

Meta–Analysis of Web Surveys

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Summary: Many studies have compared the response rates of Web survey mode with other survey modes. Unfortunately, the majority of studies do not properly isolate the impact of the survey mode from other causes. The factors are usually mixed and unclear due to non-experimental or quasi-experimental designs. There is thus little scientific evidence about Web survey mode non-response disadvantages. In this paper we limit the discussion only to the comparisons based on split samples experimental designs. The results of these comparisons confirm the well-known impression that response rates in Web surveys are lower compared to other survey modes. However, the reasons for this can still be attributed to existing (but temporary) technological obstacles and to relatively low Internet usage. In addition, the total survey error and cost considerations were excluded from the study due to lack of the data. Strictly speaking, thus, no study has shown yet that with given costs and with given total survey error the Web survey mode would really reduce response rates. With further technological improvements and with more elaborated Web survey solicitation procedures, the comprehensive evaluation of the survey modes may show much more encouraging results for the Web survey mode.

1 Introduction

Web surveys are often treated as alternative to traditional survey modes where response rates are rapidly declining (e.g., Chang and Krosnick, 2001; Cook et al., 2000; Rosovsky, 1999; Smith, 1999; Spaeth, 1999: 7; Terhanian and Black, 1999: 32). However, in Web surveys, too, there exists the problem of non-response. First, there are some indices that response rates in Web surveys are declining too. For example, the novelty effect, which might have positively affected response in Web surveys at the beginning, is disappearing. With the large number of Web surveys, Internet users may actually become over-surveyed (Hollis, 1996: 138; Rounds and O'Donnell, 1996: 109). In addition, activity of direct marketers with unsolicited email practice (spam) has a negative impact on response in Web surveys (just as telemarketing has negative consequences for telephone surveys).

Secondly, the methodology of Web surveys is probably still not developed enough to take the full advantage of the possibilities offered. While in traditional survey modes, non-response research has been performed already for several decades (for example, de Leeuw, 1999; Goyder, 1987; Groves, 1989; Groves and Couper, 1998; Groves et al., 1992; Groves et al., 2002; Heberlein and Baumgartner, 1978; Hox and de Leeuw, 1994; Little and Rubin, 1987), while with Web surveys it has just started to appear. Procedures for achieving response rates in Web surveys that are reasonably comparable to those obtained by other methods are still actively being sought. Several papers (e.g., Bauman et al., 2000; Clark and Harrison, 2000; Cook et al., 2000; Dillman, 2000; Frick et al., 1999; Griffin and Holbert, 2001; Knapp and Heidingsfelder, 2001; Krotki, 2001; Lesser and Newton, 2001; Lozar Manfreda et al., 2001; MacElroy, 2000b; Nichols et al., 2001; Perrott, 2001; Tuten et al., 1999/2000; Vehovar et al., 2001c; Wiebe et al., 2001) actually report on promising research efforts towards reduction of non-response in Web surveys. There are also studies that tried to give an overview of the magnitude of response rates in Web (and email)

surveys (e.g., Cook et al., 2000; Knapp and Heidingsfelder, 2001; Lozar Manfreda and Vehovar, 2002; MacElroy, 2000b; Sheehan, 2001; Tuten et al., 2001).

The purpose of this paper is to show whether response rates in Web surveys are really lower than response rates in other survey modes. This cannot be shown simply by giving an overview of response rates in Web surveys. First, there are namely many types of Web surveys as regards the sampling and implementation procedures used (for typologies see Bradley, 1999b; Couper, 2000; Lozar Manfreda, 2001; MacElroy, 2000a; Vehovar et al., 2002, Watt, 1997), some of which cannot even be compared to surveys in traditional survey modes (for example, there is no alternative to pop-up Web surveys). Therefore only those Web surveys that could also be implemented on the same sample using traditional survey modes can be compared.

In this paper we therefore give an overview (using a meta-analytical approach) of studies that compared response to a Web and to another survey mode (or modes), using split samples experimental designs. We first describe our methodology, then report on differences in response rates, and finally discuss and comment possible reasons for the differences obtained.

2 Methodology

In the literature on Web surveys at the WebSM Web site (www.Websm.org) we identified 13 papers reporting comparisons of response rates of Web and alternative survey modes using split samples experimental design. The studies are presented in Appendix 1. In analyzing these studies we use a method of meta-analysis, since we code data from each study and make quantitative comparisons across studies (Heberlein and Baumgartner, 1978: 448).

The reported comparisons are perhaps not a representative selection among all comparisons that have been done. As already established, we report on comparisons only from papers available in the bibliography list at the WebSM Web site. Although the WebSM updates are very exhaustive, it is possible that more comparisons have been made, but never reported in journal, monograph or at some conference. In particular, studies where no difference was found may be particularly underrepresented. As suggested by Heberlein and Baumgartner (1978), authors of one of the first meta-analyses on survey response rates, the “editorial gate keeping” and self censoring is very likely to be reflected in such meta-analyses. However, the sample presented definitely covers most of the studies publicly presented or available to the scientific audience to date.

As mentioned, our analysis is limited only to papers based on split samples experimental designs where two or more experimental groups are randomly selected from the same sample. There are, of course, also many other studies reported that do not use split samples experimental design. Often they also report about the use of a Web questionnaire within a mixed-mode survey design (for example, Aoki and Elasmr, 2000), however respondents in these modes usually do not come from the same population (e.g., McNeish, 2001, Medlin et al., 1999). In such cases the comparisons of response rates cannot be included in our analysis, since the reasons for differences in response rates cannot be separated. Specifically, they often occur because of sample selection and types of contacts, and not

due to the mode. Nevertheless, these comparisons may also give some insight, so occasionally we also refer to them when explaining the differences in response rates.

For each study we present response rates for the survey modes compared. We report response rates as presented by the authors, without discussing their definitions used to calculate them (often they are not elaborated at all). In seven studies the statistical significance of the differences across modes was already reported. For the remaining 6 studies, we calculated t-test for independent samples using information on sample size.

For studies where response rates from more than two modes were compared, each pairing of Web with other mode is taken as the unit of interest (e.g., case). Where two types of Web surveys were used, their pairing constitutes a separate case. Therefore, from 13 studies:

- 7 compare only two survey modes, the rest compare more than two survey modes,
- 24 cases (e.g., pairs) were extracted (see Appendix 2).

Analysis is then performed on these 24 cases. These include the following mode comparisons: Web – email, Web – mail, Web – fax, Web – telephone, and Web – IRV (Interactive Voice Response).

There has already been an overview performed on comparisons between Web survey response rates and response rates in other survey modes. McNeish (2001) reports on 14 studies where response rates for email or Web surveys were compared to those for mail surveys. However, she does not separate between email and Web surveys. In addition, her comparison also includes studies using mixed-mode designs (i.e. Comley, 1996) or samples, which are not comparable (i.e. Medlin et al., 1999). From her comparison we thus include only cases using split samples experimental design.

3 Differences in Response Rates

The overall impression from our meta-analysis is that response rates in Web surveys are lower compared to other survey modes (see Table 1). Among 24 comparisons response rate for Web mode was lower in 19 cases (18 of them statistically significant, $p < 0.05$). Only for 4 comparisons (2 of them statistically significant, $p < 0.05$) the response rate was higher for the Web survey mode.

In addition, four out of five comparisons of **Web vs. email survey**, response rate for the email survey was higher. This happened regardless of whether mail or email invitation was used for the Web survey. Slevin and Chisholm (1997) identified several reasons for higher response rates in email surveys:

- In some organizations, either because of technical constraints or corporate policy, employees may have access to internet email, but not to the Web.
- Answering a Web survey requires more steps than an email survey (clicking on, copying and pasting, or typing in a URL, and waiting for a page to be downloaded from Web server to PC), it therefore takes more time and may confuse some respondents (this perhaps already disappeared due to modern email software).

- Respondents generally need to be connected to the internet while completing a Web survey; however, they may be off-line when completing an email survey. This is also a disappearing advantage of email surveys.

We can conclude that email survey advantages are only temporary. In addition, modem users may end the connection before reading their email and therefore may be less likely to reply to Web questionnaires than to email questionnaires.

Mode to which Web is compared			statistically significant difference	Total
			no (yes)	
Web – email		Web response lower	0 (4)	4
		Web response higher	1 (0)	1
	Total		1 (4)	5
Web – mail		Web response equal	1 (0)	1
		Web response lower	0 (11)	11
		Web response higher	0 (2)	2
	Total		1 (13)	14
Web – fax		Web response lower	1 (0)	1
		Web response higher	1 (0)	1
	Total		2 (0)	2
Web – telephone		Web response lower	0 (2)	2
	Total		0 (2)	2
Web - IVR		Web response lower	0 (1)	1
	Total		0 (1)	1

Table 1: Differences in response rates of Web surveys in comparison to other survey modes

The two statistically significant higher response rates in Web survey occurred when comparing **Web with mail survey**. However, for all other Web-mail comparisons, response rate for the Web survey was lower (11 cases) or equal (1 case). In both cases participants were intensive computer and internet users. In the Bates' study (Bates, 2001), where participants were employees within several organizations, they had access to high-speed Web connections conveniently available at their own desktop computers. In addition, the survey was designed to be compatible with the browsers that were standard for the organizations surveyed. Finally, the target population used computers and the internet as a routine part of their jobs. Similarly, in the Wygant and Lindorf (1999) study participants were students with regular access to the internet who were also familiar with its use.

The lower rate of response for Web in comparison to mail surveys can be attributed also to the following reasons:

- The remote nature of a Web survey (Medlin et al., 1999) may influence its lower rate of response. A paper-based survey is likely to remain on a respondent's desk and act as a continual reminder; this is not the case with Web surveys, especially for those with email invitation.
- Paper-based surveys are also easily completed in sections with minimal effort. For Web surveys, this is only possible if a special design (software) is used. However,

in this case too, the respondent needs to log on to the internet, an action that is much more demanding.

- Respondents may not possess the required equipment to answer a Web questionnaire, while they always have a pencil to answer a mail questionnaire.
- Respondents may not even be familiar with the internet and therefore prefer a paper-based questionnaire.
- Especially for Web surveys with email invitation, it is possible that the perception of email invitation as spam or email in general as junk mail results in lower response rates.
- The researcher's 'investment' in sending a letter with a prepaid envelope for a mail survey may emphasize its importance in comparison to that of the Web survey (Jones and Pitt, 1999: 557).
- When mail is used for invitation to a Web survey, lower response can occur due to larger effort needed to answer it. In the worst case, the respondent needs to turn on the computer, dial-up to the internet, open the browser and type in the URL address to finally access the questionnaire's introductory page. Again, all these are disappearing advantages of mail survey.

It is interesting to note that in two cases where **Web** was **compared** to **fax survey** the difference was very small and not statistically significant. It appears that it takes just as much effort to return a completed paper questionnaire by fax as to complete a Web questionnaire. In both cases, respondents usually incur actual costs from participating in the survey.

The reasons for lower response for **Web in comparison to telephone surveys** may also be attributed to the remote nature of the Web survey. Potential respondents may find it much easier not to participate in a Web than in a telephone survey where they need to refuse an interviewer. Human voices on the phone are harder to ignore and turned away than are mail or electronic messages. Moreover, answering a Web survey needs much more action from the respondent (as described above) than simply answering questions from an interviewer over the telephone.

4 Discussion

In this paper we presented a meta-analysis of experimental studies regarding response rates in Web surveys compared to other survey modes. We did not evaluate the response measures themselves, as we simply did not have enough information to do that. Most often the studies simply report some form of completion rates. Nevertheless, we believe that the reported comparisons do provide sufficient insight into response patterns of Web surveys and the comparison to other modes.

Unfortunately, the limited number of studies also prevents further quantitative analysis of observed differences, e.g. regression. Therefore, a rather qualitative approach has been applied.

There are, of course, many other variables that interact with observed differences in response rates, in addition to the mode itself. For example, one is the characteristic of the population surveyed, as already suggested in the above analysis. The time (year) when the study was conducted may also have an impact. It is very likely that transition effects (lower

response when learning the new method for the first time) and respondent comfort effects (higher responses over time when respondents get to know the method) also occur. Advanced email software, permanent and broadband access are also changing the environment every year.

Another limitation of this meta-analysis may be the fact that we included only probability-based Web surveys, where the list of units invited to take part in the survey is available. Namely, only these types of Web surveys have alternatives in other survey modes in the sense that the same population could be surveyed with another survey modes. Surveys with general invitations on the Web where anyone noticing the invitation can access the questionnaire and participate, for example, cannot be repeated using traditional survey modes, since the same population cannot be reached in any other way. Proper comparison of response rates for such surveys therefore cannot be made.

Despite the limitations in our analysis, it seems we must conclude that, as for now, response in Web surveys is in general much lower than in other survey modes when comparable samples and comparable implementation procedures are used.

However, the above studies – despite split sample experimental designs - still do not provide sufficient scientific evidence to conclude about this causal relation (e.g. Web survey mode decline response rate). The main reason for this is the fact that costs and total survey error criteria were not included into evaluation, what is – of course – very complicated demanding research.

Web surveys may have lower response rates simply because they are much cheaper. Cheaper mail survey (i.e. with only one reminder) also gives lower response rate than a more expensive one (i.e. with three reminders). So, these were all relatively unfair comparisons for Web surveys, which are usually much cheaper to perform. If all the resources that are needed for other survey mode - when we want to achieve the same sample size as with Web survey, for example, envelopes, data-input, administration procedures in mail survey - would be allocated into the incentives in Web survey, the differences in response rates may change. However, none of these studies has compared the equal budget pairs of surveys, but only equal sample size pairs of surveys. There, the Web survey was typically with much lower response rate, but it was also much cheaper, what was not taken properly into account.

Furthermore, even the proper costs comparison may still not suffice, because non-response error may not be isolated from other errors. It may be true that the Web surveys have larger non-response rates, however, the non-response error may still not be there. On the other hand, the sampling error may be much smaller in Web survey due to larger sample size we can afford with the same budget.

We can conclude that no study yet has properly included all these aspects into the comparisons. However, it is also true that in practice, the researchers actually do all these complex judgments while deciding whether using Web survey or some other survey mode.

Besides other insights, this small empirical study thus bring some additional evidence and warnings about extreme caution that is needed in social sciences whenever the causal inference is the target of the study.

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APPENDIX 1: Studies included in the meta-analysis

Reference	Description of the study	Web response rate	Email survey response rate	Mail survey response rate	Fax survey response rate	Telephone response rate	IVR response rate	Statistically significant difference
Bates (2001)	Two random samples of employees: mail survey vs. Web survey with mail invitation. In both cases a reminder card and periodic reminders at the enterprise level.	67%		63%				Yes
Chisholm (1998a)	Two random samples of attendees of a conference (n=600): email survey vs. Web survey with email invitation. 30-question survey on satisfaction with the conference, without pre-notification or reminders.	24%	30%					Yes, at p<0.1
Dillman et al. (2001)	Four random samples of customers: mail (n=2000), telephone (n=2999), IVR (n=2000) and Web survey (n=2000). Among the randomly assigned units to the Web mode, a telephone screening was first conducted in order to identify respondents who are able to complete the questionnaire on the Web. ¹	13%		75%		44%	28%	
Elder and Incalcatera (2000a)	Four random samples of units from a database of technology influencers (n=2760): mail vs. three Web survey (three different designs of the questionnaire) with email invitation. Participants first pre-recruited by a telephone survey and asked for mail and email address. Study on reading computer and non-computer magazines.	37-48%		54%				Yes at p<0.05
Jones and Pitt (1999)	Three random samples of employees of English universities (n=500): mail vs. email vs. Web survey with email invitation.	19%	34%	72%				Yes, at p<0.01

Studies using split samples experimental design for comparing response rates of Web versus other survey modes. Part 1.

¹ For the second phase of this study other survey modes were used in order to examining the effect of switching modes on response rate. Only response rate after the first phase is reported here.

Reference	Description of the study	Web response rate	Email survey response rate	Mail survey response rate	Fax survey response rate	Telephone response rate	IVR response rate	Statistically significant difference
Kwak and Radler (1999)	Two random samples of students (n=2000): mail survey vs. Web survey with email invitation. Questionnaire on information technology. Skip-and-fill sequences were automatic and appeared seamless to the respondent in the Web questionnaire. ID number in the URL address of the email invitation. Two follow-ups for non-respondents in both groups.	27.4%		41.9%				Yes, at p<0.001
Lesser and Newton (2001)	Three random samples of faculty professors (n=1182): mail vs. email (2 subgroups: all email contacts vs. mail pre-notification + 2 email contacts) vs. Web survey (2 subgroups: all correspondence by mail vs. email). Questionnaire about undergraduate students. A pre-notice and one follow-up reminder used (3 contacts).	20.6% (21.9% for mail invitation; 18.6% for email invitation)	45.6% (38.9% for mail pre-notification; 53.0% for email pre-notification)	58.9%				Yes, at p<0.0001
Lozar Manfreda et al. (2001)	Two random samples of school institutions (n=600): mail vs. Web survey with mail invitation (2 subgroups: Web with replacement paper questionnaire in follow-up contacts vs. Web only). Questionnaire on the use of Internet. 2 follow-up contacts.	78.8% (77.0% for Web only; 80.5% for Web with replacement paper questionnaire)		89.0%				Yes, at p<0.1
Marketing Communications Division of Information Technology (1999)	Two random samples of university students: mail survey vs. Web survey with email invitation. Both questionnaires identical regarding question wording and sequence. The online questionnaire had skip-and-fill sequences programmed in. In both cases two reminders at same time intervals were sent.	27.3% (+/- 6.0%)		41.9% (+/- 4.8%)				Yes

Studies using split samples experimental design for comparing response rates of Web versus other survey modes. Part 2.

Reference	Description of the study	Web response rate	Email survey response rate	Mail survey response rate	Fax survey response rate	Telephone response rate	IVR response rate	Statistically significant difference
McNeish (2001)	Two random samples of business respondents, pre-recruited by telephone (in order to find qualified respondents): mail survey vs. Web survey (however, how invitation was communicated is not reported). Long questionnaire. An incentive used after completing the survey.	44%		44%				No
Vehovar et al. (2001d)	Four random samples of business companies: phone (n=900) vs. mail (n=300) vs. fax (n=100) vs. Web survey with mail invitation (n=300) ² . Survey on e-commerce usage. Only response of Internet users reported here.	26%		39%	32%	52%		Web different from mail and telephone at p<0.1, but not from fax
Weible and Wallace (1998)	Four random samples of professors (n=800): mail, fax survey with fax invitation, email survey and Web survey with email invitation. Questionnaire on Internet use. A personalized cover letter. One follow-up using email for non-respondents for all four groups.	26%	24%	35%	25%			Web different from mail at p<0.1, but not from other modes
Wygant and Lindorf (1999)	Two random samples of on-campus residents: mail (n=1299) vs. Web survey with email invitation (n=1270).	50%		32%				Yes, at p<0.1

Studies using split samples experimental design for comparing response rates of Web versus other survey modes. Part 3.

² Another two experimental groups were used, however not comparable to the ones presented here. One group received email invitation to the Web survey, however email addresses were searched on companies Web sites, therefore the sample used is not comparable to the others. Another group received mail invitation with paper questionnaire that they could return by mail, fax, or they could answer a questionnaire on the WWW (Vehovar et al., 2001d). The results of this experiment are presented in section 3.2 on mixed-mode surveys.

APPENDIX 2: The data set

	REFERENC	Mode to which Web is compared	Invitation to Web survey	Web response rate	Other mode response rate	Statist. significant difference	Difference between response rates
1	Bates (2001)	mail	mail invitation	67	63	yes	Web response higher
2	Chi shol m, 1998a	email	email invitation	24	30	yes	Web response lower
3	Dillman et al., 2001	mail	mail invitation	13	75	yes	Web response lower
4	Dillman et al., 2001	telephone	mail invitation	13	44	yes	Web response lower
5	Dillman et al., 2001	IVR	mail invitation	13	28	yes	Web response lower
6	Elder and Incalcatera (2000a)	mail	email invitation	43	54	yes	Web response lower
7	Jones and Pitt, 1999	email	email invitation	19	34	yes	Web response lower
8	Jones and Pitt, 1999	mail	email invitation	19	72	yes	Web response lower
9	Kwak and Radler, 1999	mail	email invitation	27	42	yes	Web response lower
10	Lesser and Newton, 2001	email	email invitation	19	46	yes	Web response lower
11	Lesser and Newton, 2001	email	mail invitation	22	46	yes	Web response lower
12	Lesser and Newton, 2001	mail	email invitation	19	59	yes	Web response lower
13	Lesser and Newton, 2001	mail	mail invitation	22	59	yes	Web response lower
14	Lozar Manfreda et al., 2001	mail	mail invitation	77	89	yes	Web response lower
15	Lozar Manfreda et al., 2001	mail	mail invitation, paper questionnaire in follow-ups	81	89	yes	Web response lower

Data set for meta-analysis of response rates in Web surveys in comparison to other survey modes. Part 1

	REFERENC	Mode to which Web is compared	Invitation to Web survey	Web response rate	Other mode response rate	Statist. significant difference	Difference between response rates
16	Marketing Communications Division of Information T	mail	email invitation	27	42	yes	Web response lower
17	McNeish, 2001	mail	email invitation	44	44	no	Web response equal
18	Vehovar et al., 2001d	mail	mail invitation	26	39	yes	Web response lower
19	Vehovar et al., 2001d	fax	mail invitation	26	32	no	Web response lower
20	Vehovar et al., 2001d	telephone	mail invitation	26	52	yes	Web response lower
21	Weible and Wallace, 1998	email	email invitation	26	24	no	Web response higher
22	Weible and Wallace, 1998	mail	email invitation	26	35	yes	Web response lower
23	Weible and Wallace, 1998	fax	email invitation	26	25	no	Web response higher
24	Wygant and Lindorf, 1999	mail	email invitation	50	32	yes	Web response higher

Data set for meta-analysis of response rates in Web surveys in comparison to other survey modes. Part 2