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Mode-switch protocols: how a seemingly small design difference can affect attrition rates and attrition bias

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Non-Technical Summary

Many surveys involve interviewing a sample of people face-to-face in their own homes. This is a tried and tested way of implementing a survey, which has some advantages. People are generally more likely to agree to take part in a survey if they are asked face-to-face and if someone has made the effort to visit their home. Also, the interviewer can help the interviewee by explaining what is required and answering any queries. This would not be possible if someone was filling out a questionnaire on their own.

However, surveys carried out face-to-face in this way are expensive. For a survey that aims to be nationally representative, it will be necessary to employ interviewers in all parts of the country, and to pay them for the considerable time that they will have to spend travelling to and from the homes of the sample members, in addition to the time they spend actually carrying out interviews. The time spent travelling around in order to make contact with sample members could be eliminated if it were possible instead to make contact and carry out interviews by telephone. The use of telephone interviewing is often rejected for high quality social surveys, mainly because it is much more difficult to persuade people to participate, but also because telephone numbers are typically not available in conjunction with a high quality sample. But panel surveys, in which people are re-interviewed at regular intervals, offer hope in both respects. It may be easier to persuade people to participate in a telephone interview if they have already taken part in the survey, face-to-face, previously. And they can be asked for their telephone number the first time they are interviewed.

This paper reports the results of an experiment in which an attempt was made to re-interview panel members by telephone where possible. The telephone interviewing was organised in two different ways, the success of which we compare. We examine the effect of these telephone methods on:

- the proportion of people who agree to be interviewed (the "response rate");
- the proportion of people who additionally agree to one, or two, subsequent face-to-face interviews, one year and two years later;
- the types of people who agree to be interviewed.

The findings help us to understand whether and how we should ask panel survey members to take part in telephone interviews, and what impact that will have on the number and types of people who then continue to take part in the survey.

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Abstract: We consider the effect of a wave of mixed-mode data collection (telephone and face-to-face), in an otherwise face-to-face survey, on panel attrition and the extent to which this effect is dependent on the nature of the mode-switch protocol. Findings are reported from an experiment on a survey in which the objective is to interview each adult member of the household. One protocol involves making extended efforts to interview each household member by telephone before switching to face-to-face, while the other involves switching a household to face-to-face as soon as it is apparent that an interviewer visit will be needed for at least one household member. With both protocols response rate at the mixed-mode wave is lower than with face-to-face single mode data collection, but with the protocol involving extended efforts this response differential is eroded over the following two waves, while with the other protocol the difference remains.

Keywords: mixed modes, panel attrition, R-indicators, telephone interviewing, Understanding Society Innovation Panel

JEL Codes: C81, C83

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1. Introduction

Mixed mode data collection methods are increasingly being considered in a range of survey contexts. The opportunities for mixed mode data collection, and the potential benefits they might bring, appear to be particularly great for longitudinal surveys. As part of a programme of research designed to inform decisions about whether, when and how the UK Household Longitudinal Study (UKHLS) might make the transition from a single-mode face-to-face survey to a mixed-mode survey, an experiment was carried out with ways of mixing telephone and face-to-face interviewing. The issues involved in deciding how to mix modes are more complex in the context of a survey in which the objective is to interview all household members than in a simple survey of individuals. Consequently the experiment compared two alternative protocols for defining when a household should be switched from telephone to face-to-face.

Our focus here is on the effect that a wave of mixed-mode data collection (telephone and face-to-face), in an otherwise face-to-face survey, can have on panel attrition. Specifically, we assess whether and how the effect may differ between the two mode-switch protocols. The UKHLS includes an "Innovation Panel" (UKHLS-IP), the purpose of which is to provide a vehicle for methodological development and testing (Uhrig, 2011). The experiment reported here was implemented at wave 2 of the UKHLS-IP. We are interested both in the immediate effects on nonresponse at wave 2 and also on longer-term effects on panel attrition and composition. We therefore examine effects on response at waves 2, 3 and 4.

We begin (section 2) by outlining the potential advantages of mixed-mode data collection relative to face-to-face, and how these apply in a household panel survey context. We then describe the design of our study, including the details of the two mode-switch protocols (section 3) and present descriptive analysis of the effect of the experimental treatments on response rates at waves 2, 3 and 4 (section 4) before moving on to our comparison of the effects of the two mode-switch protocols (section 5). As we are interested not only in response rates but also in nonresponse bias and sample composition, we also assess differences between the experimental groups in differential nonresponse propensity between subgroups (section 6). We find that response rates do not differ between the two mode-switch protocols at wave 2, while both result in lower response rates than with the single-mode face-to-face protocol. However, cumulative response rates at wave 4 differ between the two mode-switch protocols, with the result that only one of the two protocols is significantly different

from the single-mode face-to-face protocol. In section 7 we discuss the mechanisms that could cause this phenomenon and the implications for panel surveys.

2. Mixed Mode Designs and Longitudinal Surveys

Different data collection modes have different strengths and weaknesses. For this reason, researchers have long thought that combining modes within a single survey might provide opportunities to benefit from the strengths of each (de Leeuw, 2005). However, modes have generally only been combined in the form of multiple-mode surveys, in which different items may be collected using different modes, but that any one item is always collected by the same mode for all respondents. The classic example of such a design would be a face-to-face interview with an additional self-completion component, which might either be completed in the interviewer's presence or left behind (a "drop off" questionnaire) for the respondent to complete later.

It is only relatively recently that there has been a notable rise in the number of mixed-mode surveys. These are surveys in which the same data items may be collected by different modes for different respondents. The growth of mixed mode surveys has, unsurprisingly, been accompanied by a fair amount of research into ways of mixing modes. Much of this research is focussed on identifying ways of harnessing the complementary strengths of different modes while avoiding some of the weaknesses. The two main potential benefits of mixed mode designs concern costs and nonresponse. With respect to costs, researchers strive to reduce costs relative to a single-mode approach by collecting some of the data via a less expensive mode. For example, a combination of web interviewing and face-to-face interviewing should cost less than relying solely on face-to-face interviewing. The question is whether this can be done in a way which does not unduly compromise other important aspects of the survey, such as measurement or non-response error. With respect to the second major potential benefit of mixed mode designs, nonresponse, researchers hope that mixing modes may result in higher response rates and/or more balanced response (less non-response bias). This could arise if different types of people tend to respond in each mode, with the result that subgroups who would be under-represented in a single-mode survey are better represented in a mixed-mode survey.

Longitudinal surveys provide a particularly promising setting in which to harness the advantages of mixed-mode survey designs. This is because some of the common constraints

on implementing mixed-mode surveys effectively are much reduced in the longitudinal context. A major barrier to cost reduction is the need to have contact information for sample members that permits the initial approach to the sample member to be made in the most cost-efficient mode. For example, most of the cost saving associated with telephone interviewing rather than face-to-face interviewing is only obtained if the need to make a personal visit to the sample member's dwelling is completely avoided. In other words, it is necessary to know in advance the sample member's telephone number. In many cases the sampling frames used for social surveys, especially those of the general population, do not include telephone numbers, in which case a mixed-mode design involving both face-to-face and telephone interviewing cannot be (effectively) implemented. However, a longitudinal survey offers the opportunity to collect respondents' telephone numbers at the first wave and thereafter to use a mixed-mode design that includes telephone interviewing. Similarly, email addresses can be collected in order to facilitate subsequent invitations to complete web questionnaires. A second constraint on the effectiveness of mixed-mode designs is that typically little or nothing is known in advance about which sample members are more or less likely to respond in which modes. This makes it impossible to target particular modes or mode strategies at the sample subgroups for whom they are most appropriate or to avoid approaching respondents in a mode that is particularly likely to invoke a refusal. Again, the longitudinal context offers a wealth of opportunities to collect information that can help the researcher to target mode strategies to appropriate sample subgroups. This information might include indicators of telephone use, web use, mode preference, education level and other demographic factors known to be associated with response propensity in particular modes, as well as mode-specific response behaviour at previous waves.

For these reasons, then, there is a strong motivation to identify effective ways of mixing modes on longitudinal surveys. But there is also a very wide variety of design options, due to the extensive information available about longitudinal sample members. Consequently, there is much to evaluate.

3. Study Design

At each wave of a household panel survey, the aim is to collect data from each member (above a certain age) of each target household. With face-to-face interviewing, the need to visit and make contact with each household is a major driver of data collection costs. Alternative modes of data collection may reduce costs, but significant savings will be made

only for households to which a personal visit can be completely avoided, requiring that all members respond by a mode other than face-to-face interviewing. The aim of our study was to identify mixed-mode designs that reduce the proportion of households requiring a personal visit (thereby saving costs) while not damaging response rates.

The study was concerned with mixed-mode designs that combine telephone interviewing (CATI) with face-to-face interviewing (CAPI). Two alternative designs were considered. The first, which we refer to as the "late transfer" protocol, involves making extended efforts to interview each household member by telephone before switching to face-to-face. In this protocol, if one household member refuses the telephone interview or is unable to participate by telephone (for example due to poor aural health), the interviewer should continue to make efforts to obtain telephone interviews with any other household members who have not yet been interviewed. Only when all possible telephone interviews have been obtained is a face-to-face interviewer deployed to visit the household. The second design, the "early transfer" protocol, involves switching a household to face-to-face as soon as it is apparent that an interviewer visit will be needed for at least one household member. The rationale behind the early transfer design is that there are only very marginal cost savings to be made by interviewing a respondent by telephone rather than face-to-face in a household that will in any case require a visit by a face-to-face interviewer, while there may be a response rate penalty to pay for approaching sample members by telephone rather than face-to-face. A preference for one protocol rather than the other should therefore depend on the extent to which costs savings are greater with the late transfer protocol and to which response rates are higher with the early transfer protocol.

An experiment was implemented at wave 2 of the UKHLS-IP. All households successfully enumerated at wave 1 – regardless of whether or not the household members had agreed to the survey interview – were randomly allocated to one of three treatment groups. In the first group (the control group) all field work was carried out face-to-face. The second and third groups were administered the late transfer and early transfer mixed-mode protocols respectively. In each of these latter two groups, any households for whom no valid telephone number had been collected at wave 1 were issued immediately to face-to-face, as they already met the criterion for switching modes.

Although the household is a key entity in data collection – and a driver of data collection costs –sample units for household panel surveys are individuals. The central interest of

researchers is therefore in maintaining the co-operation over time of individual sample members, albeit that they are observed in their household context. The analyses presented here therefore relate to the sample of individuals aged 16 or over, who constitute those eligible for a wave 2 interview. There were 897 individuals allocated to the face-to-face treatment, 906 to the late transfer mixed-mode treatment and 874 to the early transfer mixed-mode treatment.

4. Effect of Mixed Modes on Nonresponse and Attrition

We first compare the face-to-face and mixed mode treatments in terms of response rates at each wave conditional on having responded at wave 1. In this analysis, the two mixed-mode treatment groups are combined. At wave 2, the wave at which the experiment was implemented, response rate was 8.3 percentage points lower with mixed-mode data collection than with face-to-face, representing an odds ratio of 0.67 (p=0.001, Table 1).

The odds ratio for participating at wave 3, for the wave 2 mixed mode treatment group relative to the face-to-face group, was 0.79 (p=0.06). For participation at wave 4 the equivalent odds ratio was 0.88 (p=0.29). A substantial initial effect of the mixed mode approach on response rate therefore appears to have eroded over the subsequent two waves.

Table 1: Wave 2, 3 and 4 response rates: comparison of mixed mode with face-to-face

	Response rate			
	Face-to-face	Mixed-mode	Odds ratio	*P*
Wave 2	73.9	65.6	0.672	0.001
Wave 3	65.2	59.8	0.793	0.06
Wave 4	57.1	54.0	0.880	0.29

Note: The base for all estimates consists of persons who participated in wave 1. Persons known to have died prior to the respective wave are removed from the base. N = 2,555 (wave 2), 2,521 (wave 3), 2,506 (wave 4).

5. Comparison of Mode-Switch Protocols

We next compare the two mixed mode treatments. At wave 2, there is no difference in response rate between the early and late transfer protocols, with both delivering significantly lower response rates than the face-to-face single-mode protocol. However, at wave 3 a small difference emerges, with response rate being 3.8 percentage points higher in the late transfer group than in the early transfer group. The result (Figure 1) is that response rate is

significantly lower than face-to-face with the early transfer protocol (OR = 0.732, p = 0.03) but not with the late transfer protocol (OR = 0.857, p = 0.26). By wave 4, this response rate gap between the mixed-mode treatments widens further, to the extent that there is no longer any difference at all between the late transfer protocol and face-to-face (OR = 1.02, p = 0.86), while response rate for the early transfer protocol group remains 7.1 percentage points below that for the face-to-face group (OR = 0.752, p = 0.03).

Therefore the gradual erosion of the difference in response rates between face-to-face and mixed modes applies only with the late transfer protocol. With this mode-switch protocol, the difference has eroded completely within two waves. With the early transfer protocol response rates remain at a lower level than with the face-to-face treatment: the lines for these groups in Figure 1 are effectively parallel.

This difference between the two mixed-mode protocols at waves 3 and 4 could be caused by either or both of two phenomena. It could be that wave 2 late transfer respondents are more likely to continue responding than wave 2 early transfer respondents or it could be that wave 2 late transfer non-respondents are more likely to return to the survey subsequently than wave 2 early transfer non-respondents. To identify which phenomenon is operating we analyse, in Table 2, response at waves 3 and 4 conditional on wave 2 outcome. We see that the difference between treatments is restricted to wave 2 respondents. There is no difference in response propensity amongst wave 2 non-respondents, but amongst respondents the conditional propensity of response at wave 3 is 7.3 percentage points higher (p = 0.05) in the late transfer group, and by wave 4 the difference has increased to 10.2 percentage points (p = 0.006).

Therefore, the two mixed-mode protocols affect equally the propensity to participate at wave 2 but, conditional on participating at wave 2, the early transfer protocol adversely affects the propensity to participate at waves 3 and 4, even though the field work protocols were identical for both groups at these waves. We remind the reader at this point that the protocols differed only for households in which there were at least two persons eligible for interview (i.e. residents aged 16 or over). We confirmed that the effect was restricted to such households, by analysing response at waves 3 and 4 conditional on response at wave 2 separately for persons in one-person households and persons in households with more than one adult. This analysis (detailed results not shown) confirmed that there was indeed no significant different between mixed-mode protocols in the conditional response rates at

waves 3 and 4 amongst people in one-person households at wave 2, while response rates were higher for the late transfer group at both wave 3 (OR = 1.46, p = 0.08) and wave 4 (OR = 1.70, p = 0.004) amongst people who, at wave 2, were in a household with at least one other adult. It is therefore clear that the two protocols differentially affect the propensity of subsequent continued participation for wave 2 respondents in households that contain at least one other adult.

Figure 1: Wave 2, 3 and 4 response rates: comparison of three treatment groups

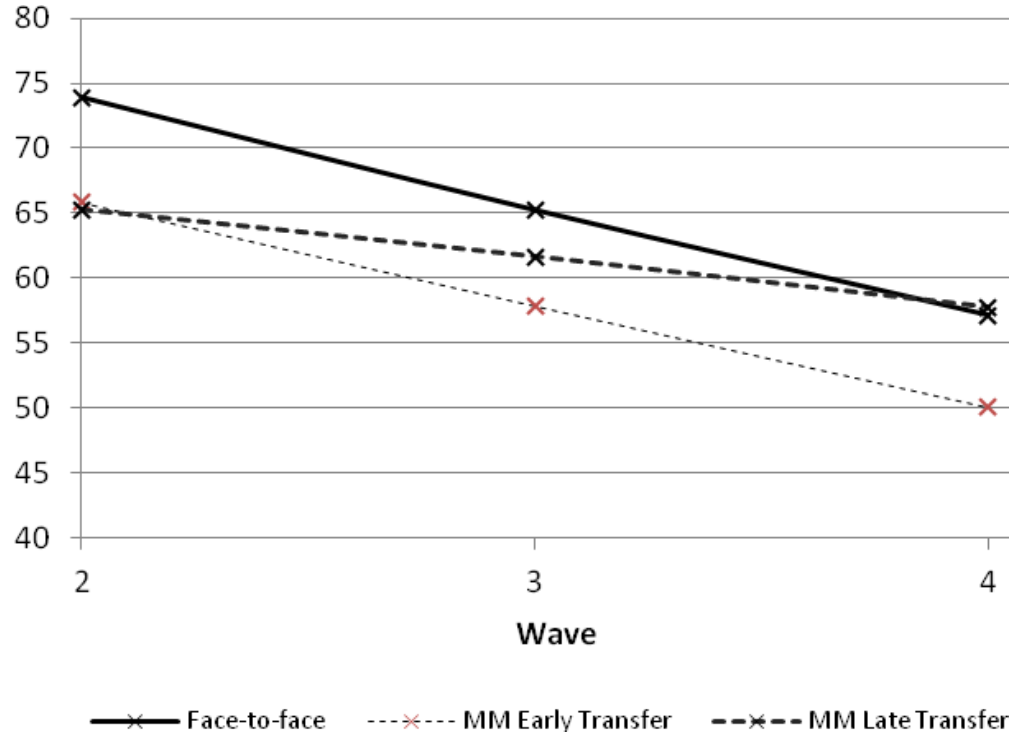

Table 2: Wave 3 and 4 response rates conditional on wave 2 outcome: comparison of mixed mode protocols

	Wave 2 respondents		Wave 2 non-respondents	
	Wave 3	Wave 4	Wave 3	Wave 4
Early transfer	71.5	62.4	29.4	23.4
Late transfer	78.8	72.6	27.6	26.9
Difference	+7.3	+10.2	-1.8	+3.5
P	0.05	0.006	0.65	0.43

Sample sizes: 551 early transfer respondents, 566 late transfer respondents, 286 early transfer non-respondents, 301 late transfer non-respondents

6. Subgroup Differences

In this section we explore whether the three different protocols have different implications for sample composition. In other words, is differential response propensity between sample subgroups affected by the data collection protocol? We fitted separate logistic regression models of response for each of waves 2, 3 and 4, conditional upon participation at wave 1. A set of demographic and substantive indicators (listed in annex table A1) were included in the models and we tested for interactions between each of these indicators and a 3-category indicator of mode protocol. A significant interaction term would indicate that the association between the substantive variable and propensity to participate differed between mode protocols. The variables were all observed at wave 1.

To facilitate comparisons between waves, we present in Table 3 models in which the same set of covariates is included for each wave. The set of covariates consists of all those which exhibited a significant interaction with mode protocol in independent models for at least one of the three waves. Consequently, the models presented here include a set of seven covariates, each interacted with mode protocol. The other twelve of the nineteen variables listed in table A1 showed no significant interaction with mode protocol for any wave and are therefore not included in the models presented. It should be noted that several of these excluded variables exhibited significant main effects on participation. There is therefore evidence of non-response bias with respect to these variables. However, that is not our focus here; our interest is in identifying differences between mode protocols in non-response bias.

At wave 2 there are two significant interactions. The early transfer group differs from the face-to-face group in its representation of mobile phone owners and people aged 66 or older. Specifically, non-owners of mobile phones are under-represented in the early transfer sample but not in the face-to-face sample, while people aged 66 or older are slightly under-represented in the face-to-face sample and slightly over-represented in the early transfer sample, leading to a significant difference between the samples. At wave 3 the nature of the interaction with age changes somewhat. Those in the youngest age group, 16-25, are now significantly under-represented in both the face-to-face and late transfer samples but not in the early transfer sample. Meanwhile, the interaction with mobile phone ownership is no longer significant, but three other interactions with mode protocol have become significant: household composition, number of cars in the household, and country of residence.

By wave 4, three interactions remain: those with age, number of cars in the household, and country of residence. Those aged 41 to 55 and 66 and over are over-represented in the early transfer sample but not in either of the other two samples. Those aged 56 to 65 are over-represented in both the face-to-face and early transfer samples but not in the late transfer sample. Only the late transfer sample under-represents persons in households with three or more cars. In the early transfer group people in Scotland have a slightly higher propensity to respond than others while in the other two groups response propensity is slightly lower for people in Scotland, resulting in a significant difference between the samples in the propensity to respond of people in Scotland.

The overall picture is therefore that that are no dramatic differences between the treatment groups in differential non-response. Considering cumulative response up to and including wave 4, relative to face-to-face interviewing there is perhaps a tendency for mixed-mode data collection to result in greater age differentials with the early transfer protocol but reduced age differentials with the late transfer protocol. On the other hand, the late transfer protocol appears to increase differentials with respect to car ownership.

As the effects are all marginal effects conditional on all other variables in the model, it is not straightforward to identify the impacts on sample composition. In Table 4 we therefore present comparisons of the resultant wave 4 sample composition with respect to each of the seven variables in the model. Only for car ownership is there a significant difference in the distribution between the treatment groups ($p = 0.01$): the late transfer group appears to under-represent people in households with either no car or three or more cars, while over-representing those with one or two cars. There are, however, two other variables for which differences appear sizeable, though they do not reach convention levels of significance. The early transfer group appears to under-represent people without internet access at home ($p = 0.12$) and people who do not own a mobile phone ($p = 0.08$), while the other two groups do not under-represent people with these characteristics. To give an overall impression of the relative representativeness of the three respondent samples, we have calculated R-indicators (Schouten et al, 2009) with respect to the same seven variables. This was done by fitting separate logistic regression models of response at wave 4 conditional on participation at wave 1 for each sample. The model-predicted values provided the estimated response propensities upon which the calculation was based. The obtained values of R were 0.902 for the face-to-face sample, 0.817 for the mixed-mode late transfer sample, and 0.778 for the mixed-mode

early transfer sample. On that basis, then, neither mixed mode protocol performs as well as the face-to-face protocol, though late transfer performs slightly better than early transfer.

Table 3: Logistic regression models of response at waves 2, 3 and 4

Odds ratio	Wave 2			Wave 3			Wave 4		
	Main effect	Interaction		Main effect	Interaction		Main effect	Interaction	
Covariate		with early transfer	with late transfer		with early transfer	with late transfer		with early transfer	with late transfer
Mode (reference: face-to-face)									
Early transfer	0.21**			0.56			0.42		
Late transfer	0.69			2.38			1.99		
Age (reference: 26-40)									
16-25	0.54*	1.35	0.64	0.38**	2.14*	1.05	0.53**	1.35	0.81
41-55	0.93	1.70	1.13	1.09	1.21	0.96	1.09	1.74*	1.27
56-65	1.15	0.59	1.10	1.90*	0.54	0.62	2.60**	0.51	0.46*
66 or over	0.70	1.72*	1.25	1.17	1.05	1.12	0.87	1.49*	0.94
Household composition (ref: Single adult*)*									
Single parent	1.03	1.41	0.47	0.95	1.67	0.57	1.34	0.93	0.63
Couple, no child(ren)	0.87	1.53	0.77	0.79	1.55	0.57	0.70	1.23	0.94
Couple with child(ren)	1.04	0.91	0.48	1.16	0.89	0.44*	0.99	0.71	0.94
2+ adults, no couple	0.50	1.66	0.87	0.75	0.73	0.69	0.69	0.42	1.26
Housing tenure (ref: buying on mortgage)									
Renting	0.76	1.19	1.30	0.87	0.66	0.97	0.71	0.87	1.12
Owns outright	1.75*	0.94	0.61	1.50	0.75	0.58	1.20	0.73	0.71
No. of cars in household (ref: 1 or 2)									
None	1.55	0.74	0.62	1.39	0.98	0.29**	1.23	0.83	0.41*
3 or more	1.31	1.32	0.41	1.78	0.59	0.38*	2.29	0.47	0.20**
Regular internet user	1.24	1.27	1.20	1.42	1.07	0.62	1.29	1.39	0.82
Has mobile phone	0.88	1.84*	1.56	0.94	1.40	1.50	1.01	1.72	0.94
Country (ref: England)									
Wales	0.88	1.18	1.06	1.23	0.47*	0.74	1.15	0.78	1.22
Scotland	0.64	2.09	1.06	1.79	0.86	0.85	0.62	1.83*	1.40

Notes: The table presents fitted values from three models, predicting outcome at each of three waves. Definitions of all variables are given in annex table A1. * indicates $0.01 < p < 0.05$, ** indicates $p < 0.01$

Table 4: Comparison between treatment groups of sample distributions of demographic variables

	Respondents				*P*
	Wave 1	Wave 4 FTF	Wave 4 MM early	Wave 4 MM late	
	%	%	%	%	
Age					0.43
16-25	12.2	9.7	9.7	6.7	
26-40	24.1	25.2	23.0	23.4	
41-55	27.7	27.7	34.6	33.1	
56-65	15.2	18.5	14.5	19.1	
66+	20.9	18.9	18.2	17.7	
Household type					0.53
1 adult, no children	15.9	17.4	15.5	15.7	
1 adult + children	4.4	5.0	5.8	3.1	
Couple, no children	44.4	42.7	42.9	46.5	
Couple + children	28.9	29.0	32.7	29.5	
Other multi-adults	6.5	5.9	3.2	5.3	
Housing tenure					0.98
Buying on mortgage	41.6	45.4	45.5	43.9	
Renting etc	24.6	19.8	21.1	21.3	
Owns outright	33.8	34.9	33.4	34.8	
Cars in household					0.01
None	17.8	16.8	15.7	11.8	
1 or 2	72.0	70.0	72.4	80.7	
3 or more	10.2	13.2	11.9	7.5	
Internet user	59.5	60.3	67.6	62.4	0.12
Has mobile phone	87.3	86.8	91.8	89.0	0.08
Country					0.36
England	87.3	88.5	88.4	86.2	
Wales	5.0	5.7	3.9	5.7	
Scotland	7.8	5.9	7.8	8.1	
N	2,568	476	413	492	

Variables shown are those included in the final logistic regression model (Table 3); *P* reflects a test of equality of proportions at wave 4 between the three treatment groups

7. Discussion and Conclusion

The first important finding of this study was that a mixed-mode data collection protocol, involving telephone interviewing where possible followed by face-to-face interviewing, resulted in a lower response rate than a single-mode face-to-face protocol. Response rate was fully eight percentage points lower, representing an odds ratio of response of 0.67. This is a rather substantial effect. While it has been argued that mixing modes should increase response rates (Dillman, 2000; Shih & Fan, 2007), it would appear that realising this gain is dependent on the way in which the modes are combined. In particular, we suggest that the

sequential order in which modes are offered may be crucial. It may be the case that first offering a mode with a lower overall propensity of response (than a subsequent mode) has a negative impact on the subsequent propensity of (some) sample members to respond in the higher-propensity mode. In our case, some sample members must have been less likely to respond face-to-face, having first been contacted by telephone and asked for a telephone interview, than they would have been had they simply been approached face-to-face, with no prior telephone contact. The mechanisms by which this effect operates are unclear, but our finding is consistent with other studies that have found a lower response rate when either or both of telephone and web is followed by face-to-face (Lagerstrøm, 2008; Martin & Lynn, 2011) than with single-mode face-to-face, or have found a lower response rate with web followed by telephone than with single-mode telephone (Janssen, 2006: Leesti, 2010). (Link & Mokdad (2006) find the opposite, but in their study web response was permitted by anyone in the household while telephone respondents were randomly selected.) In similar vein, a number of studies (Millar & Dillman, 2011; Olson et al, 2012; Smyth et al, 2010) found that response rates were no higher with web followed by mail than with mail alone and Souren (2012) found that response rates were slightly lower with web followed by a mix of telephone and face-to-face than with just the mix of telephone and face-to-face. This phenomenon may also be related to the finding that concurrent mixed mode designs in which sample members are explicitly offered a choice of modes also tend to result in lower response rates than a uni-mode design using the highest response rate mode of those included in the concurrent mixed mode design (Griffin et al, 2001; Holmberg et al, 2010; Medway & Fulton, 2012; Millar & Dillman, 2011; Tourkin et al, 2005; Vanneuiwenhuyze et al, 2010), though there may also be other specific factors at play in that situation, to do with the psychology of being offered a choice. The specific reasons why being offered a less-preferred mode should detrimentally affect the propensity to participate when subsequently offered a more-preferred mode are not yet well understood. This is an important issue on which research should be encouraged. If researchers could understand the mechanisms by which this happens it may become possible to design survey protocols which avoid invoking the mechanisms.

The second important finding of our study is that when subsequent waves of the survey are administered by uni-mode face-to-face, the response rate difference between the mixed-mode and face-to-face groups erodes. The wave-on-wave response rates amongst previous wave respondents are higher at both of the two subsequent waves amongst the mixed-mode group than amongst the face-to-face group, with the result that by the latter wave the cumulative

response rate does not differ significantly between the mixed-mode and face-to-face samples. This suggests that the occasional implementation of a mixed-mode wave on a longitudinal survey may not have a long-term negative impact on cumulative response rate, even though there may be a short-term effect. The mixed-mode wave may encourage those people who would eventually drop out anyway to do so earlier.

However, comparison of the two mixed-mode protocols employed in our experiment (early or late transfer) reveals an interesting pattern. The initial detrimental effect of mixed-mode data collection on response propensity was equally evident for both mixed-mode protocols. However, the erosion in response differential observed at the two subsequent waves was driven entirely by the late transfer group, for whom overall cumulative response rate two waves later was virtually identical to that for the uni-mode face-to-face group. For the early transfer group, the response differential was maintained at subsequent waves. Specifically, those who responded at the mixed-mode wave were less likely to continue responding at the subsequent two waves if they had been administered the early transfer protocol than if they had been administered the late transfer protocol. The sole difference between the protocols was that with the late transfer treatment if one household member refused the telephone interview (or was found to be unable to carry out a telephone interview), additional attempts were made to contact and interview by phone any other household members, whereas with the early transfer treatment the remaining household members would have been approached solely face-to-face in this circumstance. We showed that the effect on subsequent response rates was indeed restricted to respondents in wave 2 households containing at least two adults eligible for interview.

We suggest that the observed effect must have been caused by intra-household communications regarding contact with the survey. Specifically, we speculate that taking part in a survey interview is far more likely than refusing an approach for a telephone interview to become a topic of conversation within a household, at least between members of a couple. We think this is plausible as being interviewed takes a substantial amount of time, involves diverse cognitive stimuli and may invoke a number of emotional or affective responses (e.g. reminding the respondent of events in their life over the past year or arousing sensitivity regarding personal questions), whereas rejecting a telephone request for an interview may be a very brief event of low salience. This difference in the likelihood of discussing an event within the household would be consistent with the finding that the effect of protocol on

response emerged only at the following wave (as the interview is discussed only after the respondent has already given the interview).

However, while providing an opportunity for such effect it does not explain why such an effect might occur. We suggest that it could be the result of perceived inequity in treatment. Imagine a scenario in which a respondent mentioning to her partner that she has just taken part in a survey interview prompts the partner to recall having been approached by telephone for an interview some days or weeks earlier. The respondent may feel aggrieved that, unlike the partner, he or she was not given the opportunity to do the interview by telephone. This inequity would arise only with the early transfer protocol. Alternatively the partner may feel aggrieved that, having already refused the interview the interviewer then visited the family home and obtained an interview from his partner instead. This might seem particularly unacceptable if no prior phone calls were made, a situation which, again, arises only with the early transfer protocol. We feel that there is scope for these aspects of the early transfer mixed-mode protocol to adversely affect subsequent propensity to co-operate. We suggest that further research could seek to identify the existence or otherwise of the respondent reactions posited here.

Finally, we found that differences in non-response bias between the three protocols were modest in magnitude and inconsistent in direction. The late transfer protocol induced greater non-response bias in terms of car ownership but the early transfer protocol induced greater non-response bias in terms of internet use and mobile phone ownership. This suggests that any differential effects of mixed-mode protocol, as discussed in the previous paragraph, may operate fairly broadly across sample subgroups and independently of most of the socio-demographic variables tested in this study.

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Annex

Table A1: Covariates Tested in the Logistic Regression Models

Variable	Categories
Age group (5 categories)	16-25 (reference); 26-40; 41-55; 56-65; 66+
Sex (2)	Male (reference); female
Marital status (2)	Married or living as married (reference); Never married, divorced, separated, or widowed
Number of persons in household (3)	1 (reference); 2; 3 or more
Number of adults in household (3)	1 (reference); 2; 3 or more
Dependent children in household (2)	No (reference); yes
Children aged under 10 in household (2)	No (reference); yes
Housing tenure (3)	Buying on mortgage (reference); owns outright; renting or other
Ethnic group (2)	White British (reference); other
In arrears with rent or mortgage payments (2)	No (reference); yes
Household type (6)	Pensioner household (one or more person of pensionable age, reference); one-person household (below pensionable age); single parent (one adult and one or more dependent children); childless couple; couple with child(ren) (including if other adults are present); other multi-adult household (no couple)
Number of bedrooms in the dwelling (3)	3 or fewer (reference); 4 or more
Number of cars in the household (3)	None; 1 or 2 (reference); 3 or more
Broadband (2)	No broadband connection in the dwelling (reference); broadband connection
Internet user (2)	Not a regular internet user (reference); regular internet user
Mobile phone user (2)	Does not have a mobile phone (reference); has a mobile phone
Has long-standing illness or impairment (2)	No (reference); yes
Incentive offered at wave 1 (3)	£5 (reference); £10; £5 increasing to £10 if all household members participate[sample households were randomly allocated to one of three treatment groups]
Country of residence (3)	England (reference); Wales; Scotland

Note: all variables relate to the situation reported at the time of wave 1.