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Extended field efforts to reduce the risk of non-response bias: Do they pay off?

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Extended field efforts to reduce the risk of non-response bias: Do they pay off?

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Non-Technical Summary

Many social surveys in the UK are based on random samples of residential addresses. The success of these surveys depends on the co-operation of the residents of those addresses. However, this co-operation is not always easy to achieve. Some people are hard to find at home, while others are reluctant to give up their time to be interviewed. Survey organisations often make considerable – and costly – efforts to find people at home and to persuade them to be interviewed. In this paper we examine what difference those efforts make to survey estimates. We look separately at the effects of, a) trying to persuade people who initially refuse to take part, and b) trying to make contact with people who were not found at home after several attempts. We look at the effects on estimates of both demographic and substantive variables from the Health Survey for England 2006 and 2007, the British Social Attitudes Survey 2006 and 2007, and the Family Resources Survey 2007. We compare our estimates to equivalent estimates for the same surveys a decade earlier. This provides useful insights into trends in non-response bias in the UK over a ten-year period. Additionally we assess whether statistical weighting can be used to achieve the same improvement in the survey estimates as is achieved by the expensive field work efforts.

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Abstract

We examine the effects on survey estimates of extended interviewer efforts to gain survey response, including refusal conversion attempts and attempts to make contact with hard-to-contact sample members. Specifically, we update and extend the research of Lynn & Clarke (2002). We estimate bias reduction for demographic and substantive variables from the Health Survey for England, the British Social Attitudes Survey, and the Family Resources Survey and we assess change over a ten-year period. We consider a more precise measure of the difficulty of contact, which was not available to Lynn & Clarke, and we assess the effect of extended efforts on weighted estimates.

Keywords: interviewers, non-contact, non-response, refusal

JEL Codes: C81, C83

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1. Introduction

Non-response is a serious concern for survey researchers. The aspect of central concern is the possibility that non-response may be systematic with respect to key survey estimates, leading to bias in those estimates (Lynn 2008). However, while survey methodologists have learnt a lot about ways in which features of survey design and implementation can affect response rates, effects on non-response bias are generally much harder to predict or to identify (Groves 2006). Consequently, surveys typically go to great efforts to maximise response rates in the hope that this will reduce non-response bias, rather than specifically targeting bias.

One technique designed to maximise response rates involves making extended field efforts in the case of face-to-face surveys (Lynn et al 2002). These extended efforts include making additional attempts to persuade sample members who initially refuse to take part and making additional visits to try to contact sample members who have not been contacted after 'normal' or 'minimum' field procedures have been completed. A couple of decades ago, survey organisations used to implement such extended efforts only *in extremis*, i.e. when a survey was unexpectedly suffering from an unusually low response rate. But these extended efforts are now seen as good practice for all scientific studies for which accuracy of estimation is important. These extended efforts can account for a sizeable proportion of the field budget and must therefore be justified in terms of cost-effectiveness. Central aims of this paper are therefore to establish the extent to which extended efforts, a) improve response rates, and b) reduce non-response bias. An additional aim is to assess the extent to which these factors may have changed since a decade previously. Regular reassessment of the justification for survey design features is warranted in a changing world where propensities to be contacted and propensities to co-operate with surveys are likely to change both over time and between sample subgroups. In the past decade in the UK, response rates have continued to decline on several major surveys (e.g. Betts & Lound 2010, p.7). Although there is some evidence that it has become more difficult to contact people at home, the decline in response is mainly due to an increase in refusals. To tackle both forms of non-response, survey organisations have had to invest greater field resources and to consider new tactics. For example, analysis of process data from general population face-to-face surveys carried out by the National Centre for Social Research (NatCen) shows that the mean number of interviewer visits before a final outcome of non-contact is recorded (not including reissues to a different interviewer) was 6.6 in 1995/1996, 7.6 in 2006 and 8.0 in 2009/2010.

A decade ago, Lynn and Clarke carried out a study with similar aims to ours. They concluded that extended field efforts appeared to be justified in terms of bias reduction. In particular, they identified significant bias reduction in all three of the surveys they examined due to contacting those who were initially difficult to contact. The impact of extra efforts to convert initial refusals was less clear cut: refusal conversion appeared to affect the estimates of financial variables but there was no systematic impact on estimates related to health or attitude variables. We replicate the methodology of Lynn and Clarke using data from three large national general population surveys that they too used, namely the Health Survey for England (HSE), the British Social Attitudes (BSA) survey and the Family Resources Survey (FRS). We use data from 2006 and 2007 for the HSE and BSA, and 2007 for the FRS. Using the same methodology and the same surveys, both of which are still carried out by the same organisation as ten years previously, gives us a strong basis for drawing conclusions about changes in effects over this period.

Additionally, we are able to extend the work of Lynn and Clarke in two important ways. First, we use a more precise measure of the difficulty of contact, which was not available to Lynn & Clarke, and we assess the sensitivity of the findings to the choice of measure. Second, we also assess the effect of extended efforts on weighted estimates, to establish the extent to which weight adjustments for non-response can overcome any differential non-response bias. If weighting were able to achieve the same bias-reduction effects as extended field efforts, this would greatly reduce the justification for investing in expensive field efforts.

2. Methods

2.1 The Data

All three surveys used in the Lynn and Clarke (2002) paper are currently still ongoing, and we are therefore able to utilise more recent years of these same surveys for our analysis. We have used the 2006 and 2007 years of the BSAS and the HSE, and the 2007 year of the FRS. These surveys were chosen by Lynn and Clarke because they differ in terms of subject matter, respondent burden, respondent selection criteria, response rates, and the extent to which they rely on extended interviewer efforts. The fieldwork for the first two surveys is conducted wholly by the National Centre for Social Research (NatCen), while the latter

survey has fieldwork conducted jointly by both the Office for National Statistics (ONS) and NatCen. Consequently, we have only used one half of the FRS data for our analysis due to data availability. This follows the approach of Lynn and Clarke. The sample is split between the two organisations in such a way as to keep its stratified random sampling properties.

The BSAS consists of a face-to-face computer-assisted interview followed by the administration of a paper self-completion questionnaire, with fieldwork carried out in the spring and summer of each survey year. It measures attitudes, values and beliefs on a range of political and social issues and is a stratified random probability sample of private households within Britain selected from the Postcode Address File (PAF). One adult aged 18 or over is selected per household to answer the questionnaire (both the face-to-face component and the self-completion component). In 2006 and 2007 the BSAS interviewed approximately 4,000 individuals in each year, with response rates of 54% and 51% respectively.

The HSE comprises a series of annual surveys covering the adult population aged 16 and over living in private households in England. The survey provides regular information that cannot be obtained from other sources on a range of aspects concerning the public's health and many of the factors that affect health. As with the BSAS it is a multi-stage stratified probability sample selected from the PAF. However, unlike the BSAS all adults aged 16 years or older are selected for the face-to-face interview. In 2006 there were 14,142 interviews with adults representing a response rate of 61%, and in 2007 6,882 adults were interviewed with a response rate of 58%.

The FRS has a similar sampling design to the BSAS and HSE (multistage stratified random sample from the PAF) and is representative of adults aged 16 and above (non-dependents). As with the HSE, all adults in the household are interviewed, and the annual target sample size is 24,000 households. The face-to-face interviews are mainly concerned with income, living standards and related issues. The data analysed here are from the 2007-08 FRS, which had an achieved response rate of 58% (23,121 fully co-operating households in Great Britain).

For all three surveys interviewer effort is captured through the sample management system. Interviewers were asked to record for each address the date, time and outcome of each visit made. The outcome categories were: no reply, contact made, appointment made, any CAPI interviewing done, or other. The 'other' category includes refusals and ineligible, thus from

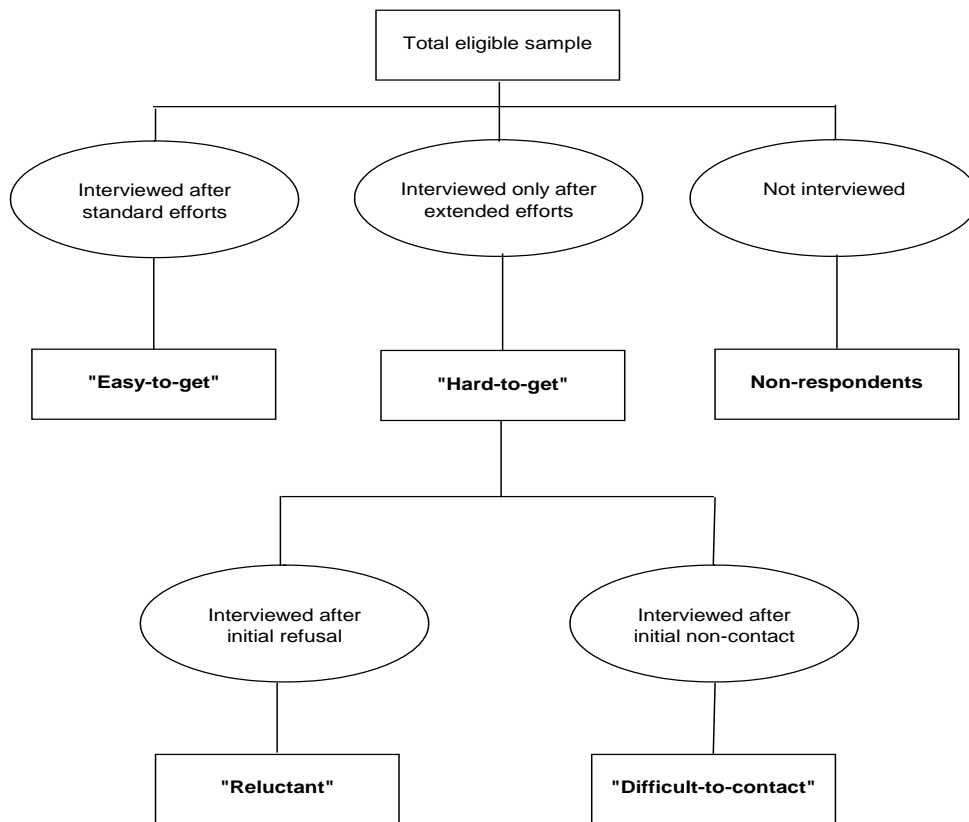
this code once final productive addresses are isolated we can deduce whether any visits to these addresses resulted in a refusal. This information was captured on the paper-based Address Record Form and subsequently entered into the electronic sample management system at regular intervals throughout the fieldwork period.

2.2 Definitions

Following Lynn and Clarke, “reluctant” responding households are classified as all those households that initially refused to take part in the survey but subsequently agreed to be interviewed after being reissued to another interviewer. The “difficult-to-contact” households are all those households that required 6 or more visits before an interview was obtained . The “reluctant” and “difficult-to-contact” households when combined form the “hard-to-get” group (see Figure 1) – that is, these cases were the ones where extended efforts were needed on the part of the interviewer. We term all responding households where extended efforts were not required as “easy-to-get”, though it must be borne in mind that this is a relative term. Figure 1 is used to illustrate this categorisation (Lynn and Clarke, 2002).

As in Lynn and Clarke (2002), we present findings based on the definition of “difficult-to-contact” if the household was only interviewed after 6 or more visits ($v=6$). Lynn and Clarke had recognised that total number of visits was not ideal as a measure of “difficult-to-contact”, particularly because successful interviewer strategies involve leaving and returning on another occasion in order to avoid prompting a refusal. Hence, total number of visits is influenced by reluctance as well as ease of contact. Their preferred definition would have been based on whether contact was made before 6 visits. Unfortunately Lynn and Clarke were unable to use this measure for all of the surveys they analysed as the information needed was not routinely recorded in an electronic format at that time.

Figure 1 - Classification of households



Nonetheless, Lynn and Clarke were able to use paper-based records for one survey (BSA 1998) to determine the difference this alternative definition made to the percentage classed as “difficult-to-contact”. They concluded that: “The extent to which total number of visits may mislead as a measure of difficulty in contacting households is obvious...of the 4.6% of households for which 10 or more visits were needed..., less than half required 10 or more visits to make contact with the household...”. However, Lynn & Clarke did not compare estimates of bias using this alternative definition of "difficult-to-contact" with estimates based on total number of calls.

Since the introduction of routine electronic recording of the outcome of every visit made to an address during the fieldwork process, we can now make this adjustment for each survey quite easily. Therefore we have extended the Lynn and Clarke research by using this alternative definition as well as the original definition and comparing the two to provide an assessment of the sensitivity of the findings to the measure used.

2.3 Weighting for Non-Response Bias

All three surveys weight respondents to try and adjust for biases caused by differential non-response. The weighting for the BSAS first involves fitting a logistic regression, with the dependent variable indicating whether or not the selected individual responded to the survey. A number of area-level and interviewer observation variables were used to model response, such as Government Office Region (GOR), dwelling type, condition of the address, and whether there were entry barriers to the selected address. The final stage of the BSAS weighting adjusts the final non-response weight so that the weighted sample matches the population in terms of age, sex and region using calibration (using ONS mid-year population estimates).

The HSE weighting involved calibration weighting to ensure that the weighted distribution of household members in participating households matched ONS mid-year population estimates for age/sex groups and GOR. The aim of the calibration was to reduce non-response bias resulting from differential non-response at the household level. Adults in responding households were then given a non-response weight using logistic regression to reduce bias arising from individual non-response. Age group by sex, household type, GOR, and social class of the household reference person were entered into the model as covariates.

The FRS weighting did not involve logistic regression weighting but did involve calibration at different levels: individual, benefit unit, and household. The calibration variables used for individuals were age, sex and GOR. For benefit units they were presence of children (England and Wales with dependent children, Scotland with dependent children), and lone parents by sex of the parent. For households the variables used were tenure, council tax band and region (London, Scotland and all other England and Wales).

For the comparison of weighted estimates, presented in section 3.3 below, the overall responding sample and the ‘easy-to-get’ respondent sample are each independently weighted according to the weighting schemes set out here. We would expect this weighting to reduce differences in estimates between the samples, to the extent that the weighting variables are associated with the target variables of interest.

2.4 Analysis Methods

Estimates of marginal biases that would have been present in the survey had extended efforts not been made were calculated as the percentage or mean for the easy-to-get group less the percentage or mean for the overall responding sample. To test the significance of the marginal bias estimates in section 3.1 we performed t-tests between the easy-to-get group and the hard-to-get group (see Appendix), not taking into account the complex sample design of each survey (as this is what Lynn and Clarke did). For the extension analysis of sections 3.2 and 3.3 we performed t-tests between the easy-to-get group and all respondents, taking into account the complex sampling (clustering and stratification) of each survey. Additionally, weighting was applied when running the t-tests in section 3.3. SPSS version 18 and Stata version 10 were used for the analysis. Missing values were dealt with using pairwise deletion.

Significance was evaluated at the 95% level, although significance at the 90% level is also indicated.

3. Results

3.1 Replication of Lynn & Clarke Study

As in Lynn and Clarke (2002), we present findings based on the definition of “difficult-to-contact” if the household was only interviewed after 6 or more visits ($v=6$). We also carried out sensitivity analyses using $v=8$ and $v=10$. Most of the broad patterns found using $v=6$ remained for $v=8$ and $v=10$. In some cases, the differences between the “difficult-to-contact” and “easy-to-get” households become smaller as the definition of “difficult-to-contact” is made more restrictive, but all of the differences that were significant with $v=6$ remained significant with $v=8$ and $v=10$ for the demographic variables in both surveys. For the remainder of this paper, we only present results based on $v=6$.

Tables 1, 2 and 3 present estimates of the proportion of sample households classified as difficult to contact, reluctant, hard to get and easy to get, for HSE, BSA and FRS respectively. Estimates are presented separately for 2006 and 2007 and are compared with the estimates from Lynn & Clarke (2002) for the earlier years, which are: 1996 and 1997 in the case of HSE; 1995, 1996 and 1998 in the case of BSA; and 1997 for the FRS.

The proportion of the eligible sample classified as “difficult-to-contact” has, on average, increased for all three surveys. From 1995 to 2007, the proportion classified as “difficult-to-contact” increased from 14.4% to 20.1% for the BSA. The average over 1995-1997 for the BSA was 16.1% while for 2006-2007 the average was 18.0%. Similarly, for the HSE the proportion increased from 13.9% in 1996 to 19.1% in 2007. For 1996-1997 the average was 15.0%, while for 2006-2007 the average was 19.1%. For the FRS the proportion classified as “difficult-to-contact” increased slightly from 14.3% in 1997 to 14.8% in 2007.

For the HSE, the proportion of reluctant households also increased over this period – from 2.9% in 1996 to 8.2% in 2007 (with an average over 1996-1997 of 2.8% and an average over 2006-2007 of 8.7%). The picture is a bit more complicated for the BSA. In 1995, the proportion of reluctant households was larger than for 1996 and 1997 (10.7% compared to 2.3% and 6.1% respectively). However, there was a substantial increase in the proportion of reluctant households between 1998 and 2006 (6.1% compared to 28.4%). If we look at the averages, the increase in the proportion of reluctant households over time is further substantiated – the average for 1995-1997 was 6.4% while for 2006-2007 the average was 25.3%. There was also a large increase in the proportion of reluctant households in the FRS from 1997 to 2007 (increasing from 1.6% to 5.4%).

Although the proportion of refusals has increased over the years for both surveys, it is important to note that the proportion of reissued cases has also increased. In other words, a proportion of households 10 years ago may have been similarly reluctant but we never made an effort to convert them after their initial refusal. Therefore, we cannot conclude on the basis of these results that households are now more reluctant to take part than they were 10 years ago – the increase may simply be down to more refusals being reissued.

Lynn and Clarke identified a higher prevalence of “difficult-to-contact” households for the BSA surveys compared to the HSE and FRS (Lynn & Clarke 2002:9). However, in 2006 the HSE has a higher proportion of “difficult-to-contact” households when compared to the BSA (19.0% compared to 15.8%), and in 2007 the proportions are very similar (19.1% compared to 20.1%). Such variations are likely to be caused by differences in fieldwork practices across surveys and across years.

Table 1– HSE distributions of difficult-to-contact, reluctant and easy-to-get households

	HSE 1996	HSE 1997	HSE 2006	HSE 2007
	%	%	%	%
A. "Difficult-to-contact"	13.9	16.0	19.0	19.1
B. Reluctant	2.9	2.6	9.2	8.2
C. Hard-to-get (A+B)	16.9	18.6	28.2	27.3
D. Easy-to-get	83.1	81.3	71.8	72.7
E. All responding households (C+D)	100.0	100.0	100.0	100.0

Table 2– BSA distributions of difficult-to-contact, reluctant and easy-to-get households

	BSA 1995	BSA 1996	BSA1998	BSA 2006	BSA 2007
	%	%	%	%	%
A. "Difficult-to-contact"	14.4	18.9	15.0	15.8	20.1
B. Reluctant	10.7	2.3	6.1	28.4	22.1
C. Hard-to-get (A+B)	25.1	21.3	21.0	44.2	42.2
D. Easy-to-get	74.9	78.7	79.0	55.8	57.8
E. All responding households (C+D)	100.0	100.0	100.0	100.0	100.0

Table 3 – FRS distributions of difficult-to-contact, reluctant and easy-to-get households

	FRS 1997	FRS 2007
	%	%
A. "Difficult-to-contact"	14.3	14.8
B. Reluctant	1.6	5.4
C. Hard-to-get (A+B)	15.8	20.3
D. Easy-to-get	84.2	79.7
E. All responding households (C+D)	100.0	100.0

Tables 4, 5 and 6 show the five socio-demographic variables presented in Lynn and Clarke (2002), with an estimate of the marginal bias that would have occurred had extended efforts not been made. For all three surveys, the conclusions drawn in the Lynn and Clarke paper remain for the later survey years. Respondents in hard-to-get households are considerably younger, on average, than those in easy-to-get households (this difference has increased in both the HSE and BSA¹). Respondents in hard-to-get households are also much more likely to be employed than those in easy-to-get households, and the marginal bias for employment has increased noticeably since the earlier years of all three surveys. The “difficult-to-contact” remain the group with the highest percentage who are employed. For the HSE and FRS, hard-to-get households are also less likely to be owner-occupiers or white, findings that mainly agree with those of Lynn and Clarke (2002) (there was no significant difference in the proportion of owner occupiers for the FRS in 1997). For the BSA, hard-to-get households are more likely to be owner-occupiers in both 2006 and 2007, and less likely to be white in 2007 only. The latter conclusion is consistent with Lynn and Clarke (2002) but a statistically significant difference between hard-to-get and easy-to-get households in terms of the owner occupier variable is a new finding. Prior to 2006 the BSA survey reported a higher prevalence of owner-occupiers in the easy-to-get households (although not significant), whereas this trend has reversed in 2006 and 2007.

¹ We were unable to look at age for the FRS as they only released age group for 2007.

Table 4 – HSE: Demographic characteristics for easy-to-get and hard-to-get households

	Survey year	Difficult-to-contact	Reluctant	Hard-to-get	Easy-to-get	All responding households	Non-response bias ^a
Male (%)	1996	46.7	40.5	45.7	45.5	45.5	(0.0)
	1997	46.1	40.6	45.3	45.5	45.4	(0.1)
	2006	45.1	42.7	44.3	44.9	44.7	(0.2)
	2007	44.7	40.5	43.4	45.1	44.6	(0.5)
Age (Mean)	1996	39.4	46.5	40.7	47.9	46.7	1.2
	1997	39.5	45.4	40.3	47.6	46.3	1.3
	2006	42.1	46.7	43.6	51.5	49.2	2.2
	2007	43.5	46.3	44.4	50.8	49.1	1.8
Owner-occupier ^b (%)	1996	66.8	74.1	68.1	72.8	72.0	0.8
	1997	68.7	72.8	69.2	72.3	71.8	0.5
	2006	72.8	71.5	72.4	75.5	74.6	0.9
	2007	67.4	70.3	68.3	74.6	72.9	1.7
Employed ^c (%)	1996	66.6	47.7	63.3	50.9	53.0	-2.1
	1997	66.0	55.8	64.6	52.0	54.4	-2.4
	2006	69.4	56.8	65.3	49.9	54.2	-4.4
	2007	66.9	54.6	63.2	50.2	53.7	-3.5
White (%)	1996	92.0	90.9	91.8	94.1	93.7	0.4
	1997	91.8	90.2	91.6	94.8	94.2	0.6
	2006	88.0	89.7	88.6	91.9	91.0	0.9
	2007	85.9	85.4	85.7	91.1	89.6	1.4

^a: An estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for the hard-to-get households ($p < 0.05$).

^b: Percent owner-occupied includes own it outright, buying with the help of a mortgage or loan, and pay part rent and part mortgage (shared ownership).

^c: ILO definition

* Significant difference when $p < 0.10$.

Table 5 – BSA: Demographic characteristics for easy-to-get and hard-to-get households

	Survey year	Difficult-to-contact	Reluctant	Hard-to-get	Easy-to-get	All responding households	Non-response bias ^a
Male (%)	1995	46.5	48.3	47.3	45.5	45.9	(-0.4)
	1996	47.6	56.9	48.6	44.9	45.7	(-0.8)
	1998	48.9	37.5	44.2	45.3	45.2	(0.1)
	2006	45.9	43.9	44.6	44.7	44.6	(0.0)
	2007	43.7	43.1	43.4	44.6	44.1	(0.5)
Age (Mean)	1995	41.3	46.7	43.6	47.3	46.4	0.9
	1996	41.3	48.4	42.1	47.7	46.5	1.2
	1998	44.0	47.3	45.3	47.2	46.9	0.3
	2006	43.3	49.6	47.4	51.3	49.6	1.75
	2007	44.2	50.7	47.6	52.3	50.3	1.97
Owner-occupier ^b (%)	1995	68.7	68.7	68.7	68.5	68.6	(-0.1)
	1996	69.7	56.9	68.2	70.3	69.8	(0.5)
	1998	75.7	66.4	71.9	72.5	72.4	(0.1)
	2006	69.3	72.9	71.6	68.5	69.9	-1.3
	2007	71.0	73.7	72.4	69.2	70.6	-1.3
Employed ^c (%)	1995	65.9	50.6	59.4	49.2	51.8	-2.6
	1996	69.1	60.0	68.1	50.6	54.3	-3.7
	1998	71.2	59.4	66.3	54.9	56.5	-1.6
	2006	71.8	56.2	61.8	48.7	54.5	-5.8
	2007	69.2	53.7	61.1	46.5	52.7	-6.2
White (%)	1995	95.2	92.4	94.0	95.3	95.0	(0.3)
	1996	92.2	95.0	92.5	94.7	94.3	0.4
	1998	93.6	90.7	92.4	94.4	94.1	(0.3)
	2006	90.4	93.8	92.6	91.1	91.8	-0.6*
	2007	87.2	91.7	89.6	92.9	91.5	1.4
Adults in household (mean)	1995	2.66	2.82	2.73	2.84	2.81	0.03
	1996	2.55	2.51	2.55	2.71	2.67	0.04
	2006	2.37	2.30	2.32	2.18	2.25	(-0.06)

^a: An estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for the hard-to-get households ($p < 0.05$).

^b: Percent owner-occupied includes own it outright, buying with the help of a mortgage or loan, and pay part rent and part mortgage (shared ownership).

^c: ILO definition

* Significant difference when $p < 0.10$.

Table 6 –FRS: Demographic characteristics for easy-to-get and hard-to-get households

	Survey year	Difficult-to-contact	Reluctant	Hard-to-get	Easy-to-get	All responding households	Non-response bias ^a
Male (%)	1997	48.8	47.2	48.7	46.7	47.0	-0.3
	2007	47.8	45.9	47.3	46.8	46.9	(-0.1)
Owner-occupier ^b (%)	1997	64.5	71.7	65.2	65.7	65.6	(0.1)
	2007	67.7	68.7	68.0	70.7	70.2	0.6
Employed ^c (%)	1997	65.1	57.4	64.3	55.8	57.1	-1.3
	2007	56.4	48.5	54.3	40.7	43.4	-2.8
White (%)	1997	91.3	95.2	91.7	95.0	94.5	0.5
	2007	90.3	89.3	90.0	92.1	91.6	0.4

^a: An estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for the hard-to-get households ($p < 0.05$).

^b: Percent owner-occupied includes own it outright, buying with the help of a mortgage or loan, and pay part rent and part mortgage (shared ownership).

^c: ILO definition

* Significant difference when $p < 0.10$.

We now turn to estimates for seven important survey variables for the HSE, BSA and FRS respectively (Tables 7, 8 and 9). Again, the differences between the hard-to-get and easy-to-get households found in Lynn and Clarke (2002) remain for these later years. Persons in hard-to-get households are more likely to be regular smokers, are less likely to have a long-standing illness, and are likely to have lower body mass index and lower blood pressure².

For the BSA we again only see small differences in attitude scores between persons in easy-to-get households and those in hard-to-get households. Although there is now a significant difference for some measures (most were not significant in Lynn and Clarke), the differences are small in substantive terms.

For the FRS, persons in hard-to-get households work more hours per week, on average, than those in easy-to-get households. They also belong to households which obtain a larger proportion of their household income from employment and a smaller proportion from state

² We were unable to compare 'heavy drinkers' with the results in Lynn and Clarke as the questions relating to this in the HSE have been changed to reflect the Department of Health's recommendations (they now recommend a maximum of 2-4 units daily, whereas their previous recommendation was 21 units weekly).

benefits. Hard-to-get households also have higher housing costs than easy-to-get households, on average³.

Table 7 – HSE survey estimates for easy-to-get and hard-to-get households

	Survey Year	Difficult-to-contact	Reluctant	Hard-to-get	Easy-to-get	All responding households	Non-response bias ^a
Regular smokers ^b (%)	1996	28.8	24.5	28.1	23.9	24.6	-0.7
	1997	29.7	29.5	29.7	22.9	24.1	-1.2
	2006	18.6	21.3	19.5	16.6	17.4	-0.8
	2007	19.8	20.1	19.9	16.6	17.5	-0.9
Body mass index (mean)	1996	25.3	25.9	25.4	26	25.6	0.1
	1997	25.8	26.8	25.9	36.4	26.3	0.1
	2006	26.9	27.1	27.0	27.3	27.2	0.1
	2007	26.7	27.1	26.8	27.2	27.1	0.1
Systolic blood pressure (mean)	1996	132.1	138.1	133	136.6	136.1	0.5
	1997	131.1	136.8	131.9	135.7	135.1	0.6
	2006	128.5	130.0	129.0	132.0	131.2	0.7
	2007	128.0	130.6	128.7	131.2	130.6	0.6
Longstanding illness ^c (%)	1996	35.9	41.9	37	43.9	42.8	1.1
	1997	37.6	40.8	38	45.9	44.4	1.5
	2006	35.8	43.9	38.5	48.5	45.7	2.8
	2007	37.2	48.2	40.5	47.6	45.7	1.9

^a: An estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for the hard-to-get households ($p < 0.05$).

^b Regular smokers are defined as respondents who report smoking more than 5 cigarettes per day on average.

^c Longstanding illness includes both limiting and non-limiting illness.

* Significant difference when $p < 0.10$.

³ We were unable to compare total household savings and whether the household has a savings account with the results in Lynn and Clarke as the variables used to derive these measures have changed.

Table 8 – BSA survey estimates for easy-to-get and hard-to-get households

	Survey Year	Difficult-to-contact	Reluctant	Hard-to-get	Easy-to-get	All responding households	Non-response bias ^a
Libertarian-authoritarian scale (mean score)	1995	68.2	69.7	68.8	68.4	68.5	(-0.1)
	1996	66.0	70.9	66.5	68.1	67.8	0.3
	1998	68.1	69.0	68.4	71.1	70.8	0.3
	2006	73.2	74.9	74.4	75.2	74.8	0.4
	2007	74.6	76.4	75.6	75.4	75.5	(-0.1)
Left-right scale (mean score)	1995	34.3	32.6	33.6	34.0	33.9	(0.1)
	1996	34.3	33.3	34.2	35.0	34.8	(0.2)
	1998	37.4	40.2	38.3	37.1	37.2	(-0.1)
	2006	53.4	52.8	53.0	52.5	52.7	(-0.2)
	2007	54.3	52.0	53.0	52.0	52.5	-0.4
Welfarist scale (mean score)	1995	47.4	50.6	48.7	47.8	47.9	(-0.1)
	1996	48.2	48.5	48.3	48.1	48.2	(-0.1)
	1998	50.2	53.6	51.3	52.3	52.2	(0.1)
	2006	59.2	59.6	59.5	60.5	60.1	0.5
	2007	61.9	62.4	62.2	61.0	61.5	-0.5

^a: An estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for the hard-to-get households ($p < 0.05$).

* Significant difference when $p < 0.10$.

Overall, our findings are consistent with Lynn and Clarke (2002). The demographic characteristics of respondents in hard-to-get households have remained the same as in previous years – they are more likely to be younger, employed, and non-white. The differences in survey variables for the HSE between the hard-to-get and easy-to-get households also remain.

However, both the reluctant and “difficult-to-contact” groups now make up a larger proportion of responding households than they did 10 years ago. While some of the increase in reluctant households could be due to a higher proportion of the population refusing to take part in surveys, it is more likely that most of the increase can be put down to changes in survey design, such as changes in fieldwork priorities and the amount of reissuing carried out.

Table 9 –FRS: survey estimates for easy-to-get and hard-to-get households

	Survey year	Difficult-to-contact	Reluctant	Hard-to-get	Easy-to-get	All responding households	Non-response bias ^a
Proportion of household income from employment	1997	59.0	42.6	57.5	42.6	44.9	-2.3
	2007	62.1	56.1	60.5	46.9	49.7	-2.8
Proportion of household income from state benefits	1997	24.3	36.9	25.5	36.3	34.6	1.7
	2007	18.0	22.9	19.3	29.4	27.3	2.0
Housing costs (£ per week)	1997	51.20	36.58	49.75	42.37	43.54	-1.17
	2007	84.56	78.52	82.94	67.27	70.45	-3.17
Hours worked per week	1997	40.2	39.6	40.2	39.2	39.3	-0.1
	2007	39.1	38.4	38.9	37.7	38.0	-0.3

^a: An estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for the hard-to-get households ($p < 0.05$).

* Significant difference when $p < 0.10$.

Lynn and Clarke (2002) state that “A clear message is that extended field efforts appear justified in terms of bias reduction”. This conclusion is substantiated by the results presented here. Indeed it appears that greater field efforts were required in 2006-07 to make similar bias reductions, compared to 1996-98.

3.2 Refining the measure of hard-to-contact

In this section, we adjust the analysis set out in Lynn and Clarke to account for when contact was first made at an address (for HSE 2006 and 2007, BSA 2006 and 2007, and FRS 2007). So instead of the definition of “difficult-to-contact” being based on the total number of visits to a household, the definition will now be based on whether contact was made before 6 visits. For example, if contact was made with a household on the 4th visit but the interview was not conducted until the 7th call, the previous analysis would have classed this household as “difficult-to-contact” based on $v=6$ (if they have never refused on any of the visits). However, in this section, this household will be classified as easy-to-get (with $v=6$), since contact was made before the 6th visit (albeit without an interview taking place on that particular visit).

Tables 10, 11 and 12 present the same demographic variables as in tables 4, 5 and 6 based on this new definition of “difficult-to-contact”. For the HSE (Table 10), the significant differences remain – that is, easy-to-get households are still older, more likely to be owner-occupiers, less likely to be employed, and more likely to be white. As expected, the estimates of marginal bias are now smaller in magnitude.

For the BSA (Table 11), the significant differences have altered slightly when using this new definition of “difficult-to-contact”; in 2006 and 2007 differences in age are no longer significant whereas differences in the proportion of white respondents have become significant in 2006. However, easy-to-get households are still significantly less likely to be owner-occupiers and less likely to be employed. Similarly to the HSE, the marginal bias estimates have reduced in magnitude.

For the FRS (Table 12), those in hard-to-get households are still more likely to be employed, but the findings that these households are less likely to be owner-occupiers and white are now only significant at the 10% level. Again, the marginal bias estimates have reduced in magnitude.

The conclusions drawn under the old definition remain using this better definition of “difficult-to-contact”. That is, respondents in hard-to-get households are more likely to be younger, employed, and non-white. This again confirms the conclusion that extended field efforts are needed in terms of reducing the risk of bias.

Table 10 – HSE: Demographic characteristics for easy-to-get and hard-to-get households using the updated definition of “difficult-to-contact”

	Survey Year	Difficult-to-contact	Reluctant	Easy-to-get	All responding households	Non-response bias ^a
Male (%)	2006	48.1	42.7	44.7	44.7	(0.0)
	2007	51.2	40.5	44.7	44.6	(0.0)
Age (Mean)	2006	43.7	46.7	49.8	49.2	0.6
	2007	47.1	46.3	49.4	49.1	0.4
Owner-occupier ^c (%)	2006	68.5	71.5	75.3	74.6	0.7
	2007	67.9	70.3	73.4	72.9	0.5*
Employed ^d	2006	70.7	56.8	53.0	54.2	-1.3
	2007	67.0	54.6	52.9	53.7	-0.8
White (%)	2006	88.6	89.7	91.3	91.0	(0.3)
	2007	88.7	85.4	90.1	89.6	0.4

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

^b: bias calculated as (easy to get households plus difficult to contact households) minus all responding households. Those in brackets indicate that the estimate for the easy-to-get households plus the “difficult-to-contact” households is not significantly different from the estimate for the reluctant households ($p < 0.05$).

^c: percent owner-occupied includes own it outright, buying with the help of a mortgage or loan, and pay part rent and part mortgage (shared ownership).

^d: ILO definition

* Significant difference when $p < 0.10$.

Table 11 – BSA: Demographic characteristics for easy-to-get and hard-to-get households using the updated definition of “difficult-to-contact”

	Survey Year	Difficult-to-contact	Reluctant	Easy-to-get	All responding households	Non-response bias ^a
Male (%)	2006	51.4	43.9	44.5	44.6	(-0.1)
	2007	42.8	43.1	44.4	44.1	(0.4)
Age (Mean)	2006	44.7	49.6	49.9	49.6	(0.3)
	2007	45.4	50.7	50.5	50.3	(0.2)
Owner-occupier ^c (%)	2006	73.1	72.9	68.5	69.9	-1.4
	2007	67.6	73.7	69.9	70.6	(-0.7)
Employed ^d	2006	74.9	56.2	52.5	54.5	-1.9
	2007	69.8	53.7	51.1	52.7	-1.6
White (%)	2006	89.7	93.8	91.1	91.8	-0.7
	2007	85.1	91.7	91.9	91.5	(0.4)

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

^b: bias calculated as (easy to get households plus difficult to contact households) minus all responding households. Those in brackets indicate that the estimate for the easy-to-get households plus the “difficult-to-contact” households is not significantly different from the estimate for the reluctant households ($p < 0.05$).

^c: percent owner-occupied includes own it outright, buying with the help of a mortgage or loan, and pay part rent and part mortgage (shared ownership).

^d: ILO definition

* Significant difference when $p < 0.10$.

Table 12 – FRS: Demographic characteristics for easy-to-get and hard-to-get households using the updated definition of “difficult-to-contact”

	Survey Year	Difficult-to-contact	Reluctant	Easy-to-get	All responding households	Non-response bias ^a
Male (%)	2007	48.6	45.9	46.9	46.9	(0.0)
Owner-occupier ^c (%)	2007	66.6	68.7	70.5	70.2	0.3*
Employed ^d	2007	57.8	48.5	42.3	43.4	-1.1
White (%)	2007	90.2	89.3	91.9	91.6	0.2*

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

^c: percent owner-occupied includes own it outright, buying with the help of a mortgage or loan, and pay part rent and part mortgage (shared ownership).

^d: ILO definition

* Significant difference when $p < 0.10$.

Tables 13, 14 and 15 present the survey variable estimates using this new definition of “difficult-to-contact” for HSE, BSA and FRS respectively. As seen in Tables 10, 11 and 12, the marginal bias estimates are now smaller compared to when we used the definition of “difficult-to-contact” set out in Lynn and Clarke. While these smaller differences remain significant for the HSE 2006, all but regular smoking become non-significant in the HSE 2007. The hard-to-get remain more likely to be regular smokers than the easy-to-get. This was true for both reluctant households and difficult-to-get households.

Using the original measure of “difficult-to-contact”, little variation was observed between easy-to-get and hard-to-get households for the BSA. Therefore, when using the revised “difficult-to-contact” definition, some additional attitudinal variables consistent from a time series perspective were added. The additional variables were selected on the basis of length of time series, being frequently used by analysts and possible to analyse (in the context of this analysis).

The original bias estimates have reduced in magnitude with the exception of the libertarian-authoritarian scale in 2007 (this bias estimate has also become significant at the 10% level whereas before it was not significant). The two biases which were significant at the 10% level previously have now become non-significant, while the bias associated with the welfarist scale in 2006 is now only significant at the 10% level. The only remaining bias at the 5% level is that associated with the welfarist scale in 2007.

With respect to the additional attitude variables there seems to be little overall or reluctant non response bias when considering self reported no religion, party identification, racial prejudice or attitudes to unemployment benefits. In 2006 easy to get respondents were significantly more likely to agree that sex before marriage was wrong (although this was only significant at the 10% level), and were more likely to belong to non-Christian religions.

For the FRS, while the magnitude of the marginal bias has reduced for all four of the survey variables examined, they all still remain significant under this new definition.

These results give mixed evidence for the need for extended efforts. Only a few variables (being a regular smoker, systolic blood pressure, having a longstanding illness, being of non-Christian denomination and the attitudinal question towards sex before marriage) have significant overall bias remaining in the 2006 surveys. However, the bias in most of the

survey specific variables disappears in the HSE and BSA 2007. However, the bias remains in all variables examined in the FRS 2007.

Table 13 – HSE survey estimates for easy-to-get and hard-to-get households using the updated definition of “difficult-to-contact”

	Survey Year	Difficult-to-contact	Reluctant	Easy-to-get	All responding households	Non-response bias ^a
Regular smokers ^b (%)	2006	18.3	21.3	16.9	17.4	-0.5
	2007	20.6	20.1	17.1	17.5	-0.4
Body mass index (mean)	2006	27.1	27.1	27.2	27.2	(0.0)
	2007	26.8	27.1	27.1	27.1	(0.0)
Systolic blood pressure (mean)	2006	129.2	130.0	131.5	131.2	0.2
	2007	131.1	130.6	130.6	130.6	(0.0)
Longstanding illness ^c (%)	2006	39.2	43.9	46.3	45.7	0.6
	2007	42.1	48.2	45.6	45.6	(-0.1)

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

^b Regular smokers are defined as respondents who report smoking more than 5 cigarettes per day on average.

^c Longstanding illness includes both limiting and non-limiting illness.

* Significant difference when $p < 0.10$.

Table 14 – BSA survey estimates for easy-to-get and hard-to-get households using the updated definition of “difficult-to-contact”

	Survey Year	Difficult-to-contact	Reluctant	Easy-to-get	All responding households	Non-response bias ^a
Sex before marriage wrong (%)	2006	10.7	10.2	14.5	13.1	1.4*
	2007	12.5	10.7	11.8	11.6	(0.2)
Sex between same sex adults wrong (%)	2006	29.6	31.0	36.5	34.6	(1.9)
	2007	25.5	41.0	37.7	37.8	(-0.1)
Conservative (%)	2006	25.7	24.4	26.3	25.8	(0.6)
	2007	23.9	27.6	25.6	25.9	(-0.4)
Labour (%)	2006	32.6	34.3	32.4	32.9	(-0.6)
	2007	37.8	35.6	33.9	34.5	(-0.6)
Liberal Democrats (%)	2006	9.7	11.5	11.8	11.7	(0.2)
	2007	9.5	8.1	9.6	9.3	(0.3)
Other political party (%)	2006	8.0	6.9	6.5	6.7	(-0.2)
	2007	5.4	6.1	6.6	6.4	(0.2)
No political affiliation (%)	2006	15.4	14.8	15.5	15.3	(0.2)
	2007	15.3	15.6	16.4	16.2	(0.2)
Religion - Christian (%)	2006	46.3	51.7	49.1	49.7	(-0.6)
	2007	49.1	52.8	50.5	51.0	(-0.4)
Religion - Non-Christian (%)	2006	5.1	3.0	5.1	4.5	0.6
	2007	3.2	4.2	4.7	4.5	(0.2)
No Religion (%)	2006	47.4	45.0	45.1	45.2	(-0.1)
	2007	46.8	42.8	44.2	44.0	(0.2)
Racially Prejudiced ^b (%)	2006	28.6	31.2	31.8	31.5	(0.3)
	2007	33.6	32.2	31.9	32.1	(-0.2)
Unemployment benefits too high (%)	2006	51.1	57.6	56.5	56.6	(-0.1)
	2007	59.4	58.1	55.2	56.1	(-0.9)
Libertarian-authoritarian scale (mean score)	2006	70.9	74.9	75.0	74.8	(0.2)
	2007	74.5	76.4	75.3	75.5	-0.2*
Left-right scale (mean score)	2006	53.4	52.8	52.7	52.7	(-0.1)
	2007	54.0	52.0	52.5	52.5	(0.0)
Welfarist scale (mean score)	2006	58.1	59.6	60.4	60.1	0.3*
	2007	62.0	62.4	61.2	61.5	-0.3

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

^b : Those who consider themselves to be very or a little prejudiced

* Significant difference when $p < 0.10$.

Table 15 – FRS: survey estimates for easy-to-get and hard-to-get households using the updated definition of “difficult-to-contact”

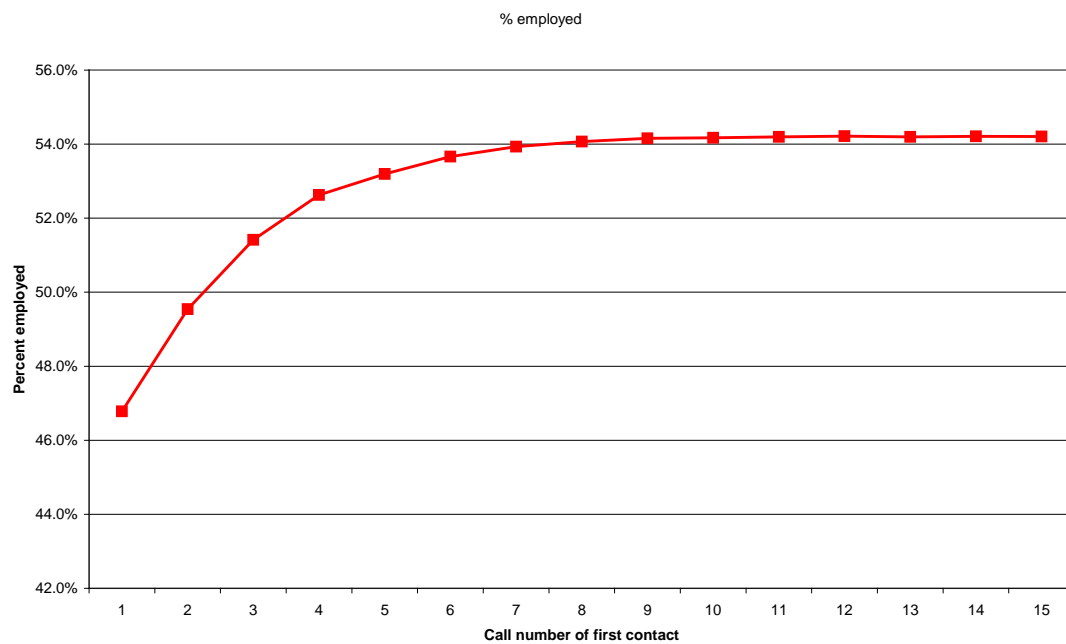
	Survey year	Difficult-to-contact	Reluctant	Hard-to-get	Easy-to-get	All responding households	Non-response bias ^a
Proportion of household income from employment	2007	61.2	56.1	58.5	48.6	49.6	-1.0
Proportion of household income from state benefits	2007	19.7	22.9	21.4	28.0	27.3	0.7
Housing costs (£ per week)	2007	79.4	78.5	78.9	69.5	70.4	-1.0
Hours worked per week	2007	40.1	38.4	39.3	37.9	38.0	-0.2

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

* Significant difference when $p < 0.10$.

To illustrate why it is important for interviewers to visit a household more than once, figure 2 plots the estimate of the percentage employed by when first contact was made at an address. For example, if we were to include only households where contact was made on the 1st or 2nd call, we would obtain an estimate of the percent employed of 49.5%. Using all households where contact was made before or on the 7th call, the estimate is 53.9%. It is not until interviewers have made 7 or more calls to achieve first contact that the estimate of the percent employed stables out – i.e. it appears that efforts after the 7th call (to make first contact) will not reduce the bias much, but calls before and including 7 are justified in terms of bias reduction.

Figure 2 – Estimates of the percent employed by when first contact was made at an address.



Lynn and Clarke recognised that using the total number of calls to an address to define “difficult-to-contact” was not ideal. Therefore, estimates of marginal bias based on this definition could be misleading. However, when we use a more appropriate measure of “difficult-to-contact” (based on the number of calls to first contact), we largely find that the conclusions drawn by Lynn and Clarke remain for the demographic variables (albeit with smaller estimates of bias). That is, extended field efforts both in the form of converting refusals and making numerous (perhaps as high as or higher than 7) calls to achieve contact are needed to reduce the risk of bias. However, the evidence for survey-specific variables becomes more mixed. In 2007, using the definition of “difficult-to-contact” as first contact being on or after 6 calls, limited bias remains in most of the survey variables. This suggests that calls after the 5th call to make first contact with a household are not needed to reduce the risk of bias in survey measures.

3.3 Impacts on weighted estimates

In this section we compare the easy-to-get households with all responding households in terms of weighted estimates. The easy-to-get households (using the adjusted definition as set out in section 3.2 above) have been weighted as if they were the final respondent pool, using

the same weighting procedure as used for all respondents in each survey, and as described in section 2.3.

Tables 16, 17 and 18 present weighted estimates for demographic variables and estimates of the marginal residual non-response bias, i.e. the difference between the two weighted estimates. Presented alongside for ease of comparison are the estimates of marginal non-response bias from Tables 10, 11 and 12. In both the HSE and the BSA the estimates of marginal non-response bias after weighting are generally smaller in magnitude than the estimates of marginal non-response bias from the unweighted data (the exceptions are percentage of males in the HSE in both 2006 and 2007, and the percentage of owner occupiers in the HSE 2007 and the BSA 2006). For the FRS, the bias associated with three of the four demographic variables have increased in magnitude, but they are now all not significant.

Table 16 – HSE: Demographic characteristics for easy-to-get and all responding households using the updated definition of “difficult-to-contact”, using weighted data

	Survey Year	Easy-to-get	All responding households	Non-response bias ^a	Non-response bias Unweighted
Male (%)	2006	48.2	48.4	(-0.2)	(0.0)
	2007	48.5	48.8	(-0.3)	(0.0)
Age (Mean)	2006	46.5	46.4	(0.1)	0.6
	2007	46.4	46.4	(0.0)	0.4
Owner-occupier ^b (%)	2006	73.6	73.1	0.4*	0.7
	2007	72.0	71.4	(0.6)	0.5*
Employed ^c (%)	2006	56.5	56.9	-0.4	-1.3
	2007	56.4	56.8	(-0.3)	-0.8
White (%)	2006	89.3	89.3	(0.0)	(0.3)
	2007	88.6	88.2	(0.4)	0.4

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

^b: percent owner-occupied includes own it outright, buying with the help of a mortgage or loan, and pay part rent and part mortgage (shared ownership).

^c: ILO definition

* Significant difference when $p < 0.10$.

Table 17 – BSA: Demographic characteristics for easy-to-get and all responding households using the updated definition of “difficult-to-contact”, using weighted data

	Survey Year	Easy-to-get	All responding households	Non-response bias ^a	Non-response bias Unweighted
Male (%)	2006	48.3	48.3	(0.0)	(-0.1)
	2007	48.4	48.4	(0.0)	(0.4)
Age (Mean)	2006	47.4	47.4	(0.0)	(0.3)
	2007	47.3	47.3	(0.0)	(0.2)
Owner-occupier ^b (%)	2006	69.4	70.9	-1.5	-1.4
	2007	71.3	71.7	(-0.4)	(-0.7)
Employed ^c (%)	2006	55.4	56.9	-1.5	-1.9
	2007	56.2	56.9	(-0.7)	-1.6
White (%)	2006	88.7	89.2	(-0.5)	-0.7
	2007	89.5	89.2	(0.3)	(0.4)

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

^b: percent owner-occupied includes own it outright, buying with the help of a mortgage or loan, and pay part rent and part mortgage (shared ownership).

^c: ILO definition

* Significant difference when $p < 0.10$.

Table 18 – FRS: Demographic characteristics for easy-to-get and all responding households using the updated definition of “difficult-to-contact”, using weighted data

	Survey Year	Easy-to-get	All responding households	Non-response bias ^a	Non-response bias Unweighted
Male (%)	2007	48.6	48.6	(-0.1)	(0.0)
Owner-occupier ^b (%)	2007	72.2	71.2	(0.9)	0.3*
Employed ^c (%)	2007	46.4	46.7	(-0.3)	-1.1
White (%)	2007	90.5	90.1	(0.4)	0.2*

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

^b: percent owner-occupied includes own it outright, buying with the help of a mortgage or loan, and pay part rent and part mortgage (shared ownership).

^c: ILO definition

* Significant difference when $p < 0.10$.

This is also true for the survey estimates in the HSE (Table 19). The HSE weighted estimates of marginal non-response bias for the survey variables are all smaller in magnitude than the unweighted estimates except for longstanding illness in the HSE 2007. This is also true for the FRS: all of the biases in survey estimates become smaller in magnitude and no longer significant (Table 21). On the other hand, the non-response bias remaining for the BSA weighted survey estimates are often larger in magnitude than the non-response bias found when using unweighted data (Table 14). This is true for 13 of the 15 survey estimates in the BSA 2007, and for 3 of the weighted survey estimates in the BSA 2006 (although most still not significant).

These results slightly weaken the case for investing in extended interviewer efforts. The findings suggest that appropriate weighting can remove much of the marginal non-response bias. However, the extent differs between variables. Broadly speaking we find that weighting corrects for the marginal non-response in the case of health variables (with the exception of smoking behaviour) and demographic variables (with the exception of housing tenure), but not for attitudinal variables.

Table 19 – HSE survey estimates for easy-to-get and all responding households using the updated definition of “difficult-to-contact”, using weighted data

	Survey Year	Easy-to-get	All responding households	Non-response bias ^a	Non-response bias Unweighted
Regular smokers ^b (%)	2006	17.4	17.8	-0.3*	-0.5
	2007	17.6	17.9	(-0.3)	-0.4
Body mass index (mean)	2006	27.0	27.0	(0.0)	(0.0)
	2007	27.0	27.0	(0.0)	(0.0)
Systolic blood pressure (mean)	2006	130.5	130.4	(0.0)	0.2
	2007	129.9	130.0	(0.0)	(0.0)
Longstanding illness ^c (%)	2006	42.5	42.6	(-0.1)	0.6
	2007	42.6	43.0	(-0.4)	(-0.1)

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

^b Regular smokers are defined as respondents who report smoking more than 5 cigarettes per day on average.

^c Longstanding illness includes both limiting and non-limiting illness.

Table 20 – BSA survey estimates for easy-to-get and all responding households using the updated definition of “difficult-to-contact”, using weighted data

	Survey Year	Easy-to-get	All responding households	Non-response bias ^a	Non-response bias Unweighted
Sex before marriage wrong (%)	2006	13.7	13.1	(0.6)	1.4*
	2007	11.1	11.5	(-0.4)	(0.2)
Sex between same sex adults wrong (%)	2006	34.7	33.7	(1.0)	(1.9)
	2007	37.1	37.6	(-0.6)	(-0.1)
Conservative (%)	2006	25.5	25.4	(0.2)	(0.6)
	2007	24.0	24.6	(-0.6)	(-0.4)
Labour (%)	2006	32.4	32.8	(-0.4)	(-0.6)
	2007	33.4	34.1	(-0.7)	(-0.6)
Liberal Democrats (%)	2006	11.7	11.9	(-0.1)	(0.2)
	2007	9.6	9.3	(0.4)	(0.3)
Other political party (%)	2006	6.9	6.8	(0.1)	(-0.2)
	2007	7.0	6.7	(0.3)	(0.2)
No political affiliation (%)	2006	15.5	15.2	(0.2)	(0.2)
	2007	17.4	17.3	(0.2)	(0.2)
Religion - Christian (%)	2006	46.7	47.6	(-0.8)	(-0.6)
	2007	47.1	47.8	(-0.7)	(-0.4)
Religion - Non-Christian (%)	2006	6.6	6.0	0.6*	0.6
	2007	6.4	6.1	(0.4)	(0.2)
No Religion (%)	2006	45.9	45.8	(0.1)	(-0.1)
	2007	45.9	45.6	(0.3)	(0.2)
Racially Prejudiced ^b (%)	2006	31.1	31.0	(0.1)	(0.3)
	2007	31.8	32.4	(-0.6)	(-0.2)
Unemployment benefits too high (%)	2006	56.2	56.6	(-0.4)	(-0.1)
	2007	54.8	56.4	-1.6	(-0.9)
Libertarian-authoritarian scale (mean score)	2006	74.6	74.4	(0.2)	(0.2)
	2007	74.7	75.0	-0.3	-0.2*
Left-right scale (mean score)	2006	52.7	52.8	(-0.1)	(-0.1)
	2007	52.8	52.6	(0.2)	(0.0)
Welfarist scale (mean score)	2006	60.6	60.3	(0.3)	0.3*
	2007	61.3	61.8	-0.4	-0.3

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

^b : Those who consider themselves to be very or a little prejudiced

Table 21 – FRS: survey estimates for easy-to-get and hard-to-get households using the updated definition of “difficult-to-contact”, using weighted data

	Survey year	Easy-to-get	All responding households	Non-response bias ^a	Non-response bias Unweighted
Proportion of household income from employment	2007	52.9	53.2	(-0.2)	-1.0
Proportion of household income from state benefits	2007	24.4	24.3	(0.1)	0.7
Housing costs (£ per week)	2007	77.2	76.8	(0.4)	-1.0
Hours worked per week	2007	38.3	38.4	(-0.1)	-0.2

^a: this is an estimate of the (marginal) bias that would have been present in the survey estimate had extended efforts not been made. It is estimated as the easy-to-get estimate less the estimate for all responding households (column 4 less column 5). Those in brackets indicate that the estimate for the easy-to-get households is not significantly different from the estimate for all responding households ($p < 0.05$).

4. Conclusion

A number of conclusions can be drawn from the analyses presented in this paper. Overall the data from the BSAS and HSE indicate that there has been a substantial increase over the past decade in the proportion of difficult to contact households in Britain, although the same trend is not evident in the FRS data. Changes in the relative amount (or effectiveness) of extended effort between surveys are also apparent. In 2006, for the first time, the HSE exceeded the BSA with regards to the proportion of difficult to contact respondents. Similarly, the proportion of reluctant households, that is those who initially refused but took part after being reissued to another interviewer, has also increased over time for all three surveys. This latter finding may reflect a combination of increased reluctance in the population and increased propensity to attempt to convert initial refusals into respondents.

Lynn and Clarke (2002) concluded that hard-to-get households are more likely to be younger, employed and smaller. With the exception of the last point, this remains the case for both the BSA and HSE (and the FRS for the employment finding). Most significantly, the proportion of employed respondents who live in hard-to-get households has increased over time. Gender

and ethnicity have continued to have only a weak association with ease of obtaining a response.

In the HSE a decade ago, Lynn and Clarke (2002) identified that women were more likely to be in reluctant households than men and the opposite was true for the BSA. In the current analysis (2006 and 2007) women are consistently more likely to be in reluctant households in relation to both surveys. Similarly, Lynn and Clarke (2002) highlighted that owner occupiers were less likely to be reluctant than the other specified categories when considering the BSA, but in 2006 and 2007 reluctant households are much more likely to be owner-occupiers than any of the other groups.

When looking at attitudinal measures overall, there are only small differences between difficult to contact, reluctant, and easy to get households, a finding consistent with those of Lynn and Clarke (2002). The health indicators also largely replicate Lynn and Clarke's findings. Lynn and Clarke (2002) found that members of hard-to-get households were more likely to have positive health indicators such as lower blood pressure, but were more likely to drink and smoke. In 2006 and 2007 the same is true of the health indicators and smoking. A further extension to the analysis could be to investigate the impact of age on these variables in particular, as they tend to be associated with younger respondents who are also more likely to be hard-to-get.

As well as replicating the Lynn and Clarke analyses (2002), in this study we were able to refine the measure of "difficult-to-contact"; our refined measure was based on the number of visits before contact was made with the household as opposed to the total number of visits. In summary, this adjustment resulted in consistently lower bias estimates, similar significant demographic results and fewer survey specific significant results. Figure 2 demonstrates the reduction in bias in the per cent employed as more visits are made to achieve first contact, and so re-iterates the Lynn and Clarke (2002) conclusion that there is evidence to suggest that not pursuing extended efforts is likely to bias any sample in terms of demographic characteristics. However, the case for extended efforts (that is, visits made after the 5th visit to obtain first contact with a household) is weakened for survey measures when we use this improved measure of "difficult-to-contact".

A further extension in this paper was to assess the impact of extended efforts on estimates in the context of corrective non-response adjustment weighting. Our results slightly weaken the

case for investing in extended interviewer efforts. The findings suggest that appropriate weighting can remove much of the marginal non-response bias. In other words, although unweighted estimates are significantly affected by the extended efforts, weighted estimates are not affected to the same extent. However, the extent differs between variables. Broadly speaking we find that weighting corrects for the marginal non-response in the case of health variables (with the exception of smoking behaviour) and demographic variables (with the exception of housing tenure), but not for attitudinal variables. Nevertheless, even in the presence of weighting we see that extended efforts appear to reduce non-response bias for some estimates. Furthermore, relying on weighting to achieve the same effects that might have been achieved by extended efforts is perhaps a risky strategy and will not always be possible as it depends on appropriate auxiliary data being available. We should perhaps conclude that the case for extended efforts is greater in situations where there is little or no relevant unit-level auxiliary information that can be used for weighting, for example from an informative sampling frame. The case may also depend on the survey topic. Our findings suggest a stronger case for surveys related to housing, smoking or attitudes than for surveys related to other health issues or to demography.

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