidentiality for the young person so that their parent/guardian does not see the responses. The young person was encouraged to complete and return the questionnaire whilst the interviewer/nurse was in the household. The interviewer/nurse returned the completed questionnaire to Kantar Public after they left the household. In some instances, the interviewer/nurse left a postage-paid envelope for the household to return the youth self-completion (e.g., if the young person was not in the house at the time of the interview(s)). The questionnaires are available on the *Understanding Society* website.⁴

The youth questionnaire stated that returning it means participants consent to their data being used for research purposes. The child had an independent right to refuse to participate even if the parents/guardians give their consent.

Collection of biomeasures

1. Blood pressure

The aim of the experiment with BP measurement was to examine a) whether participants would measure their BP themselves, and how best to encourage this b) whether self-measured BP was consistent with that measured by trained clinicians.

There were two measurements of BP in the study. First, all participants were asked to measure their own BP before the interview and record the results. Secondly, those who were interviewed by a lay person (an interviewer) or a clinician (research nurse) were asked for their permission to have their blood pressure measured during the interview. Pregnant women were excluded from both measurement approaches.

1a. Self-measurement of blood pressure

In the advance letter participants in all three modes were asked to have their blood pressure measured prior to the interview (at home if they have the equipment, at a GP surgery or at a

⁴ <https://www.understandingsociety.ac.uk/documentation/innovation-panel/questionnaires>

local pharmacy offering the service) and record this in a measurement card enclosed. As part of the self-measurement of blood pressure, participants in each of the three modes were randomly allocated to one of three variations of the advance letter. The allocations for this experiment were carried out at household level so everyone in one household will get the same advance letter. The different groups were:

1. Information treatment: one third of the sample was provided with the information on their nearest pharmacy offering free BP checks;
2. Pro-social appeal: one third of the sample included a pro-social appeal text in their advance letter (information from the interview will be used to determine the causes and risk factors of high BP, thereby reminding participant that they would be contributing to medical research);
3. Neither of the above: the third group was treated as the control group and sent a standard advance letter (e.g., request to carry out self-measurement of BP with no pro-social message or location of nearest pharmacy offering BP measurement).

1b. Measurement of BP during interview

During the face-to-face interview direct measurement of BP was carried out either by the nurse or interviewer using an automated sphygmomanometer (an Omron HEM 907 BP monitor). This produced a reading for systolic and diastolic BP and pulse.

Prior to the BP measurement, the participant was instructed not to eat, smoke, drink alcohol, or participate in vigorous activity half an hour before the nurse/interviewer visited. The nurse/interviewer checked and recorded whether the participant had done any of these activities. Where possible, the BP reading was taken from the right arm, with any outer garment removed and the sleeve rolled up. There were several different sized cuffs that could be used, depending on the size of the participant's arm. The participant was asked to sit comfortably so that the right arm was resting at a level to bring the elbow to approximately heart level. The participant was seated with their legs uncrossed and their feet flat on the floor. The nurse/interviewer then located the brachial pulse just medial to the biceps tendon and positioned the arrow on the cuff over the brachial artery. The lower edge should have been about 1-2 cm above the elbow crease. The participant was then asked to sit quietly for five minutes and that during that time they could not eat, drink or smoke. During this time, the nurse/interviewer used a digital thermometer to record the ambient air temperature. After

five minutes of rest, the BP measurement began. The nurse/interviewer explained to the participant that the cuff would inflate three times, and that they would feel some pressure on their arm. When the measurement was taken, the result was displayed on the Omron HEM 907 LCD screen and the interviewer/nurse recorded it in the CAPI interview. There were no range checks on the values entered into CAPI. There was around a one-minute gap between readings, and each result was recorded.

The advice given to the participant was based on the lowest systolic and the lowest diastolic reading from the last two measurements. If the lowest BP reading was greater than or equal to 150/90mmHg, the participant was advised that their BP is high, and they should seek medical advice through their GP. The interviewer/nurse also notified the survey doctor at the end of the day, who then decided whether to follow up with the participant. However, if the participant's BP was extremely high (e.g., greater than or equal to 160/95mmHg) the nurse/interviewer contacted the survey doctor immediately after the interview. Participants with BP readings outside the normal range were told that the nurse/interviewer would be informing the survey doctor about the reading after the interview who may wish to contact the participant to follow up.

If the participant wanted to know their readings, the nurse/interviewer copied details of their measures on a measurement record card.

2. Body weight and height

The aim of this experiment was to determine misreporting in body weight and height i.e., whether the interview mode, either interviewer or nurse-administered or self-completion, affects the accuracy of individuals' responses on body weight and height.

During the interview participants were asked to report their height and weight. Households (and all adults within them) were randomly assigned to be asked this in the face-to-face part of the interview or in the self-completion section. Later in the interview, the nurse or interviewer also measured the participants' standing height and weight. Participants who were chair-bound/ in a wheelchair did not have their height measured; participants who were pregnant did not have their weight measured. In addition, if a participant appeared to be heavier than the maximum limit of the scales (31st 6lb) they were not asked to undertake weight measurement.

Height was measured using a Leicester Stadiometer. The participant was asked to remove their shoes and loosen any hair accessories if possible. The stadiometer was assembled by the nurse/interviewer, near a wall if possible. The participant was then asked to stand with their feet flat on the centre of the base plate, feet together and heels against the back of the base plate. The participant's back should be as straight as possible, and they should have had their arms hanging loosely by their sides. They should be facing forwards. The nurse/interviewer moved the participant's head so that the Frankfort Plane is in a horizontal position (i.e., parallel to the floor). The Frankfort Plane is an imaginary line passing through the middle of the Tragus (cartilage at the entrance of the external ear canal) and across the top of the lower bone of the eye socket, immediately under the eye. This position is important to obtain an accurate reading. To make sure that the Frankfort Plane is horizontal, the nurse/interviewer could use a Frankfort Plane Card to line up the bottom of the eye socket with the middle of the Tragus.

The nurse/interviewer then instructed the participant to keep their eyes focused on a point straight ahead, and without moving their head position, to breathe in deeply and stretch up through their spine to their fullest height. The head plate was then brought gently down onto the participant's head. Once the head plate is in place, the participant was asked to breathe out and relax, and then to step forwards away from the Stadiometer. The nurse/interviewer could then take a reading from the stadiometers, which was recorded into the CAPI interview to the nearest even millimetre.

Weight was measured using SECA 877 or Tanita THD-305 scales. The scales are re-calibrated regularly at the fieldwork agency's operational office. The nurse/interviewer aimed to weigh the participant on a hard and even surface where possible, rather than a carpeted floor. The participant was asked to remove shoes, heavy outer garments such as jackets and cardigans, heavy jewellery, and to empty their pockets of all items. The nurse/interviewer wiped the footplate surface of the scales with an antibacterial wipe and allowed it to dry. When the scales display read 0.0, the participant was asked to stand with their feet together in the centre and their heels against the back edge of the scales, with their arms hanging loosely at their sides and their head facing forward. When the weight reading flashed on the screen, the scales had stabilised and the weight reading was recorded in CAPI, in kilograms to one decimal point. After the measurement was recorded, the participant could step off the scales, and the footplate was wiped again.

If participants asked to be given their height and weight measurements taken on the day, the interviewer/nurse recorded these on the measurement card.

3. Collection of tissue samples

The aim of including tissue sample collection in this study was fourfold. First to investigate whether participants would be willing to provide their own blood and hair samples. Second, whether the uptake and sample quality would be comparable whether taken by participants or nurses. Third, whether interviewers providing information and the collection kit would encourage participants to give samples compared to participants being asked directly. Finally, if the analytes obtained from hair and dried blood samples were comparable to those from venous blood (and each other).

The collection of new tissue samples was either done by the participant, in the web and interviewer-led groups, or by the nurse. For those eligible, on completion of the online questionnaire, participants in the web-first group were asked if they would be willing to participate in the biomarker collection component of the survey. If willing, participants were posted kits for hair and dried blood spot collections. The sample collection kit included participant information sheets, consent forms and detailed protocols to collect the samples, including links to sample collection animations on the *Understanding Society* website.⁵ In households where the interview was being conducted by a social interviewer, they introduced the biomarker collection kit at the end of the interview. They explained what the kits were for and asked whether the participant would be willing to take part. If the participant indicated that they were willing, the interviewer handed over the kit, which had the same contents as that used for those who completed online. In nurse-led interviews, the nurse introduced the biomarker collection, and handed the participant information leaflets and consent forms for the human tissue collection. If the participant consented, the nurse implemented the dried blood spot and hair sample collection. The nurse also collected a peripheral venous blood sample where the participant consented to this. The nurse returned the samples and signed consent forms, in the participant-led and interviewer groups, it was the participant who returned the signed consent forms.

⁵ Blood collection: <https://www.understandingsociety.ac.uk/blood>; Hair collection: <https://www.understandingsociety.ac.uk/hair>. Other fieldwork documents: <https://www.understandingsociety.ac.uk/documentation/innovation-panel/fieldwork-documents>

3a. Hair samples

Participants were asked to collect, or to allow the nurses to collect, a hair sample 2mm width from the posterior vertex area of the head and at least 2cm in length. Exclusion criteria are noted above. The information and equipment needed for this was included in the kit that was either sent to participants or handed over by the interviewer. The kit contained a comb, a pair of scissors, hair bands, a sheet of aluminium foil to place the hair in once cut, and an arrow shaped sticker so the participant could indicate the scalp end of the hair sample.

For the nurse visits, the nurse introduced the hair sample collection and, if the participant was eligible and gave written consent, took the hair sample.⁶ Participants were excluded if they: were pregnant or breast-feeding, had a scalp condition which rendered the hair sample soiled or where there was a risk of transmission of a known/unknown blood borne virus (e.g. active bleeding or infection) or if the participant was unable to sit with head remaining still (e.g. continual tremor, head shaking).

The nurse explained to the participant that they were going to take a relatively small hair sample from the back of their head. The nurse then divided the hair if necessary, and held together several strands of hair (with an overall thickness of about 5mm). The nurse tied the hair with a hairband provided, close to the scalp but with enough space to cut the hair just above where it was tied. If the participant's hair was less than 2cm long, the nurse could cut multiple samples. The hair sample was then cut, as close as possible to the scalp (between the hairband and scalp) with the scissors. The scissors included a ruler on the blades to help the nurse measure the width of the hair sample.

The nurse then placed the foil sheet on the table and stuck a red arrow sticker to the foil pointing at the top end of the hair sample to indicate the end of the hair strands closest to the scalp. The hair was positioned so that the foil was the length of the hair and that there was enough foil to fold over. The aluminium foil was then folded over the enclosed hair and the hair was packed in a way that it did not fold or move around too much. The nurse put the folded foil containing the participants hair sample into the Ziploc bag, and placed this with the consent form into a pre-addressed and pre-paid envelope to return it to the university. The

⁶ Consent forms are available online:

https://www.understandingsociety.ac.uk/sites/default/files/downloads/documentation/innovation-panel/fieldwork-documents/wave-12/ip12_consent_forms.pdf Booklets available at:
https://www.understandingsociety.ac.uk/sites/default/files/downloads/documentation/innovation-panel/fieldwork-documents/wave-12/ip12_health_measures_sample_collection-leaflets.pdf

hair analysis was undertaken by Professor Clemens Kirschbaum at the Technical University of Dresden. The samples were analysed for a steroid panel, including dehydroepiandrosterone, progesterone, testosterone, cortisol and cortisone.

3b. Dried blood spots

If eligible, participants were asked to collect, or to consent to the nurses collecting a dried blood spot sample on a Whatman 903 Protein Saver card using a BD safety lancet.

Participants were ineligible if they: were pregnant; had clotting or bleeding disorders; were on anti-coagulant medication (e.g. Warfarin, Sinthrome (Acenocoumarol), Pradaxa (Dabigatran Etexilate), Xarelto (Rivaroxaban) or Phenindione); had a recent mastectomy and there was swelling of the arm; were on renal dialysis; or they volunteered that they were HIV, Hepatitis B or Hepatitis C positive.

The protein saver card contained five circles. Each of these circles can hold 75 to 80µL of blood collected from a finger-prick. First, the participant washed their hands in warm soapy water to stimulate blood flow, and then thoroughly dried their hands. The dried blood spot collection was done when the participant was sitting, and the nurse/participant was instructed to use the participant's non-dominant hand. A Medisave alcohol wipe was provided and used to wipe the selected finger-tip. A moist wipe was provided in case the participant did not want to use an alcohol wipe. Once the finger was dry, a lancet was used to puncture the skin on the side of the finger. The nurse/participant first checked to ensure that the sterility cap was still fixed to the device to indicate that it was unused and sterile. The first drop of blood was wiped away with a moist wipe, the finger was massaged gently to produce the drops of blood. The drop was allowed to fall onto one of the printed circles on the protein saver card. The blood card included five circles and the nurse/participant was encouraged to fill all five of the circles with blood spots. Once the dried blood spot collection was complete, the finger was wiped with gauze and a plaster put onto the wound. The dried blood spot card then had to be kept uncovered and left to dry for at least four hours, and no longer than 24 hours. Once the blood was dry, the card could be folded close and placed with desiccant packs into the Ziploc® bag. The used lancet, and any spare lancets, were placed into a plastic tube and sealed. This tube was put into a rigid box capable of protecting contents from outside influences, which was placed into the pre-paid return envelope along with the Ziplock bag containing the card.

When nurses carried out the dried blood spot collection, they were also provided with isopropyl alcohol hand gel, disposable gloves, micropore tape and a gauze pad.

Samples initially analysed at the NIHR BRC Nutritional Biomarker Laboratory, Cambridge for the following markers: total cholesterol and high-density lipoproteins (HDL), triglyceride levels, HbA1c (glycosylated haemoglobin) and C-reactive protein. Future plans include producing interleukin-6 and testosterone and nutritional markers.

3c. Peripheral venous blood samples

Nurses trained in phlebotomy asked eligible participants for their written consent to collect venous blood samples.⁷ Participants were ineligible if they were pregnant; had clotting or bleeding disorders; were on anti-coagulant medication (e.g. Warfarin therapy); had a recent mastectomy and there was swelling of the arm or they were on renal dialysis.

The nurse then ensured that they and the participant were in a comfortable, suitable and well-lit position to start collection of the blood sample, and to cope with any potential fainting or fitting. The participant was asked to remove any outer garments, and to roll their sleeves up. The nurse checked with the participant that they had not had any previous problems having blood taken, and whether they had any known allergies to alcohol swabs or plasters. The nurse then inspected the antecubital fossa on each arm to decide, with the participant, which vein was most suitable, (either visually or through palpation). The nurse washed their hands with an antibacterial gel and lay out their equipment, including the vacutainer tubes in the order they were to be used (see Table 6 below). The nurse used an alcohol swab to clean the selected area for 30 seconds and allowed it to dry. The nurse then put on disposable gloves and instructed the participant to relax and to remain as still as possible. A disposable tourniquet was tied around the upper arm, and then the nurse stabilised the vein and inserted the needle, bevel up, into the vein. After the first tube was filled to the marking, the tourniquet was loosened, and the other tubes attached.

Once the tubes were filled, the nurse removed the needle while applying pressure to the venepuncture area with a gauze swab. The participant then applied gentle pressure to the wound area. The nurse then disposed of the used needle into a sharps bin before inspecting the venepuncture site and covering it with a plaster or gauze with micropore. After removing

⁷ Consent forms are available online at https://www.understandingsociety.ac.uk/sites/default/files/downloads/documentation/innovation-panel/fieldwork-documents/wave-12/ip12_consent_forms.pdf

their gloves and using the antibacterial hand gel, the nurse checked that the participant was okay, and recorded the outcome of the blood draw into the CAPI interview. The information recorded was whether the tubes were fully filled, partially filled, or not filled, which arm was used for the blood draw, and whether there was any difficulty obtaining the blood sample. The nurse also recorded the type of venepuncture system (vacutainer needle or butterfly needle), the type of wipe used (alcohol, moist, or neither), who provided pressure to the puncture site, whether plaster or tape was used, and whether there was any abnormality noted with the participant after five minutes. The nurse left the information leaflet with the participant because it included information about who to contact should they experience any side effects as a result of the blood sample. The leaflet included information on any possible side effects they may experience such as pain and bruising, and how to care for the puncture site.⁸

The vacutainer tubes were filled, and gently inverted, in the following order of priority:

Table 6: Peripheral venous blood samples

Equivalent BD Vacutainer Tube to Cambridge	Markers
1 x 4ml K ₂ EDTA (Lavender) (with 8-10 inversions)	Interleukin-6
1x 6ml Serum (Red) (with 5-6 inversions)	C-Reactive Protein
	HDL and Triglycerides
	Total cholesterol
	Testosterone
1 x 2ml K ₃ EDTA (Lavender) (with 8-10 inversions)	HbA1c (Glycated Haemoglobin)
1x 6ml Serum (Red) (with 5-6 inversions)	Nutrition biomarkers (Folate, B12, Ferritin, 25-OH Vit D, Lipidomics)
1 x6ml Lithium Heparin (Green) (with 8-10 inversions)	Nutrition biomarkers (Retinol and other carotenoids, Plasma Vit A, Vit C, Vit E, Vit B1, Vit B2, Vit B6, Lipidomics)

⁸ The leaflets are available online at https://www.understandingsociety.ac.uk/sites/default/files/downloads/documentation/innovation-panel/fieldwork-documents/wave-12/ip12_health_measures_sample_collection-leaflets.pdf

Consent to collect biomeasures.

Biomeasures were collected before the interview by participants, during the interview by nurses and interviewers, or after the interview by participants. Exclusion criteria are noted above. Those eligible were asked their consent verbal or in writing. Written consent was requested from adult participants (aged 16 and over) for the collection of dried blood spot samples, hair samples and peripheral blood samples (the latter in nurse-led mode only). For the collection of hair samples from children aged 10-15, written consent was requested from parents and written child assent was also recorded. For the collection of other bio-measures (BP, height and weight), verbal consent was requested from participants prior to the measurements being carried out and recorded in CAPI by the nurse or interviewer.

The type of consent sought for each component of the study is summarised in Table 5 (below).

Table 5: Type of consent obtained from participant

Adult participants	
Experiment	Type of consent from participant
Questionnaire	Verbal consent (recorded on CAPI or online)
Audio recording section of interview	Verbal consent (recorded on CAPI)
Self-measurement of blood pressure	Implied consent (by taking and recording blood pressure)
Height	Verbal consent (recorded on CAPI)
Weight	Verbal consent (recorded on CAPI)
Nurse/interviewer administered blood pressure measurement	Verbal consent (recorded on CAPI)
Feedback of blood pressure	Verbal consent (recorded on CAPI)
Hair sample	Written consent
Dried blood spot sample	Written consent
Peripheral blood sample (nurse only)	Written consent
Feedback of blood results	Written consent
Child participants (10-15 years old)	
Youth self-completion questionnaire	Implied consent (parent/guardian passes to child, child completed and returns the questionnaire)
Hair sample	Written parental/guardian consent and written child assent

In the event of receiving a sample from a participant in the two self-collecting groups, which was not accompanied by a consent form, the participant was contacted to remind them to send the consent form. In the event of not being able to contact the participant, or not

receiving the consent form within 21 days, the sample was destroyed (via incineration) by the School of Biological Sciences (University of Essex).

Return of samples

Peripheral blood samples were posted by the nurses directly to the NIHR BRC Nutritional Biomarker Laboratory in Cambridge for analysis using same day collection post boxes.

Vacutainers containing peripheral blood samples were contained within a triple packaging system. It consisted of three layers as follows:

1. Primary receptacle - a primary leak-proof vacutainer containing the specimen.
2. Secondary packaging - a second durable, leak-proof mailing pack which securely held and protected the vacutainers. This mailing pack was made of rigid plastic with super absorbent lining and was compliant with UN3373 regulations.
3. Outer packaging – the secondary packaging was placed in an outer shipping envelope with suitable cushioning material, capable of protecting contents from outside influences, such as physical damage, while in transit.

The outer packaging had a clearly identifiable UN Hazard Logo (UN3373).

Participants in the two self-collecting groups (participant-led web mode and interviewer mode) were asked to return the dried blood spot sample and hair sample collected, consent forms and the sample collection kit components back to the University of Essex using a pre-addressed envelope and secure packaging included in the sample collection pack sent out to them. Participants in the nurse group also needed to return their dried blood samples because these needed to stand out to dry before being packaged up to return. The nurses returned the hair samples to the University of Essex. A checklist sticker was placed on each box to ensure that all required components were included prior to posting the samples to the University of Essex.

Hair samples were contained within a triple packaging system. It consisted of three layers as follows:

1. Primary receptacle – Hair was contained within foil packaging following collection

2. Secondary packaging – The hair sample collection was placed in a durable, ZipLoc® bag.
3. Outer packaging – the secondary packaging was placed inside a pre-addressed mailing envelope.

Dried blood spot samples were contained within a triple packaging system. It also consisted of three layers as follows:

1. Primary receptacle - The multipart collection paper was imprinted with five half-inch circles and has a wraparound cover to protect the sample following collection.
2. Secondary packaging – The dried blood spot sample collection card was placed in a durable, ZipLoc® bag.
3. Outer packaging – the ZipLoc® bag was placed in a rigid box capable of protecting contents from outside influences, such as physical damage, while in transit.

The lancet used was a lancing device which incorporated both the lancet and the firing mechanism in a single unit. The lancets activate only when pressed against the skin and have an automatic retraction into the device to minimize the possibility of injury or being reused. The devices used on the study were the same that were being used by the NHS and complies with the EU Sharps Directive to reduce the risk of sharps injuries to those using it. Used and unused lancets were returned within a triple packaging system. It consisted of three layers as follows:

1. Primary receptacle - The lancet blade was manufactured to be contained within a plastic encasing. The blade was not exposed following use. Unused lancets had a safety cap over the opening.
2. Secondary packaging – The used and unused lancets were placed in a screw-top tube made of tough, durable, plastic. The tubes complied with UN3373 and Packaging Instruction P650.

3. Outer packaging – the secondary packaging was placed in a rigid box capable of protecting contents from outside influences, such as physical damage, while in transit. The boxes used complied with UN3373 and Packaging Instruction P650.
4. The triple packaging system was placed inside a pre-addressed mailing envelope.

The NHS currently posts lancets to those involved in STI testing programmes. They ask participants to return all used and unused kit components (including lancets) in this way through the post following sample collection. We introduced an additional protection measure by including the durable plastic tube where the lancets will be contained during transport.

This triple packaging system was placed inside an additional packaging layer, a pre-addressed mailing envelope. Participants were asked to place the hair sample (packed as described above) along with the dried blood spot/kit packaging in the mailing envelope and the signed consent form and return it to the University of Essex. A clearly identifiable UN Hazard Logo (UN3373) was printed on the pre-addressed external mailing envelope.

On arrival at the University of Essex, the parcel was securely transported to a laboratory at the School of Biological Sciences. In addition to the samples, the package was checked to ensure the participant's consent form had been returned. If the consent form was included and correctly completed, the dried blood spot samples were sent to the laboratory for analysis. Hair samples were stored temporarily in a secure location (at room temperature) and were sent in a single batch to the laboratory at the Technical University of Dresden, Germany for analysis. Any used and unused kit components (e.g., lancets) were destroyed through autoclaving/incineration through the School of Biological Sciences.

Feedback of results

Adults in half of the households (randomly allocated) were offered feedback of results from the venous blood samples. This was done to test the effect of offering feedback of results on participation in the survey and take-up of the biomeasures. For those in the feedback treatment group the consent form included a box to tick if they wanted to be given their results for HbA1c, HDL, and total cholesterol.

Participants' results were returned as falling within a range and not a specific value (i.e., this was not a clinical diagnosis) with a recommendation to see their GP if their results are high. These levels are defined as follows for whole blood samples:

HDL:

Below normal: > 1mmol/L

Normal: 1mmol/L and above

HbA1c:

We have separated these for diabetics and non-diabetics.

Non-diabetic:

Normal: 6% or less

Above normal: > 6%

Diabetic:

Normal: 6.5% or less

Above normal: > 6.5%

Total Cholesterol:

Normal: 5mmol/L or less

Above normal: >5mmol/L

Equivalent values for dried blood spot samples were also provided.

Audio recording

Participants' verbal consent was sought for recording specific sections of the face-to-face interviews in the nurse and interviewer groups. The audio files will not be transcribed but will be used to understand concerns and/or challenges participants expressed with different measures over and above what is formally records by interviewer.

The following sections of the face-to-face interviews were audio recorded:

1. questions about the participant self-measurement of BP
2. introduction to bio-measures and collection of biological samples in nurse group
introduction to bio-measures in interviewer group
3. interviewers introducing the biological sample collection kit
4. height and weight measurements
5. BP measurement carried out by nurse/interviewer

Follow-up interviews

All participants were invited to take part in a follow-up interview and sent an unconditional £5 voucher with their invitation. The follow-up survey was in the form of a paper questionnaire that was given to participants after the completion of the study to understand

why they agreed/or did not agree to take part, and for those that took part to understand their experiences of the data collection process. We also asked for consent to contact participants via a telephone call, following the completion and return of this questionnaire, if we felt that this was necessary.

Ethical and regulatory considerations

The study was low risk overall. The primary potential risk was a breach of confidentiality, this is taken very seriously and long-standing. Systems are in place for *Understanding Society* at the University of Essex, and fieldwork subcontractors Kantar and NatCen, to prevent this, based on the standards required by ISO27001. There was a slight risk that some participants may feel embarrassment or distress related to specific questions or providing biological samples. This was dealt with in several ways. The nurses and interviewers were trained to be sensitive to such responses and to treat participants sympathetically. Participants were informed that their overall participation and responses to any particular question(s) were voluntary and that they did not have to answer every question put to them or provide any of the biological samples. Participants who completed the questionnaire online did not have to answer each question and could skip those questions they felt uncomfortable answering.

Peripheral blood samples were only collected by registered nurses trained in phlebotomy. Some individuals may have experienced some minor discomfort, slight bruising or a little bleeding from the dried blood spot collection and peripheral blood sampling procedures. However, the effects would have been minor and should not have persisted beyond a few days. There may have been some individuals who might have felt faint during or after the blood sampling process. In the nurse group, if at any point this were to happen the process would have been stopped immediately. Participants in the self-collection groups were advised to stop the sample collection process immediately in the event of feeling faint. Participants were asked to be sitting down during the collection of all blood samples in all groups.

Nurse and interviewer training played a central role in reducing risk and burden for research participants. The bio-measure training involved specification of training objectives for each measure, use of multiple methods of instruction, hands-on practice and feedback, certification and refresher training. Interviewers and nurses that conducted the fieldwork were well trained and provided with guidance including the support of a study doctor.

The study was reviewed and approved by the NHS Health Research Authority: East of England – Essex Research Ethics Committee, REC reference: 19/EE/0146.

Further information

For more information about IP12 fieldwork and data, please consult these sources:

The IP12 User Guide:

Institute for Social and Economic Research (2020). Understanding Society – The UK Household Longitudinal Study, Innovation Panel, Waves 1-12, User Manual. Colchester: University of Essex.

https://www.understandingsociety.ac.uk/sites/default/files/downloads/documentation/innovation-panel/user-guides/ip_user_guide.pdf

The IP12 Technical Report:

Understanding Society Innovation Panel Wave 12: Technical Report.

https://www.understandingsociety.ac.uk/sites/default/files/downloads/documentation/innovation-panel/technical-reports/ip12_technical_report.pdf

The data are available from the UK Data Archive

University of Essex, Institute for Social and Economic Research. (2021). Understanding Society: Innovation Panel, Waves 1-12, 2008-2019. [data collection]. 10th Edition. UK Data Service. SN: 6849, <http://doi.org/10.5255/UKDA-SN-6849-13>

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