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Web-first or CAPI-first? How best to combine modes to recruit a probability-based general population survey sample

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Non-technical summary

Social surveys often combine in-home interviewing with online self-completion. This is felt to improve the chances of a wide cross-section of people taking part, as some will prefer a personal interview while others will prefer to complete online. However, there are different ways of combining these two methods of collecting survey data. It is not clear which way is best in terms of producing a representative sample in a cost-efficient way.

This paper reports findings from an experiment in which two different ways of combining the methods were compared. One approach gave priority to in-person interviews, with online completion only offered later in the process, as an alternative for people who had not yet responded. The other approach operated in reverse, giving priority to online participation and only later offering an in-person interview as an alternative. The two approaches differ both in cost and in outcomes.

The approach prioritising online participation was found to result in a higher response rate, a more representative sample, and lower data collection costs.

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Abstract: For social surveys, combining in-home computer-assisted personal interviewing (CAPI) with online self-completion (web) has advantages in terms of both average participation propensities (and therefore response rates) and the distribution of participation propensities over subgroups (and therefore sample composition and representativeness). However, the best way to combine the two modes of data collection is unclear. Different ways may lead to different outcomes, in terms of response rates, sample representativeness, and costs. Findings are presented from a large-scale randomised experiment on a national general population survey in the UK, in which initial use of web with a CAPI-follow up for non-respondents (web-first) is compared to initial use of CAPI with web follow up for non-respondents (CAPI-first). The web-first design is found to result in a higher response rate, a more representative sample, and lower data collection costs.

Keywords: mixed-mode, non-response, response rates, survey costs, web survey

JEL classification: C80, C83

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1 Introduction

For some time now it has been clear that different modes of survey data collection have different strengths and weaknesses: no one mode can be said to be universally superior to another (de Leeuw, 2005). This has led researchers to seek optimal ways of combining modes in order to draw upon the strengths of each (de Leeuw, 2018). However, this needs to be done in ways that avoid the weaknesses of each mode. The best way to combine modes depends not only on the inherent properties of each mode but also on the survey objectives and the societal and technological context. Many surveys combine in-home computer-assisted personal interviewing (CAPI) with online self-completion (web), recognising (Klausch et al, 2013) that there are differences between population members in the relative extent to which the two modes are convenient and appealing. A consequence of these differences in preference and in ease of survey participation is that the selection effects in the two modes may be complementary, leading to a more representative sample if the modes are used in combination than if a survey relies solely on one mode or the other (Bianchi et al, 2017; Olson et al, 2021; Voogt & Saris, 2005). Another important difference between these two modes is that web data collection benefits from a substantially lower marginal unit cost of data collection. Researchers adopting mixed-mode designs are therefore keen to obtain as large a proportion of responses as possible, *ceteris paribus*, via web.

Mixing CAPI and web data collection can, however, introduce mode measurement effects (Bowling, 2005; Jäckle et al, 2010). The presence of mode measurement effects can hamper the analysis of mixed-mode data as well as comparisons of data collected using different modes. Questionnaire design and administration practices have been developed to minimize the risk of mode measurement effects (d'Ardenne et al, 2025) and several studies have found mode measurement effects to be small or negligible in well-designed studies

(Lugtig, 2024; Tomova et al, 2026). The focus of this article is on response rates, selection effects and costs.

2 Research Questions

It is of great interest to survey researchers to better understand the trade-offs involved in selecting between alternative mixed-mode survey strategies. We focus here on the choice between initial use of web with a CAPI-follow up for non-respondents (web-first) and initial use of CAPI with web follow up for non-respondents (CAPI-first). Mode measurement effects, if any, are likely to affect both strategies similarly, as both involve the same combination of modes. The differences between the strategies lie in the priority given to a particular mode during field work and the order in which modes are offered to sample members. It is likely that web-first results in lower overall survey costs, but the extent to which this is true depends on the extent to which sample members participate online following the request to do so. Whether the cost saving, if any, is worthwhile depends on the success of each strategy in obtaining a good response rate and a representative sample. The research questions addressed in this article are therefore:

1. Does survey response rate differ between web-first and CAPI-first mixed mode protocols?

2. Does sample composition differ between web-first and CAPI-first mixed mode protocols? If so, which protocol is closer to population distributions?

3. Do data collection costs differ between web-first and CAPI-first mixed mode protocols? If so, to what extent?

3 Methods: experimental design and data collection

A large-scale randomised experiment was carried out on a general population social survey in the United Kingdom. The objective of the survey was to recruit a general population sample to be added to Understanding Society, the UK Household Longitudinal Study (https://www.understandingsociety.ac.uk/about/about-the-study/). As this is the

second general population sample to be included in Understanding Society, it is known within the study as GPS2.

In England, Scotland and Wales, a two-stage stratified sample of residential addresses was selected from the Postcode Address File, the database used by the Royal Mail to deliver mail in the UK. The first stage involved selecting 960 small areas known as postal sectors with probability proportional to number of addresses in the sector, and then selecting either 27 or 28 addresses from each (480 selected sectors randomly chosen to have 27). In Northern Ireland, a single-stage sample of 768 addresses was selected. Thus, a total of 27,168 addresses were selected for GPS2. Of the addresses in the selected sample, 119 were already in the active Understanding Society sample data base and were removed, leaving 27,049 issued to the field.

The 960 primary sampling units (PSUs) were divided randomly into 24 samples each containing 40 PSUs and, therefore, an average of 1,127 addresses. One of these samples was issued to the field each month from January 2022 to December 2023. For each monthly sample, the majority of fieldwork was completed within 10 weeks, but some cases took much longer. Fieldwork ended on 22 May 2024.

The addresses within each PSU were randomly allocated to receive either the web-first or CAPI-first field protocol. To maximise statistical power to detect differences between the mode protocols, the original intention had been to allocate 50% of addresses to each protocol. However, in January 2022 face-to-face field activities had only recently re-started after the Covid-19 pandemic. The available field force of interviewers was not yet back up to full strength and there were concerns that householders might not yet be willing to invite an interviewer into their home. Consequently, for the first three monthly samples, 80% of addresses were allocated web-first and 20% CAPI-first. Thereafter, as field capacity improved, 50% were allocated to each protocol.

In the web-first protocol, each address was first sent a prenotification letter introducing the survey and informing them that they would soon receive another

letter with details of how to complete the survey online. The prenotification letter also mentioned that should they be unable to complete online, an interviewer would contact them. Included with the letter was an information leaflet with more details of the study and of the working practices being used by the survey organisation. One week later, the invitation letter was sent, including the web address and login details. This letter explained that each person in the household aged 16 or over should take part and that the questionnaire would take 45 to 60 minutes to complete. Recipients were promised £20 for each household member who completed the questionnaire (conditional incentive) and an extra £10 if they did so within five weeks (early bird bonus). A reminder letter was sent two weeks later to all households from which no response had been received and to those for which the household information had been completed, but none of the individual interviews.

Five weeks after the invitation letter was sent, CAPI field work began for all households who had not yet completed any or all questionnaires online. Initial contact attempts were always face-to-face, but once contact had been made, interviewers were able to offer a telephone interview as an alternative to CAPI for any sample member who was reluctant to admit the interviewer to their home. Sample members were still offered £20 for completion of the interview in any mode. A 12-week field period followed, during which interviewers were encouraged to make repeated contact attempts and to seek CAPI interviews while also encouraging online response by anyone unwilling to complete a CAPI interview. After this, an additional 7 weeks were available to re-issue to the field any cases that were felt to be inadequately worked or for which it seemed possible that interviews could be achieved. At the end of this period, a final letter was sent to any households for which no face-to-face contact had been achieved and others who had not completed any interviews, again inviting them to take part online and offering £30 per questionnaire completed within 3 weeks (i.e. the standard £20 plus re-introduction of the £10 early bird bonus). The web survey remained open throughout the CAPI field period.

In the CAPI-first protocol, a prenotification letter was sent to each sample address, explaining that an interviewer would call soon and that each household member completing the survey would receive £20. The CAPI field work phase then proceeded exactly as described above for the CAPI phase with the web-first protocol, with a 12-week main field work period and a 7-week reissue period, and with interviewers able to offer telephone interviews where appropriate. At the end of that period, a letter was sent to any households that had not completed any interviews, inviting them to take part online and offering £30 per questionnaire completed within 3 weeks.

In both protocols, all letters sent to addresses in Wales were sent in both English and Welsh.

Median interview length online was 18 minutes for the household questionnaire (completed by the first person in the household to participate) and 48 minutes for the individual questionnaire. In CAPI, median completion times were 18 minutes for the household questionnaire and 60 minutes for the individual questionnaire.

Most addresses contained only one household (or none), but during the course of fieldwork, some were found to contain more than one, in which case the additional households were added to the sample (up to a maximum of three): 122 households were added in this way, creating a sample of 27,171 addresses/households.

4 Early review of response rates

During the course of 2022 it became increasingly apparent that survey response rates were below expectations. However, it was hard to establish the achieved rates, or to be able to compare them between mode protocols or regions, until field work was complete and data delivered to the University of Essex for all cases in a sample. Fieldwork for the first calendar quarter (January to March samples) was completed only on 24 August, so the first complete outcome data was available only in September. Review of these data revealed an undesirably low response rate overall, and a lower response rate with the CAPI-first protocol.

To improve response, four changes to the protocols were considered. These were: the introduction of a government logo on the mailing envelope, the addition to the invitation letter of a QR code which would take the recipient directly to the survey login page, the introduction of an unconditional incentive, and increasing the proportion of sample addresses to be issued web-first. The first three of these measures were introduced to a random half of sample addresses in sample months 13 to 15 (January to March 2023). As this proved successful, the measures were rolled out to the whole sample from month 16 onwards. The unconditional incentive consisted of a £5 gift card, included in the invitation letter to web-first addresses and in the prenotification letter to CAPI-first addresses.

As the samples for months 1 to 3 had an unusually high proportion of addresses issued web-first, and face-to-face field capacity was still in recovery, it was decided to wait and review outcomes from the second calendar quarter before deciding whether to increase use of the web-first protocol. Once available, these outcomes showed the web-first protocol to be equally superior in terms of response rates in quarter 2, so the proportion of addresses in each PSU allocated to web-first reverted to 80% from month 16 onwards. Additionally, in a final effort to boost the responding sample size, a reserve sample of 240 addresses – one additional address in each PSU – was added in the final three months of the survey. The final analysis sample therefore consists of 27,411 addresses/households.

5 Methods: data analysis

Comparisons are made between the two mode protocols. Metrics compared include proportions of the gross sample (response rates, proportion of sample addresses requiring an interviewer visit), proportions of the responding sample (demographic characteristics, mode of response), and means amongst the gross sample (mean number of interviewer visits made). Estimation is carried out in StataNow/MP version 19.5 using svy commands that take into account the effect on standard errors of sample clustering and sample stratification. All analyses are unweighted.

6 Results: response rates

Household response rates were significantly, and substantially, higher with the web-first mode protocol than with CAPI-first (Table 1). This was equally true in each of England, Scotland and Wales, though no effect was found in Northern Ireland. In the full UK sample, response rate was 11.6 percentage points higher (31.2 vs. 19.6, $p < 0.001$) with the web-first protocol. Non-contact rates did not differ significantly between mode protocols, but the refusal rate was lower with web-first.

Table 1: Response rates by mode protocol and country

	England		Scotland		Wales		N Ireland		United Kingdom	
	CAPI-first (%)	Web-first (%)	CAPI-first (%)	Web-first (%)	CAPI-first (%)	Web-first (%)	CAPI-first (%)	Web-first (%)	CAPI-first (%)	Web-first (%)
Response	19.4	30.9**	21.0	35.6**	17.5	30.5**	25.2	25.5	19.6	31.2**
Non-contact	30.3	27.9	19.0	18.1	26.1	23.7	33.3	33.2	29.1	26.9
Refusal	50.4	41.2**	60.0	46.2**	56.5	45.7**	41.4	41.3	51.3	41.9**
Total (assumed eligible)	7,089	13,480	821	1,501	418	796	297	424	8,625	16,202

** P < 0.001

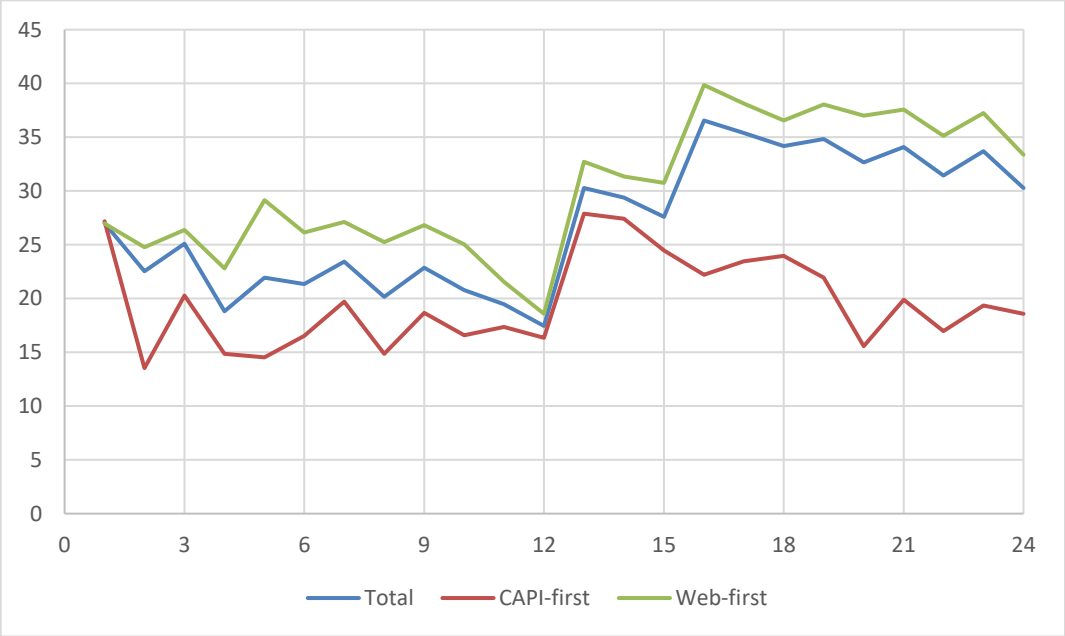
Furthermore, the response rate difference between mode protocols persisted for all sample months (Figure 1). As described earlier, other features of the survey protocols were held constant in months 1 to 3, 4 to 12, 13 to 15, and 16 to 24, but differed between those four periods. Table 2 shows that in all four of those periods, response rates were higher with the web-first protocol. In other words, regardless of the proportion of addresses issued web-first, whether a government logo was included on the envelope, whether a QR code was included in the letter, and whether an unconditional £5 incentive was offered, the web-first protocol achieved a higher response rate.

One possible explanation for differences in outcomes could be that face-to-face interviewers were not making equal efforts to gain response from the two

samples. It is hard to think of a plausible reason why this might have been the case, but in any case empirical checks show no differences in field efforts: for example, the mean number of visits made to addresses eventually classified as "non-contact" is 4.58 in the CAPI-first sample and 4.48 in the web-first sample, while the proportion of visits made on a Saturday or Sunday is 23.3% in CAPI-first and 23.7% in web-first.

Figure 1 additionally shows a clear increase in response rates in month 12 and again in month 15. This is the result of the protocol changes introduced for half the sample in month 12 and for the whole sample in month 15. We cannot however untangle the effects of the unconditional incentive, QR codes, and government logo, as all three were introduced at the same time. The effects of those features are in any case not the main focus of this article.

Figure 1: Response rate by mode protocol by sample month



Note: 12 sample months were allocated 80% web-first (months 1-3 and 16-24) and 12 sample months were allocated 50% web-first (months 4-15). Unconditional incentives, QR codes and a government logo on the envelope were introduced in month 13 for half the sample and in month 16 for the whole sample.

Table 2: Response rates by mode protocol and other survey features

Sample months	1-3		4-12		13-15		16-24	
% web-first:	80		50		50		80	
Uncond'l Incentive:	No		No		50%		100%	
QR codes & logos:	No		No		50%		100%	
	CAPI-first (%)	Web-first (%)	CAPI-first (%)	Web-first (%)	CAPI-first (%)	Web-first (%)	CAPI-first (%)	Web-first (%)
Response	20.2	26.0*	16.6	24.6**	26.6	31.6*	20.1	36.9**
Non-contact	36.6	35.6	29.5	28.3	24.4	24.9	28.9	23.3**
Refusal	43.2	38.4+	54.0	47.1**	49.0	43.5*	51.1	39.8**
Total (assumed eligible)	614	2,430	4,365	4,401	1,524	1,513	1,825	7,434

** P < 0.001; * P < 0.01; + P<0.05

7 Results: sample composition

Sample distributions amongst respondents completing the individual interview are compared between mode protocols and between each mode protocol and the population (Table 3). Population estimates are derived from mid-year population estimates for 2023 (Office for National Statistics, 2024). As these estimates relate to England and Wales, the sample distributions are similarly restricted to respondents in England and Wales, for comparability. The only statistically significant differences between the mode protocols concern the age groups 25-34 and 75-84: the CAPI-first sample contains a smaller proportion of the former and a larger proportion of the latter. In both cases, the web-first sample is closer to the population proportion. Both samples under-represent males, persons aged 85 or older, and residents of London, but again, in all three cases the web-first sample is closer to the population proportion. The overall picture is that the web-first protocol provides representation that is either better than or similar to that of the CAPI-first protocol in respect of the features examined here.

Table 3: Sample composition compared to population estimates

	CAPI-first (%)	Web-first (%)	Population (%)
Sex: Male	42.8[b]	44.5[b]	48.5
Female	57.2[b]	55.5[b]	51.5
Age: 16-24	8.8[b]	9.6[b]	13.1
25-34	14.8[a]	16.6	16.5
35-44	17.7	17.8[b]	16.4
45-54	15.5	16.0	15.4
55-64	15.5	15.7	15.6
65-74	15.8[b]	14.2[b]	11.7
75-84	10.2[a,b]	8.1	8.3
85+	1.8[b]	2.0[b]	3.1
Region: North East	4.9	4.5	4.5
North West	13.8	13.1	12.4
Yorks & Humber	10.8	9.3	9.2
East Midlands	7.8	8.8	8.2
West Midlands	8.8	9.2	9.9
East	11.9	11.0	10.6
London	9.8[b]	10.2[b]	14.6
South East	14.2	15.8	15.5
South West	12.9[b]	12.9[b]	9.7
Wales	5.1	5.2	5.3
Total individual interviews	1,718	5,149	

Notes: Analysis restricted to sample in England and Wales for comparability with Office for National Statistics mid-year population estimates for 2023. [a] indicates that the CAPI-first proportion differs significantly from the web-first proportion; [b] indicates that the population value falls outside the 95% confidence interval for the survey estimate.

8 Results: costs

The main driver of cost differentials between the two mode protocols is the mode of response and the consequent effect on the amount of face-to-face field effort required. Fixed costs are the same for each protocol as the same survey instruments and processes need to be developed. With the web-first protocol, instruments are around twice as likely to be completed online as with the CAPI-first protocol. For example, 76.4% of household grids and 75.8% of household questionnaires were completed online, compared to 39.1% and 38.6% respectively with CAPI-first.

Interestingly, these differentials varied across the four survey periods in which other features of the data collection protocol varied (Table 4). In the fourth period, where we have seen that web-first performed best in terms of response rate, the difference between the mode protocols in terms of mode of response is largest: with the web-first protocol, 82.4% of grids and 81.4% of questionnaires were completed online, compared to 31.7% and 29.3% respectively with the CAPI-first protocol.

Overall, 81.9% of addresses in the web-first sample required an interviewer visit (i.e. had not yet achieved a final outcome by the time CAPI fieldwork started), compared to 99.6% of the CAPI-first sample (the 0.4% consisting of households who reported to the survey office in response to the prenotification either that they did not wish to participate or that they were unable to do so). Including cases that did not require an interviewer visit, the mean number of interviewer visits per sample address was 3.371 with the CAPI-first protocol and 2.875 with web-first. Thus, web-first reduces the number of interviewer visits by 14.7%. With an issued sample of 10,000 addresses, for example, this would translate to nearly 5,000 interviewer visits saved.

Table 4: Mode of completion by mode protocol and other survey features

Sample months	1-3		4-12		13-15		16-24	
% web-first:	80		50		50		80	
Uncond. incentive:	No		No		50%		100%	
QR codes & logos:	No		No		50%		100%	
	CAPI-first (%)	Web-first (%)	CAPI-first (%)	Web-first (%)	CAPI-first (%)	Web-first (%)	CAPI-first (%)	Web-first (%)
Grid: CAPI	53.2	32.9**	65.3	29.7**	34.3	22.0**	62.0	16.0**
CATI	4.8	3.6	6.0	1.5**	2.2	2.3	6.3	1.6**
Web	41.9	63.5**	28.8	68.8**	63.5	75.7**	31.7	82.4**
Questionnaire: CAPI	50.9	32.5*	65.1	29.3**	34.8	22.8**	64.8	17.3**
CATI	5.7	2.8	5.4	2.0**	2.9	2.2	5.9	1.3**
Web	43.4	64.7**	29.4	68.7**	62.3	75.0**	29.3	81.4**
Total grids	124	632	723	1,084	405	478	366	2,746
Total questionnaires	106	532	625	956	345	404	321	2,675

** P < 0.001; * P < 0.01; + P<0.05

9 Discussion and conclusions

A web-first mixed-mode survey data collection protocol has been shown to obtain a higher response rate and a more representative sample than a CAPI-first protocol for a UK general population sample, and at a lower cost. These findings are robust to variations in other survey features such as the inclusion or not of an unconditional incentive and of QR codes on invitation letters. This survey was relatively burdensome, requiring participation by all household members aged 16 or over, with an average total interview time (household grid, household interview and all individual interviews) of 1 hour and 41 minutes per participating household. For shorter surveys, it is possible that the advantages of web-first would be greater still. It seems clear that web-first protocols can be recommended for general population surveys in conditions similar to those faced by this study in the UK.

For substantially less complex surveys, it may not be necessary to use CAPI at all, but it seems that currently self-completion surveys without an interviewer-administered option will only achieve a suitably representative sample if a paper self-completion option is offered in addition to a web survey (Fitzgerald et al, 2025). For surveys such as Understanding Society that rely on very heavy routing through the questionnaire, paper self-completion is not a practical option so a mix of web and CAPI (web-first) would appear to remain optimal for surveys with more complex data collection instruments best-suited to a computer-assisted approach.

A limitation of the present study is that conditions for face-to-face fieldwork in early 2022 may still have been adversely affected by the covid-19 pandemic. However, take-up of the telephone option was relatively low (Table 4), suggesting that reluctance to let an interviewer into the home was not widespread. Furthermore, the spread of the fieldwork over a period exceeding two years provides some assurance that the main conclusions still held some time later, as survey conditions were settling down into a 'steady state.' The numbers and distribution of interviewer visits made to sample addresses suggests that the field capacity issues facing the GPS2 at the start of fieldwork did not ultimately have much effect on the ability of the survey agencies involved to adequately work the sample.

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