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Introducing web in a refreshment sample of the Swiss Household Panel: Main findings from a pilot study

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SUMMARY

This report summarizes the main findings of a two-wave pilot for the SHP conducted in 2017 and 2018, designed to test the consequences of including web as a main mode in the data collection in terms of data quality and comparability between modes. The pilot had two main goals: to test the feasibility of starting a new sample using web and the inclusion of web on the individual level only versus on both the household and the individual level. The study compared three design groups: two treatment groups with web as main survey modes and one control group with the usual design of the SHP and telephone as main mode. We analysed overall response rates, sample composition and representativeness, item nonresponse and measurement differences between the telephone and web mode. We found that the response rates in the first wave, hence at recruitment into the panel, were highest in the usual design and lowest in a full web design, whereas modes mattered less in the second wave, once households had been recruited into the panel already. Switching modes between the household and the individual level decreased individual response rates, whereas switching from telephone in Wave 1 to web in Wave 2 on the household level did not have any negative impact on response rates. We assessed the sample composition by comparing characteristics of respondents with those of the full sample. We found that most of the bias emerged in the first wave, with selection effects getting smaller in the second wave. Some of the sociodemographic characteristics were biased in all designs, whereas others were more specific for each design, suggesting that the choice of mode affects the composition of the sample recruited into the panel in the first wave. For both waves, item nonresponse was considerably higher in the web mode. Although for many variables, we found no indication of measurement differences by mode, a few clear exceptions emerged that suggest a social desirability effect in telephone interviews: web respondents were more likely to report health problems and negative emotions. Also, satisfaction scores were consistently lower in the web mode.

Keywords: household panel, mixed mode, response rates, attrition, measurement

1. INTRODUCTION

Decreasing response rates and increasing costs of implementing surveys by telephone or face-to-face together with increasing digitalization and device uses have pushed many studies to incorporate the less costly web mode of data collection. Yet, as internet penetration is not universal and response rates tend to be lower for web surveys, the use of web has increased the need of mixing modes of data collection (Olsen et al., 2019). Mixing modes has some drawbacks because of the potential for non-equivalent measurements across the different modes, which can confound comparisons across modes. Nevertheless, this disadvantage is generally considered to be offset by the reduction in selection error obtained by adding modes to reduce nonresponse rates (Hox et al., 2017).

For household panel studies, mixing modes brings about concerns beyond the ones also present in cross-sectional individual surveys (Jäckle et al., 2017), such as the consequences of switching to web midstream or for refreshment samples, which modes are combined and how (interviewer versus self-administered; sequentially versus concurrently), and in what ways modes can be combined on the household and individual level. Not much is known about optimal ways of combining web with other modes in longitudinal studies, particularly in household panel surveys, because relatively few major panels have implemented and documented the effects of such designs in their main samples (see Voorpostel et al., in press and Jäckle et al., 2017, for recent reviews).

The evidence so far on the effects of mode switches in household panel studies indicates that a switch from face-to-face interviewing to a mixed-mode design including web yields comparable cumulative response rates as face-to-face interviewing (Bianchi, Biffignandi and Lynn 2017; Lüdtke and Schupp, 2016). Yet, little is known about the use of web at the recruitment stage (the first wave) of a household panel. So far, web in the first wave has been used for individual panel surveys (for example the 2018 sample of the German Internet Panel or the 2019 sample of the Swiss election study panel survey), but not for more complex household panels. There are several reasons for the reluctance of panel surveys to use web in the first wave. Web surveys do not reach the part of the population that is not well-versed with Internet or has reading difficulties and obtain lower response rates than other modes. Moreover, personal contacts with an interviewer may enhance participation not only in the first wave, but also in later waves (Tourangeau, 2018). Household panels face an additional difficulty, as certain tasks, such as the recording of the household composition and relationships between household members, can be experienced as burdensome by the respondent without the guidance of an interviewer. Because the experience of the interview at the first wave is an important determinant of later-wave participation (Lipps & Voorpostel, 2020), web questionnaires in the first wave might imply a higher attrition rate later in the panel. Hence, the presence of an interviewer may be beneficial for response rates as well as continued participation in later waves.

Research on longitudinal studies so far focused on the combination of face-to-face with web. It remains to be seen whether findings translate to the Swiss Household Panel (SHP), which relies mainly on telephone interviews. For the refreshment sample, which started in 2020, the SHP considered a larger role for the use of web for two main reasons. Firstly, as surveys in general, the SHP is facing decreasing response rates and increasing costs, with later

samples showing a sharper decline in participation over the waves than the original sample that started in 1999 (Voorpostel et al, 2020). Web questionnaires might reach sample members who are difficult to contact or reluctant to respond by telephone (e.g. sample members without a known telephone number, or who are hard to reach at home). Secondly, the cost-reduction obtained by relying more on web questionnaires allows more freedom to allocate financial means. As experiences made with other household panels could not be easily translated to the design of the SHP, the SHP IV pilot explored potential designs in a two-wave pilot study. This report presents the main findings of this pilot study, which was conducted in 2018 and 2019. Insights from this pilot study may be of benefit to survey practitioners faced with similar decisions.

The focus of the pilot study was to compare the usual design of the SHP with two alternative designs including web: a mixed mode design with telephone on the household and web on the individual level and a design using web as a first mode for all questionnaires. Hence, the pilot was not designed for the sole purpose of methodological research, but rather to test different ways of conducting the survey in a realistic setting. As a result, our study might have high external validity, but lower internal validity compared with targeted field experiments such as the ones carried out in innovation panels.

This report provides answers to the following research questions:

1. How do response rates in the first and second wave vary by telephone, mixed-mode and web design?

2. How does the sample composition in the first and second wave vary by telephone, mixed-mode and web design and how does it compare to the population?

3. Do we find any differences by mode in item-nonresponse and in measurement by mode when we hold differences in sample composition constant?

In what follows we first present the design of the SHP mode experiment, after which we present the findings of our analyses. We conclude by summarizing the lessons learned and present the design for the new refreshment sample (SHP_IV).

2.   STUDY DESIGN

2.1   DESIGN OF THE SHP MAIN STUDY

The SHP is a household panel survey (Tillmann et al. 2016) that started in 1999 with a sample of 5074 households (SHP_I). A first refreshment sample started in 2004 (SHP_II, 2703 households), and a second one in 2013 (SHP_III, 4065 households). Initially, the SHP conducted interviews exclusively by telephone. Since 2010, it has offered alternative modes to reluctant respondents. Households that are unwilling to respond by telephone are allowed to complete the household and individual questionnaires with a face-to-face interviewer, while a web-based version of the individual questionnaire is offered upon request or after an initial refusal or stated reluctance to participate. In practice, these alternative modes are rarely used (for example, 0.4% of the household questionnaires were completed face-to-face and 4.1% of the individual questionnaires were completed by web in 2018). At the start of the SHP_III in 2013, the SHP also visited households without telephone numbers at home to conduct face-to-face interviews (8.9% of the recruited households completed the household

questionnaire face-to-face in 2013). The majority of the face-to-face respondents from Wave 1 in 2013 have subsequently participated by telephone.

The small sample of household members who completed the individual questionnaire online had different characteristics compared with respondents who completed the telephone interview. As the web option was mainly offered to reluctant respondents this is not surprising and cannot be attributed to the mode only. Respondents who completed the survey by web were more likely to be male, younger, in couples with children, and employed full-time (Dangubic and Voorpostel 2017).

The annual data collection proceeds as follows. Before the start of the fieldwork, all households receive an invitation letter with an unconditional incentive of 10 CHF. Then, in a first step, a telephone interviewer approaches the contact person within the household (the household reference person), to complete the household grid assessing who lives in the household, and the household questionnaire containing questions pertaining to the household as a whole. Subsequently, he or she is asked to complete proxy questionnaires for household members younger than 14 or who are not able to participate, for example due to language or health issues, and to complete an individual questionnaire. The interviewer then tries to establish contact with all other household members aged 14 or older for individual interviews.

2.2 DESIGN OF THE SHP_IV PILOT STUDY

When designing the mode experiment we wanted to test different ways of including web into the design of the SHP. Important aspects were testing the feasibility of starting a new sample using web and inclusion of web on the individual level only versus on both the household and the individual level. For this purpose, we designed a two-wave pilot study comparing three design groups: two treatment groups and one control group with the usual design of the SHP.

The telephone group was the control group, with an almost identical design as for the SHP_III: all households with a known telephone number were approached by telephone. Face-to-face interviewers visited households without a telephone number to establish contact and conduct the interviews face-to-face. Reluctant household members were offered web as an alternative mode for the individual questionnaires. Households and household members contacted by telephone, who initially refused to participate, were recontacted later by telephone to convince them to participate.

Two treatment groups tested alternative ways of including web-based data collection. The mixed-mode group tested the importance of the interviewer to establish contact, build commitment to the study, and to complete the household grid, which contains information on the household composition and relationships between household members. Depending on the household, grid completion can be complex and burdensome for the respondent but is an essential part of the study with important consequences if errors occur. The mixed mode group followed the design of the telephone group for the household level with the grid and household questionnaire completed during a telephone interview, and included web only on the individual level. After the household reference person completed the grid, all household members including the reference person received a letter with a login code to complete the

individual interview by web. Upon request, it was possible to complete the individual questionnaire by telephone.

In the second treatment group (web group), we tested a predominant web design. At first, the contact person in the household received a login code by mail and was invited to complete the grid and the household questionnaire by web. After completion of the grid, all eligible household members, including the reference person, received a login code by mail to access the individual web questionnaires. This implied in the first wave, that the reference person could not complete the individual questionnaire immediately after the household questionnaire, which decreased the response rates on the individual level. In the second wave, we allowed for the household reference person to continue with the individual questionnaire immediately upon household questionnaire completion. As the reference person was known from the first wave this was technically less complicated compared with the first wave.

In both treatment groups, two reminders were sent two weeks apart to decrease nonresponse to the web questionnaire. If a telephone number was available for a nonresponding household (member) the second reminder was replaced by a telephone contact to offer the possibility to complete the questionnaire by telephone.

All households that completed at least the grid in Wave 1 were recontacted in Wave 2, excluding households that explicitly requested to be dropped from the study. If a household member left the original household since the first wave, the new household was approached for the study as well.

The design in Wave 2 was almost identical to Wave 1. We tested whether an interviewer was needed in the first wave only or in both waves by moving about 30% of the mixed-mode sample to the web group (mixed-mode-to-web group). This 30% was selected at random from the mixed-mode respondents who completed the individual questionnaire by web in the first wave. Hence, 70% of the mixed-mode group repeated the same design as in Wave 1, and for 30% we could examine whether the absence of an interviewer on the household level decreased response rates in the second wave when compared with the mixed-mode group.

It should be stressed that although we refer to these groups as the telephone, mixed-mode and web group, all designs combine multiple modes and are strictly speaking mixed-mode designs. Figure 1 provides an overview of the design of the pilot.
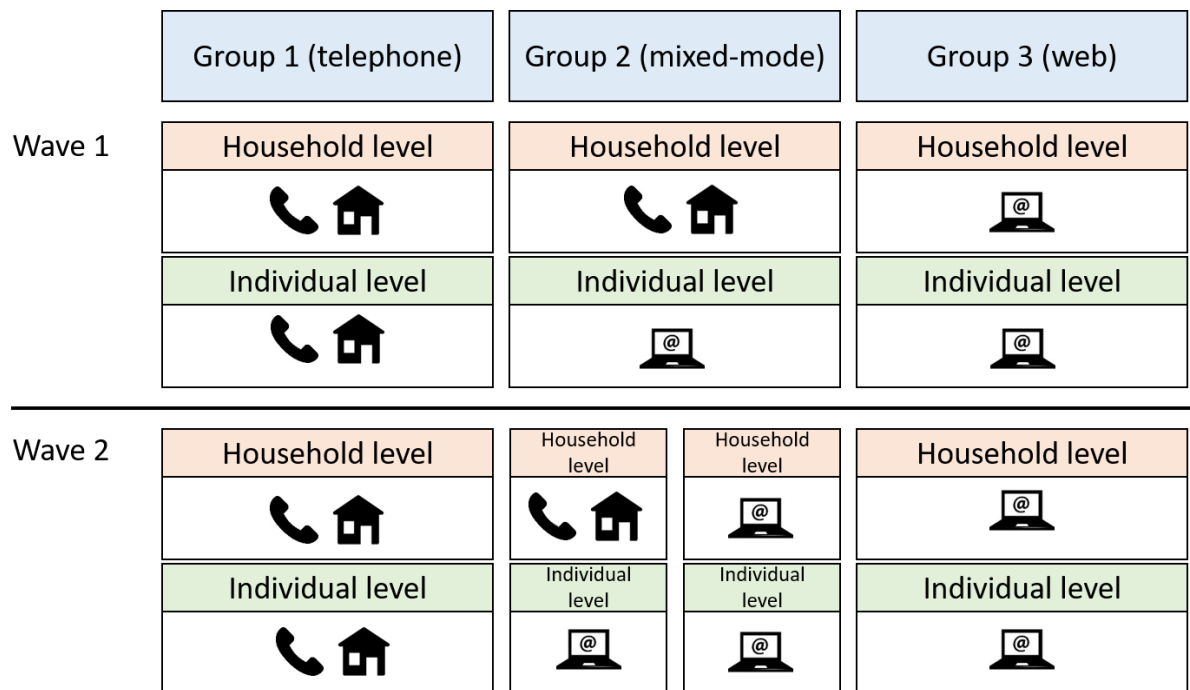
Note: At any stage, respondents had the possibility to complete the questionnaires by telephone; respondents of the telephone group could also complete the individual questionnaire by web.

Figure 1: Illustration of the research design for the two-wave pilot study of the SHP_IV

2.3 SAMPLE

The Swiss Federal Statistical Office (SFSO) drew a simple random sample of 4195 individuals from their sampling frame based on Swiss population registers. With this sample, the SFSO also delivered information on the individuals' household members yielding a total sample of 11685 individuals from 4195 households (the gross sample). The households were randomly assigned to the three treatment groups: the telephone group contained 790 households, the mixed-mode group 2192 and the web group 1213 households. The mixed-mode group was the largest as in the second wave a part of this group was moved to the web group. The web group was larger than the telephone group as we expected response rates to be lower in the first wave.

2.4 FIELDWORK

The fieldwork of Wave 1 took place between 23 January 2018 and 18 March 2018. The first contact with the sample members was established with an invitation letter for each eligible household member containing information about the survey and an unconditional incentive of 10 CHF. With an identical design on the household level, the telephone and the mixed-mode group showed a very similar fieldwork progression for the grid and the household questionnaire. In contrast, the web group had a slower start and slightly lagged behind the two other groups. On the individual level, the telephone group had the fastest fieldwork progression, followed by the mixed-mode group and finally the web group. All three groups had a very regular and steady fieldwork progression.

Fieldwork of Wave 2 was conducted between 7 January 2019 and 18 March 2019. After receiving the invitation and the information letter for Wave 2, respondents were approached in the same mode as the one in which they completed the survey in Wave 1. For example, respondents of the web group who participated by telephone in Wave 1 were recontacted by telephone. In Wave 2, the fieldwork progression of all groups was very regular and comparable with one exception: the mixed-mode-to-web-group lagged somewhat behind the other groups for the grid and household questionnaire, yet they slowly caught up in the second half of the fieldwork.

Whereas both treatment groups had a main mode of data collection on the household level (telephone in the telephone group, telephone and web in the mixed-mode group and web in the web group), respondents could participate using other modes as well. In the first wave, around 85% of the households completed the questionnaire in the main mode of the treatment group to which they were assigned. In the telephone group and the mixed-mode group, 14% and 15% respectively completed the household questionnaire face-to-face. In the web group, 15% completed the household questionnaire by telephone. In the second wave, the share of households who completed the questionnaire in the main mode was around 91% in the telephone group and both mixed-mode groups (mixed-mode and mixed-mode-to-web), and 80% in the web group. From the first to the second wave, in all groups the telephone mode increased by about 5 percentage points (see Appendices A.1. and A.2 for details). For the individual questionnaires, 85% were completed by telephone in the telephone group, and 88% and 90% by web in the mixed mode and web group respectively (Appendix A.3).

3.   RESULTS

3.1   RESPONSE RATES (RQ1)

3.1.1   Response rates household level

Table 1 shows the response rates on the household level in Wave 1. Grid completion is central because it is the basis for assessing eligibility for individual interviews and re-contact in the second wave. Among the households assigned to the telephone group, 54% completed at least the grid. This was 53% in the mixed-mode group and 50% in the web group. The web group response rate was significantly lower than that of the telephone group.

Response rates were slightly lower when, in addition to the grid, household questionnaire completion was taken into account (see Table 1) and they further decreased when counting only households with at least one individual questionnaire in addition to the household questionnaire and the grid. In the telephone group, 49% of households participated with at least one individual questionnaire. This was significantly less in the mixed-mode and the web group: 43% and 39% respectively. The lower response rate in the mixed-mode group when considering only households with at least one individual interview compared with the telephone group can likely be attributed to the mode shift from telephone at the household level to web at the individual level for the reference person.

Although there is little difference in response rates between the mixed-mode group and the telephone group on the household level, once completion of at least one individual interview is taken into account, the mixed-mode group performs worse than the telephone group. The web design obtained a significantly lower response rate at the grid, household and individual

level. The comparison between the mixed-mode and web group suggests that the benefit from recruiting households with interviewers on the household level compared with a web approach outweighs the loss resulting from switching modes in the mixed mode group. Even with the mode switch between the household and the individual level, the mixed-mode design performed better than the web approach.

Table 1. Household response rates by treatment group in Wave 1

	Telephone group		Mixed-mode group		Web group	
	n=790	%	n=2192	%	n=1213	%
Household grid	429	54.3%	1153	52.6%	601	49.5%*
Household questionnaire	417	52.8%	1139	52.0%	574	47.3%*
Grid, household and at least one individual questionnaire	385	48.7%	935	42.6%**	468	38.5%***

Notes: Significant differences with telephone group tested with two-sided z-tests, *p<.05, **p<.01, ***p<.001

All households that completed the grid questionnaire in the first wave were approached in the second wave. Response rates on the household level (household and grid questionnaire) in the second wave of the experiment were quite comparable across treatment groups (Table 2).

Table 2. Household response rates by treatment group in Wave 2

	Telephone group		Mixed-mode group		Mixed-mode to web group		Web group	
	n=434	%	n=807	%	n=354	%	n=601	%
Household grid	337	77.6%	623	77.2%	265	74.9%	461	76.7%
+ Household questionnaire	332	76.5%	621	77.0%	263	74.3%	459	76.4%
+ at least one individual questionnaire	310	71.4%	543	67.3%	248	70.1%	443	73.7%

Notes: Significant differences with telephone group tested with two-sided z-tests, *p<.05, **p<.01, ***p<.001

A central aspect in Wave 2 concerns the assigned mode switch in the mixed-mode-to-web group. While response rates in this treatment group were lowest for the completion of grid and household questionnaire, response rates were lowest in the mixed mode group when adding the completion of at least one individual interview. This indicates – as for Wave 1 – that switching modes between the household and the individual level led to dropout. Response rates were highest in the web group (73.7% compared with 71.4% in the telephone group), which may have been the result of the lower response rates in Wave 1, where, in comparison to the other groups, more reluctant households had already been lost to the panel. Z-tests indicated that none of the alternative designs differed significantly in response rate in the second wave from the original telephone design. Moving a household to a full web design in Wave 2 did not affect response rates significantly, compared with continuing with the mixed-mode design.

Overall response rates in Wave 1 and 2 suggest that whereas the designs differed with respect to recruiting households into the panel in the first wave, no differences in response rates remained in the second wave. This means that initial recruitment differences in the first wave produced lower longitudinal response rates in the mixed-mode and especially the web group relative to the original sample. After two waves, the telephone group contained 42.7% of the original sample approached in Wave 1. This was 40.5% for the mixed-mode group and 38.0% for the web group.

3.1.2 Response rates individual level

We calculated response rates on the individual level by relating the number of completed individual questionnaires to the total number of eligible household members according to grid information on their age. This shows the response rate of the eligible household members in participating households (households that completed the grid), but excludes all individuals living in households that did not participate (households that did not complete the grid). Response rates on the individual level were highest in the telephone group (69%), and slightly lower but not significantly different in the mixed mode group (67%). Hence, whereas on the household level the mixed-mode group fared worse than the telephone group, when it comes to how many of the eligible household members actually completed an individual questionnaire, the mixed-mode design, using mostly web on the individual level, was not significantly different from the telephone design. The web group, however, fared significantly worse with a response rate of 62%. Hence, the web design in the first wave collected fewer individual questionnaires from the eligible household members than the other designs (see Appendix A.3).

In Wave 2, the web group obtained the highest response rate on the individual level (76%), even marginally significantly higher compared with the telephone group (73%). None of the other designs (72% for the mixed mode, 75% for the mixed-mode to web) differed significantly from the telephone group with respect to individual participation. Hence, as was the case for the household level, also on the individual level initial differences between designs existed in the first wave but were evened out in the second wave. The mixed-mode-to-web group did not perform worse than the mixed-mode group that repeated the same design as in Wave 1. See Appendix A.4, also for details on the modes used.

To assess response rates on the individual level over both waves, we computed the share of household members that participated in both waves of the total number of household members who were eligible in both waves, meaning they were living in households that completed the grid and were at least 14 years old in both waves. In the telephone group, this was 67.5%. The mixed-mode group showed a lower percentage than the telephone group (64.9%), but this difference was not statistically significant. The web group obtained the lowest percentage of longitudinal respondents, 61.3%, which was significantly lower than the telephone group.

3.2 SAMPLE COMPOSITION (RQ2)

In a total survey error perspective, not the response rate, but the overall bias in the variables is central. To assess selection bias for socio-demographic variables, we used the auxiliary information from the population registry, which contains information on language, landline number availability, household size, age, marital status, gender, nationality. In addition, we were able to link the gross sample to the social-security registry of the federal government, providing information on income for all individuals in the gross sample. We first compared household members from participating households with the gross sample, to assess selection bias from nonresponse to the grid using registry information. This is done both for household and individual-level variables. Then, we assessed selection bias due to nonresponse to the individual questionnaire by comparing the respondents to the individual questionnaire to all eligible household members.

3.2.1 Sample composition household level

Table 3 presents the sample composition of the total sample of households and the responding households in both waves. Significant differences in proportions were tested using two-sided z-tests.

With respect to language we found only one significant difference between the total sample and the participating households. In the web group, Swiss-German speaking households were underrepresented in the first wave, but this significant difference disappeared in the second wave. Households with a known landline number were overrepresented among participating households in all groups and in both waves. Whereas in the web group a relatively large share of households without landline participated in the first wave compared with the other two treatment groups, the overrepresentation was comparable in the three treatment groups in the second wave. Hence, whereas a web design was more successful in recruiting households without a registered landline into the panel in the first wave, these households were more likely to drop out in the second wave. In Wave 1, single person households were somewhat underrepresented in all treatment groups, most strongly so in the web group. In the second wave, the web group also showed the strongest underrepresentation of single person households, as well as a slight overrepresentation of larger households of four or more individuals.

Table 3. Sample composition households by treatment group: Gross sample and responding households in Wave 1 and Wave 2 (sig. differences with gross sample)[a]

	Telephone group			Mixed-mode group			Web group		
	Gross sample (N=790)	Respondents Wave 1 (n=429)	Respondents Wave 2 (n=330)	Gross sample (N=2192)	Respondents Wave 1 (n=1153)	Respondents Wave 2 (n=868)	Gross sample (N=1213)	Respondents Wave 1 (n=601)	Respondents Wave 2 (n=451)
Language									
(Swiss-)German	70.9	70.2	71.8	72.4	71.0	72.1	68.6	64.9*	66.5
French	23.8	24.2	22.7	22.9	23.9	22.6	26.1	28.4	27.5
Italian	5.3	5.6	5.5	4.7	5.1	5.3	5.3	6.7	6.0
Telephone number	56.7	64.1**	65.5**	55.3	62.3***	63.9***	54.2	58.7*	63.4***
Household size									
1	16.6	13.1*	13.0~	17.3	15.4~	15.8	18.6	13.5**	12.0***
2	31.7	34.5	33.9	35.3	35.0	36.4	35.9	38.4	36.8
3	16.8	18.4	17.0	16.9	17.4	16.9	17.8	17.8	19.7
4+	34.9	34.0	36.1	30.5	32.2*	30.9	27.7	30.3	31.5~

Notes: two-sided Z-test: ~p<.10, *p<.05, **p<.01, ***p<.001

[a] This analysis excluded newly formed households in Wave 2, as we had no information on them from the registry.

3.2.2 Sample composition individual level: household members in participating households

To measure selection bias with respect to individual characteristics of household members resulting from nonresponse to the grid, we compared the distribution of age, marital status, gender, nationality and income from household members from participating households in the first wave with the distribution in the gross sample (Table 4). For this comparison, we excluded ineligible household members, who are younger than 14 years and household members who according to the registry lived in participating households, but who were not mentioned in the grid (n=324).

Table 4. Socio-demographic characteristics of the three experimental groups, comparing household members reported in the grid questionnaire (Wave 1) with those included in the gross sample

	Telephone group		Mixed-mode group		Web group	
	Household members gross sample	Household members in grid W1	Household members gross sample	Household members in grid W1	Household members gross sample	Household members in grid W1
	%	%	%	%	%	%
n	**1916**	**1019**	**5122**	**2663**	**2823**	**1399**
Age group						
14-30	31.3	27.7*	28.1	27.6	28.0	25.9~
31-44	20.1	18.1	21.0	19.5~	20.1	20.7
45-58	26.8	28.0	26.7	27.2	25.8	28.0~
59+	21.9	26.3***	24.3	25.6~	26.1	25.4
Marital Status						
Single	36.8	32.9**	36.0	34.3~	36.0	34.1
Married[3]	54.9	59.2**	53.9	56.6**	54.6	58.3**
Divorced	2.7	2.6	3.0	2.4~	3.1	2.3~
Widowed	5.6	5.4	7.1	6.7	6.5	5.4~
Women	50.7	51.9	50.3	50.5	49.4	49.9
(First) Nationality						
Swiss	75.5	81.0***	76.0	80.3***	75.1	80.9***
Bordering country	9.4	8.6	8.3	7.6	9.1	9.3
Other	15.1	10.4***	15.7	12.2***	15.7	9.8***

Notes: ~p<.10, *p<.05, **p<.01, ***p<.001, two-sided z-tests
Excluded: 1531 individuals younger than 14, 324 individuals included in registry but not in household grid and 102 household members from the grid not present in the registry.

Treatment groups differed with respect to age; especially participating households in the telephone group included relatively few younger and many older household members compared with the gross sample. We observed the same tendency, but to a lesser extent, for older household members in the mixed-mode group and for younger respondents in the web group. The web group also had a marginal overrepresentation of 45-58 year-olds. The participating households in the telephone group contained fewer single household members than the gross sample. For the rest, differences between the gross sample and household members from participating households in Wave 1 were biased in the same way in the three

treatment groups. Married individuals were overrepresented in all groups (slightly more in the telephone group than in web group, least in mixed mode group). There was an additional small underrepresentation of divorced household members in the mixed-mode and the web group, but only on the 10% level. Swiss nationals were strongly overrepresented, and nationals of non-bordering countries were underrepresented in all groups. Men and women were equally represented in each group. Hence, the treatment groups are similar rather than different with respect to response bias. Introducing web did not bring about large differences with respect to sample composition in the first wave with respect to these variables.

With respect to income, we had individual-level information for the gross sample on gross earnings from employment, self-employment, unemployment benefits, statutory pensions (first pillar of old age and disability insurance) and complementary pensions for statutory pensions for low-income households. This allowed us to estimate selection bias in income (Table 5). It is important to note, that these data sources do not contain information on occupational pensions (second pillar of old-age and disability insurance), which are the major income source for many retired individuals. Moreover, the registry does not contain capital income, transfers from private households and public transfers by the canton, such as social assistance and child allowances. We also missed income that is not declared. We reported income sources and median income for the sum of all income sources included in the registry and for employment income, because the other income sources applied only to a small fraction of households.

Table 5 shows selectivity based on reception of income types and median income. Individuals who had an employment income were underrepresented in the telephone group and overrepresented in the web group, whereas individuals with statutory old age and survival insurance (OASI) were overrepresented in the telephone group. This corresponds to the representation of working-age and older age individuals in the treatment groups. Recipients of other state pensions and benefits (disability pensions, unemployment insurance, complementary pensions), tended to be slightly underrepresented in all survey modes. However, the samples of the pilot study were too small to show significant effects for these income sources with small prevalence in the population. The exception was the significant underrepresentation of low-income pensioners with the right for complementary pensions in the telephone group.

In the web group, total registry income was significantly higher for household members from participating households compared with the gross sample, indicating that the web design recruited relatively more higher-income households into the study. Although in the telephone group the total registry income was lower than in the gross sample, this bias was not so much the result of an overrepresentation of low-income individuals, but rather of an overrepresentation of retired individuals whose occupational pensions and capital income were not included in the registry income data. When we restricted the analysis to working age (25-64 years), the income in the telephone group was not significantly different from the gross sample, whereas the income of the household members in the web group was still significantly higher than in the gross sample. The differences for employment income were not significant, but went in the direction of higher-earning individuals being overrepresented in the web group.

Table 5. Income characteristics of the three experimental groups, comparing household members in participating households in Wave 1 (reported in the grid questionnaire) to all household members included in the registry data

	Telephone group		Mixed-mode group		Web group	
	Household members gross sample	Household members in grid	Household members gross sample	Household members in grid	Household members gross sample	Household members in grid
	%	%	%	%	%	%
With income source						
With employment income (%)	64.4%	60.2%*	62.4%	62.4%	61.6%	65.7%**
With self-employment income (%)	1.8%	1.8%	1.8%	1.7%	1.8%	1.7%
With OASI (%)	17.9%	21.9%**	19.9%	21.1%	21.1%	19.8%
With AI (%)	3.6%	2.6%	3.7%	3.6%	3.9%	3.7%
With unemployment income (%)	3.6%	2.6%	3.9%	3.2%	3.8%	2.9%
With complementary pension (%)	2.3 %	1.4%*	2.8 %	2.3 %	2.6 %	2.1%
Median income						
Sum of all registry income (incl. 0)	29,556	26,400**	28,558	28,200	29,484	34,981*
Employment income	57,528	57,471	57,232	57,232	58,867	60,557

Notes: the median is considered as significantly different from the sample if the sample median lies outside the 95% confidence interval ~p<.10, *p<.05, **p<.01, ***p<.001 two-sided z-tests

3.2.3 Sample composition individual level: individual respondents

In a second step of examining individual level sample composition in the three treatment groups, we assessed who of the household members of at least 14 years old in the grid of participating households completed an individual questionnaire (see Table 6 for Wave 1).

For Wave 1, we found only in the mixed-mode group a further underrepresentation of younger respondents and overrepresentation of older respondents. Also, there were fewer singles completing the individual questionnaire in the mixed-mode group. Again no significant under- or overrepresentation by gender emerged. Swiss household members were more likely than other nationals to complete the individual questionnaire in the mixed-mode and web group.

Hence, whereas selection with respect to age and civil status was most pronounced for the telephone group when comparing the grid to the registry, in this second step this is no longer the case. The web group showed some selection in the first step, but none in the second with respect to these two variables. The mixed-mode group added most selection in this second step. Selection with respect to nationality is clearly present in all three designs.

The comparison of individual respondents with household members enumerated in the grid gave the additional opportunity to measure selection bias in variables that were not included in the sampling frame, such as education. For education, we found that lower educated household members were less likely to complete the individual questionnaire whereas the tertiary educated were more likely to do so. These differences were most pronounced in the mixed-mode group and least in the web group. Lower selectivity in the web group might be due to a smaller selection effect (between grid and individual questionnaire) or to stronger

selection already on the grid level, as the share of tertiary educated individuals in the web group was with 32% considerably higher than in the other groups (both 28%).

Table 6. Socio-demographic characteristics of the experimental groups, comparing responding household members (individual questionnaire) to all household members (aged 14+) in the grid (Wave 1)

	Telephone group		Mixed-mode group		Web group	
	Eligible household members	Respondents Wave 1	Eligible household members	Respondents Wave 1	Eligible household members	Respondents Wave 1
	%	%	%	%	%	%
n	1027	707	2699	1798	1425	879
Age group						
14-30	27.8	24.6~	27.8	25.7*	26.3	24.9
31-44	17.6	18.0	19.5	18.9	20.5	20.0
45-58	27.9	29.4	26.8	26.9	28.1	28.0
59+	26.7	28.0	25.8	28.5**	25.1	27.1
Marital Status						
Single	33.3	30.1~	35.3	32.9*	34.2	32.4
Married[1]	57.0	60.6	54.5	56.4~	57.1	58.0
Divorced	7.0	7.9	7.6	7.9	6.2	7.4
Widowed	2.6	2.4	2.6	2.8	2.5	2.2
Women	52	53.9	50.5	52.1	50	51.9
(First) Nationality						
Swiss	81.2	83.0	81.0	86.4***	80.9	85.3***
Bordering country	9.0	9.5	7.3	5.8*	9.0	8.2
Other	9.8	7.5*	11.7	7.8***	10.1	6.5***
Education						
Primary	23.4	19.4*	26.1	21.4***	21.1	18.5~
Secondary	49.1	49.0	45.6	46.2	46.8	46.2
Tertiary	27.6	31.6*	28.3	32.5***	32.1	35.3~

Notes: ~p<.10, *p<.05, **p<.01, ***p<.001 two-sided z-tests
[1] Includes legal partnerships.

Because the grid questionnaire does not measure income, we cannot perform the same analysis to estimate the bias resulting from participation to the individual interview. To have an idea of this selection effect nevertheless, we compared the gross sample to respondents to the individual questionnaire and found a smaller bias than when comparing household members in the participating households to the registry (see Appendix A.6). This is because eligible household members with lower income in the web group were more likely to complete the individual questionnaire compared to higher earners. Therefore, in the web group the bias with respect to income found for grid completion was partially offset by the bias for individual participation. For the telephone and the mixed mode group, there was no additional bias for participation at the individual level with respect to median income.

We repeated the analysis for individual participation for Wave 2 (results presented in Appendix A.7). We found that once a household was included in the grid (the vast majority of which already participated in the first wave), individual questionnaire completion did not introduce additional bias, except for nationality and education. The mixed-mode group included disproportionally many Swiss individual respondents. This selectivity was present, but less strong, in the web group as well, but did not occur in the telephone group nor in the mixed-mode-to-web group. Household members with primary education were less likely to complete an individual interview in the telephone group and the mixed mode group compared with higher educated household members.

In sum, a large part of selection takes place early in the process: when recruiting households in the study in the first wave. Nonetheless, selection bias increased over the process for age and nationality. The increase in share of older household members, for example, increased in the mixed-mode group to the same extent between Wave 1 and 2 as between the gross sample and the grid in the first wave. Selectivity with respect to nationality was strongest in the mixed-mode and the web group. The share of foreigners from non-bordering countries in Wave 1 was only half of the share in the gross sample in the telephone and mixed-mode group and even less in the web group. In the second wave this share remained constant in the telephone group (7.5% at Wave 1, 7.7% at Wave 2), but decreased even further in the mixed-mode group (7.8% at Wave 1, 5.7% at Wave 2) and the web group (6.5% at Wave 1, 5.5% at Wave 2).

3.3   ITEM NONRESPONSE AND MEASUREMENT EQUIVALENCE (RQ3)

The following part of the analyses focuses on differences in the data collected using telephone interviews and web questionnaires. Rather than comparing treatment groups as was done above, we now turn to a comparison of the telephone and web mode irrespectively of the treatment groups.

3.3.1   Item nonresponse

We examined whether completing the questionnaire in different modes produced differences in item nonresponse. We expected item nonresponse to be lower in the telephone interviews where interviewers did not offer these options explicitly, than in the web mode, where they were visible as a response category to the respondent. Moreover, the presence of interviewers might further contribute to lower item non-response through additional explanations for difficult questions. We counted the total number of times the respondent answered either "Don't know" or "No answer" in the household questionnaire and in the individual questionnaire in both waves.

Table 8 shows the item nonresponse in both waves for the telephone interviews and web questionnaires collection. As expected, in the web version of the household questionnaire the average (and the maximum) number of missing items was more than twice as high as in the telephone mode in Wave 1. On the individual level, findings were similar. The range of missing items per questionnaire varied between 0 and 179, with an average of 7 by phone, and 21 missing items if the questionnaire was completed by web.

Table 8. Item nonresponse by mode of data collection: household questionnaire and individual questionnaire (Wave 1 and Wave 2): Mean number of "No answer" and "Don't know" answers

	Household questionnaire				Individual questionnaire			
	Range	Mean	S.D.	N	Range	Mean	S.E.	N
Wave 1	**190 items**				**504 items**			
Telephone	0-26	1.1	1.8	1445	0-90	7.0	7.9	885
Web	0-49	3.4	6.8	509	0-179	20.6	24.6	2410
Wave 2	**190 items**				**534 items**			
Telephone	0-15	.6	1.3	1003	0-59	3.2	4.7	763
Web	0-53	2.7	5.2	599	0-144	12.9	18.1	1983

Note: the total number of questions varies by respondent due to routing in the questionnaires.

In Wave 2, item non-response was less frequent in all modes of data collection (except for face-to-face on the household level), but the difference between the modes became more pronounced. The reduction in item non-response might be a (positive) panel conditioning effect, if individuals understood the question better or were better able to choose an answer as they became used to the formulations. However, lower nonresponse might also be due to selection if individuals who frequently selected "Don't know" or "No answer" were more likely to drop out of the panel (Lipps & Voorpostel, 2020).

3.3.2 Measurement differences by mode controlling for selection

Below we report on measurement differences by mode in a number of variables. As unit nonresponse in the different modes was somewhat selective, any difference found between modes confounds selection and measurement. Our analysis of measurement differences is an approximation, where we assess differences between telephone and web controlled for a number of characteristics associated with selection. To this end we ran regressions (OLS, logistic and multinomial, depending on the measurement scale of the variable), with a large number of substantive variables as dependent variables and the mode as the independent variable, controlled for a number of demographic characteristics. Our approximation of measurement differences by mode is based on whether after controlling for these background characteristics, we find significant differences in measurement between telephone and web.

We included control variables on the household and the individual level. As household-level variables, we took account of language, household size, number of children in the household and presence of a telephone number in the registry data Individual characteristics included gender, age, civil status, level of education and nationality. For analyses of variables from the household questionnaire, these individual characteristics referred to the reference person. We did not consider information on individuals from the registries here, because the correspondence between the two was very high and it allowed us to keep individuals missing in the registry in the analysis.

We analyzed mode differences in many variables, but only report a few here. For most variables, we did not find significant differences between web and telephone (e.g. prosocial behaviour such as volunteering, political interest, political participation). Yet, for a small number of variables the differences by mode were substantial. We present here a few

examples of variables that showed a significant difference between web and telephone: income measures, health measures and satisfaction scores. The question formulation for these variables was identical in both modes, with the exception that the web mode offered a visible "Don't know" category, which was not the case for the telephone interview. The figures below show predicted outcomes based on the regression models (mean scores or predicted probabilities) for the selected variables by mode.

Individual income

Measures of income showed higher incomes in web surveys compared with telephone interviews. For total personal income, this difference between web and telephone was significant in Wave 1, but not in Wave 2 (see Figure 1). Considering that the analysis of registry data revealed a selection effect between treatment groups, with higher-income individuals overrepresented in the web group, the difference in reported income was likely mostly due to selection rather than due to measurement differences by survey modes.
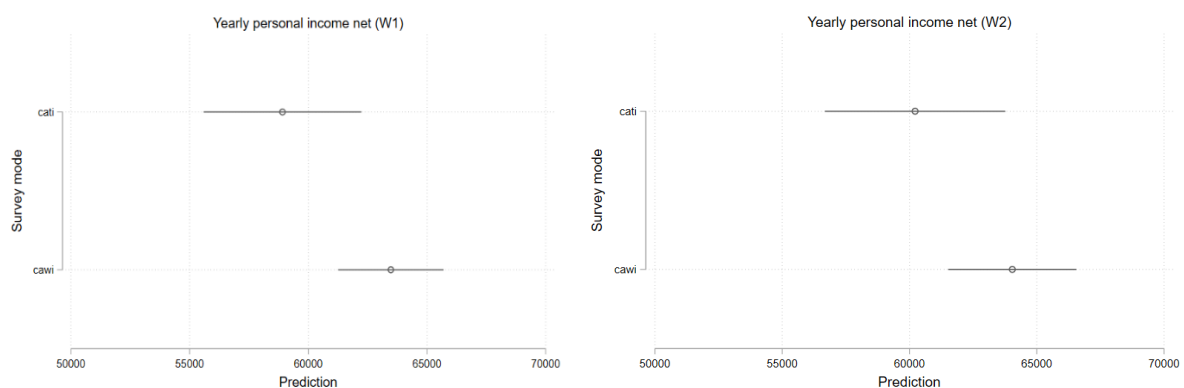

Figure 1: Predicted yearly personal income by survey mode, controlled for socio-demographic characteristics

Life style and health

Significant differences between survey modes arose also for several health-related variables. In the telephone group, fewer individuals reported that their health status was average and more individuals reported that they were well than in the web surveys (Figure 2). Social desirability due to the presence of an interviewer in the telephone survey could explain this difference between survey modes. The same pattern emerged for specific health problems, such as back problems, weakness or weariness, sleeping problems or headaches. Web respondents were more likely to report these health issues than respondents interviewed by telephone. This difference between modes was of similar magnitude in both waves.
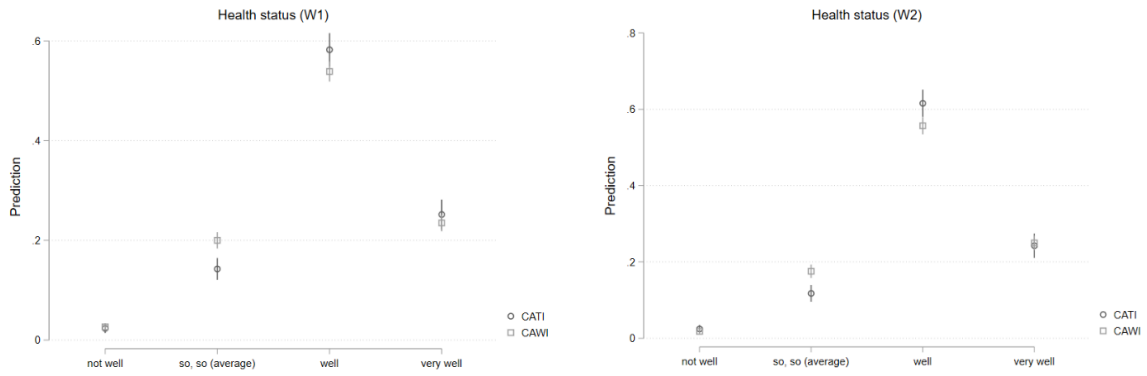
Figure 2: Predicted health status by survey mode

Furthermore, web respondents reported more frequent feelings of depression, blues or anxiety than telephone respondents in the first wave, but these differences largely disappeared in Wave 2 (see Figure 3). Similarly, feelings of optimism and energy were reported more frequently in the telephone group compared with the web group in the first wave, but not in Wave 2. One possible explanation for this is a panel conditioning effect that weakened the effect of social desirability. However, this interpretation is rather speculative, as we also observed the opposite for other variables. For example, for physical activity (Figure 4), telephone respondents reported to be more active than web respondents in Wave 2, but not Wave 1.
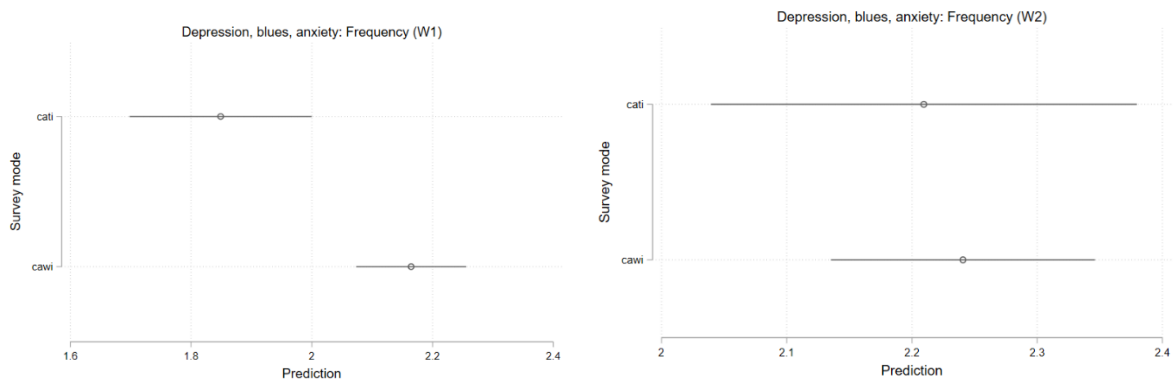

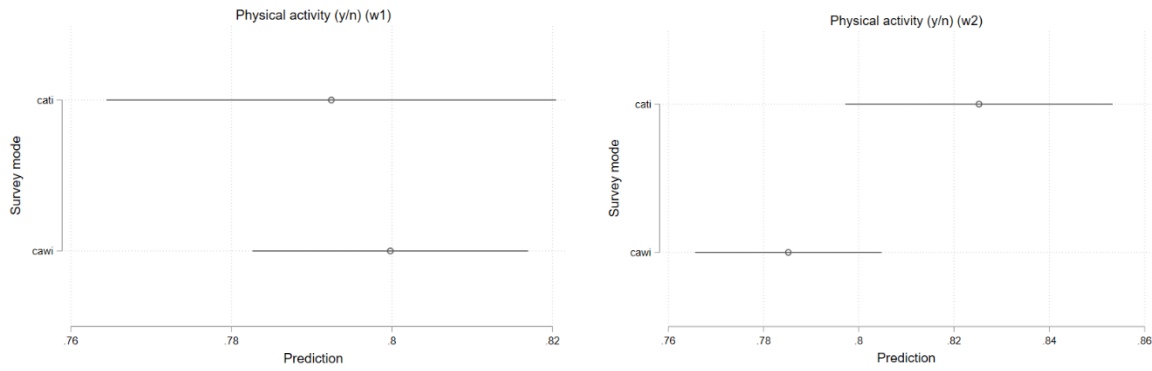Figure 3: Predicted depression, blues or anxiety by survey mode

Figure 4: Predicted physical activity by survey mode

Satisfaction scores

We found a systematic difference between telephone and web for satisfaction scores. We present results for satisfaction with life in general (Figure 5), but the patterns were similar for all other satisfaction scores (satisfaction with work, health, personal relationships, amount of free time, leisure activities, living together, living alone, division of housework, the partner): ratings were significantly higher when reported in a telephone interview in both waves. Satisfaction with the financial situation was the only exception, as the difference was no longer significant in Wave 2. Overall, it seems that the satisfaction scale is not comparable by modes.
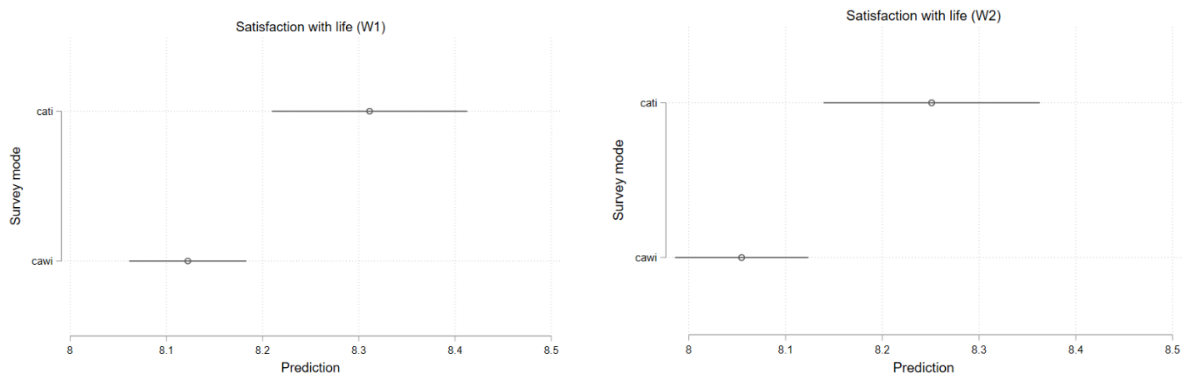

Figure 5: Predicted satisfaction with life in general by survey mode

4. CONCLUSION

This report summarizes the main findings of a two-wave pilot for the SHP, designed to test the feasibility of including web as a main mode in the data collection. We first assessed how the use of web would affect response rates. Of the three designs, in the first wave the web group performed the worst and the current design of the SHP the best. In the second wave the three design groups performed comparably well overall, and the web group performed even better on the individual level. Nonetheless, after two waves, the cumulative response rates of the telephone and mixed-modes designs were higher than in the web group. With respect to response rates, we find that in the first wave, hence at recruitment into the panel, the original design of the SHP performs best and a full web design worst, whereas modes matter less in the second wave, once households have been recruited into the panel already. We found that switching modes between the household and the individual level decreased individual response rates, whereas switching from telephone in Wave 1 to web in Wave 2 on the household level did not have any negative impact on response rates.

Also, with respect to the sample composition, we found most of the bias in the sample in comparison with the population emerged in the first wave, with selection effects getting smaller in the second wave. Some of the characteristics were biased in all designs, such as an overrepresentation of households with a registered telephone number, of Swiss nationals, of married individuals, and an underrepresentation of single-person households. Others were more specific for each design, suggesting that the choice of mode affects the composition of the sample recruited into the panel in the first wave. The telephone design had relatively fewer younger and more older household members in participating households, whereas the web group was least biased in terms of age composition. The web group recruited more households with higher income into the panel in the first wave, although this bias was reduced when considering individual questionnaire completion. We argue that most of the selectivity enters the sample in the first wave, hence when assessing selectivity of samples in longitudinal studies it is important not to focus solely on selective attrition from the study, but to incorporate the selectivity at the origin of the study, at the first wave. With respect to response rates and sample composition our findings are in line with results from Understanding Society that moved part of their face-to-face sample to web (Bianchi, Biffignandi, & Lynn, 2017): web performs relatively well when the second wave is concerned. Yet, our study also assessed the inclusion of web as of the first wave and shows that starting a new refreshment sample with a push-to-web approach yields lower response rates and a somewhat different sample composition.

Finally, we assessed item nonresponse and measurement equivalence between the telephone and web mode. Item non-response was higher in Wave 1 than in Wave 2 across modes. Yet, for both waves, item nonresponse was considerably higher in the web mode. Further improving the design of the web questionnaire could potentially decrease item nonresponse, but it is likely that it will remain higher than in a telephone interview.

Although for many variables we found no indication of measurement differences by mode, after controlling for sample composition, a few clear exceptions emerged: health problems were more likely to be reported in a web questionnaire than in a telephone interview. Also, web respondents reported a lower frequency of positive emotions and a higher frequency of negative emotions. Finally, satisfaction scores were consistently lower in the web mode. These measurement differences by mode point toward a social desirability effect when an

interviewer is present in a telephone interview, although there were also a few examples of biases that were not related to social desirability. These findings point toward caution when analysing these variables: analyses should control for the mode of data collection.

In sum, our study suggests that compared with a web design, the presence of an interviewer improves the likelihood of a household being recruited into the study and decreases the tendency of a respondent to answer with "don't know" or skip a question. Yet, given that a number of questions were answered more positively than in the web condition, our findings suggest that interviewers may be more likely to obtain a response compared with a web self-completion questionnaire, but this response is not always necessarily a more informative one.

Comparing the advantages and drawbacks of the different designs, our study obtained good response rates in the telephone group, but with selectivity problems. We did not find the expected advantage of the mixed-mode group over the other two groups: the shorter telephone interview than in the telephone design (where also the individual questionnaire was completed by telephone) did not lead to a higher response rate on the household level in the first wave. Nor was there a better retention rate in the second wave compared with the web group due to the initial contact with the interviewer. Response rates in the web group were better than expected, and the sample composition reflected the population equally well as the other designs. Nonetheless, even when bringing in web as a main mode of data collection completed by other modes may be beneficial in terms of costs and coverage, it brings about new challenges with respect to measurement equivalence by mode and item nonresponse.

Based on the experiences with the SHP_IV pilot study, the design of the SHP_IV combines the strengths of the telephone and the web design. As the SHP_IV is a refreshment sample, comparability with the existing samples is an important guiding principle. As a result, the SHP_IV will continue with telephone as the main mode of data collection. Yet, to benefit of the lower cost of web and the good experiences made with the pilot, the sampled households without a known telephone number will be approached with a web design. Hence, the SHP_IV will not use face-to-face interviewing. Mode switches remain possible, both within households as well as over time.

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APPENDICES

Appendix A.1. Participating households by treatment group and mode in Wave 1

	Telephone group		Mixed-mode group		Web group	
Wave 1	N	%	N	%	N	%
Grid completed by telephone	371	86%	982	85%	92	15%
Grid completed face-to-face	58	14%	171	15%	-	
Grid completed by web	-		-		509	85%
Household grid total	429	100%	1153	100%	601	100%

Appendix A.2. Participation on the household level by mode and by treatment group in Wave 2

	Telephone group		Mixed-mode group		Mixed-mode-to-web group		Web group	
Wave 2	N	%	N	%	N	%	N	%
Grid completed by telephone	305	90.5%	571	91.7%	35	13.2%	92	20.0%
Grid completed face-to-face	32	9.5%	51	8.2%	1	.4%	0	0%
Grid completed by web	0	0%	1	.1%	229	86.4%	369	80.0%
Household grid total	337	100%	623	100%	265	100%	461	100%

Appendix A.3. Individual questionnaire completion by treatment group (Wave 1)

Individual questionnaire	Telephone group		Mixed mode group		Web group	
Wave 1	N	%	N	%	N	%
Eligible household members[a]	1027		2699		1425	
Individual questionnaires	707	69%	1798	67%	879	62%***
Of which completed by:						
Telephone	603	85%	195	11%	87	10%
face-to-face	65	9%	24	1%	-	
Web	39	6%	1579	88%	792	90%

Notes: Significant differences with telephone group tested with two-sided z-tests, ***p<.001, **p<.01, *p<.05, ~p<.10. [a]) Eligibility according to information on age from the grid in Wave 1

Appendix A.4. Individual questionnaire completion by treatment group (Wave 2)

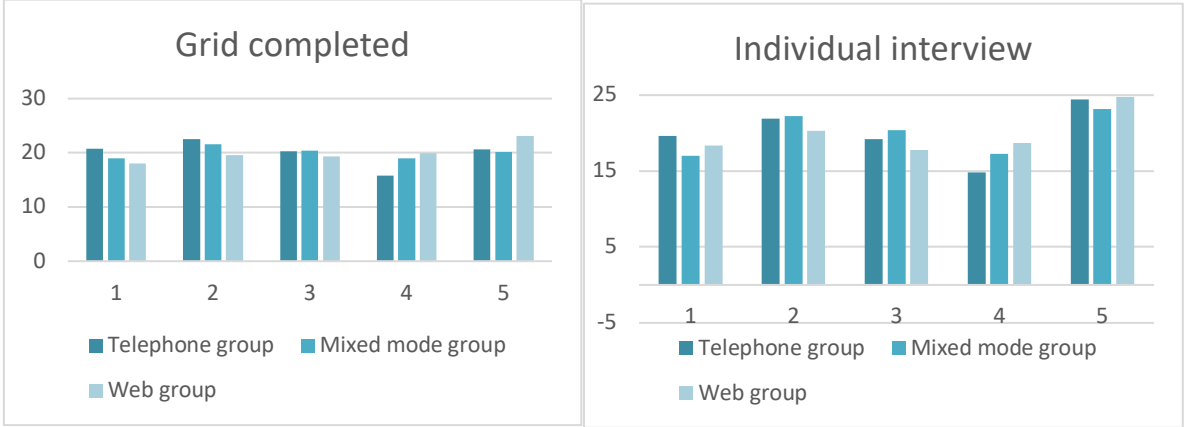| Wave 2	Telephone group		Mixed mode group		Mixed mode to web group		Web group	
	N	%	N	%	N	%	N	%
Eligible household members[a]	786		1392		611		1059	
Individual questionnaires	570	73%	1006	72%	460	75%	807	76%~
Of which completed by:								
Telephone	460	81%	181	18%	28	6%	94	12%
Face-to-face	47	8%	49	5%	1	0%	0	0%
Web	63	11%	776	77%	431	94%	713	88%

Notes: Significant differences with telephone group tested with two-sided z-tests, ***p<.001, **p<.01, *p<.05, ~p<.10.
[a]) Eligibility according to information from the grid in Wave 2

Appendix A.5: Income quintiles in the gross sample: distribution after grid completion (left) and after individual questionnaire completion (right)

Appendix A.6. Income characteristics of the three experimental groups, comparing individuals with individual or proxy interview (Wave 1) to household members included in the registry data

	Telephone group		Mixed-mode group		Web group	
	Household members gross sample	Household members in grid Wave 1	Household members gross sample	Household members in grid Wave 1	Household members gross sample	Household members in grid Wave 1
	%	%	%	%	%	%
With income source (grid)						
With employment income (%)	64.4%	60.4%*	62.4%	62.5%	61.6%	64.2%
With self-employment income (%)	1.8%	1.9%	1.8%	1.7%	1.5%	1.3%
With OASI (%)	17.9%	21.9%**	19.9%	22.3%*	21.1%	20.2%
With AI (%)	3.6%	2.6%	3.7%	3.6%	3.9%	3.7%
With unemployment income (%)	3.6%	2.7%	3.9%	2.7%	3.8%	2.8%
With complementary pension (%)	2.3 %	1.3%~	2.8 %	2.1 %~	2.6 %	2.1%
Median income (grid)						
Sum of all registry income (incl. 0)	29,556	26,796*	28,558	28,200	29,484	31,635
Employment income	57,528	57,471	57,232	57,232	58,867	60,557

Notes: the median is considered as significantly different from the sample if the sample median lies outside confidence interval ~p<.10, *p<.05, **p<.01, ***p<.001 two-sided z-tests

Appendix A.7. Individual level participation in Wave 2: sample composition of eligible household members and of individual respondents

	Telephone group		Mixed mode group		Mixed-mode-to-web group		Web group	
	Eligible household members Wave 2	Respondents Wave 2	Eligible household members Wave 2	Respondents Wave 2	Eligible household members Wave 2	Respondents Wave 2	Eligible household members Wave 2	Respondents Wave 2
n	**786**	**570**	**1392**	**1006**	**611**	**460**	**1059**	**807**
Age group								
14-30	26.4	23.7	25.8	24.2*	27.0	23.0~	24.8	22.2~
31-44	17.4	16.5	18.3	17.6	21.1	22.2	19.6	20.3
45-58	27.9	30.2	25.4	25.7	30.3	32.0	27.5	28.5
59+	28.4	29.7	30.5	32.6	21.6	22.8	28.1	29.0
Marital Status								
Single	31.9	28.6~	34.6	32.6	35.6	32.2	31.4	30.1
Married[1]	58.5	61.1	54.5	55.5	55.3	58.0	59.1	59.3
Divorced	7.3	8.1	7.9	8.3	7.4	7.8	7.2	8.3
Widowed	2.3	2.3	3.1	3.6	1.8	2.0	2.3	2.4
Women	51.8	52.5	50.8	53.5~	49.6	50.9	50.7	51.4
(First) Nationality								
Swiss	81.8	82.8	82.8	89.0***	82.8	84.6	84.3	87.2*
Bordering country	8.7	9.5	7.6	5.4**	6.6	7.0	7.7	7.3
Other	9.5	7.7	9.6	5.7***	10.6	8.5	7.9	5.5**
Education								
Primary	20.3	16.2*	24.2	20.9*	21.1	18.9	20.2	17.9
Secondary	49.0	50.2	46.7	47.6	43.1	43.4	45.6	45.5
Tertiary	30.7	33.6	29.1	31.5~	35.8	37.7	34.2	36.6

Notes: ~p<.10, *p<.05, **p<.01, ***p<.001 two-sided z-tests. [1] Includes legal partnerships.