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## Online versus paper: format effects in tourism surveys

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## Online versus paper: format effects in tourism surveys

### Abstract

The popularity of online surveys is rising, yet the validity of survey data collected online is frequently questioned. This study compares online surveys versus paper surveys administered via regular mail in the tourism context, and examines in detail the extent and nature of survey bias resulting from survey format specific respondent self-selection.

Results suggest that (1) both online and mail samples deviate from census data population statistics regarding socio-demographics to the same extent (but differ in nature), (2) no differences exist in the contamination of data by response styles, (3) online respondents have a lower dropout rate and produce less incomplete data, and (4) responses to tourism-related questions differ significantly, indicating that survey format can dramatically influence results of empirical studies in tourism.

Our findings show that neither pure online surveys nor pure paper surveys administered through regular mail are unbiased. Format-specific self-selection of respondents to participate leads to systematic biases in both cases, making multi-method survey approaches the most reliable way of data collection at present.

### Keywords

survey research, online survey, mail survey, self-selection bias, non-response bias

### Disciplines

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# ONLINE VERSUS PAPER

## Format effects in tourism surveys

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Sara Dolnicar completed her PhD at the Vienna University of Economics and Business Administration where she worked as Assistant Professor and Secretary General of the Austrian Society for Applied Research in Tourism from 1994 until moving to Australia in 2002. Her research interests include market segmentation, quantitative methodology in marketing research, answer format effects and response styles and tourism marketing.

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## **ONLINE VERSUS PAPER**

### **Format effects in tourism surveys**

#### **ABSTRACT**

The popularity of online surveys is rising, yet the validity of survey data collected online is frequently questioned. This study compares online surveys versus paper surveys administered via regular mail in the tourism context, and examines in detail the extent and nature of survey bias resulting from survey format specific respondent self-selection.

Results suggest that (1) both online and mail samples deviate from census data population statistics regarding socio-demographics to the same extent (but differ in nature), (2) no differences exist in the contamination of data by response styles, (3) online respondents have a lower dropout rate and produce less incomplete data, and (4) responses to tourism-related questions differ significantly, indicating that survey format can dramatically influence results of empirical studies in tourism.

Our findings show that neither pure online surveys nor pure paper surveys administered through regular mail are unbiased. Format-specific self-selection of respondents to participate leads to systematic biases in both cases, making multi-method survey approaches the most reliable way of data collection at present.

Keywords: survey research, online survey, mail survey, self-selection bias, non-response bias

# ONLINE VERSUS PAPER:

## Format effects in tourism surveys

### INTRODUCTION

Conducting surveys online has several practical advantages: most importantly, they are generally cheaper and can be administered significantly faster than conventional mail surveys. Yet the validity of online surveys is regularly questioned. Consequently, a significant body of work has developed describing alternative formats of data collection and — less frequently — comparing different formats, which is discussed in detail in later sections.

In the area of tourism, only two studies have investigated this problem (Cole 2005, and Hwang and Fesenmaier 2004). Cole (2005) studied survey format effects when questioning tourism professionals. Hwang and Fesenmaier (2004) investigated the relationship between stated willingness to provide personal information on travel websites and respondents' demographic and behavioral characteristics. However, Hwang and Fesenmaier's study did not compare online versus mail surveys; rather, they compared characteristics of people who stated their willingness to disclose personal information on the internet. Their findings are therefore not directly comparable to behavior-based comparative studies of survey formats. Despite this, a major contribution of Hwang and Fesenmaier lies in identifying that online survey biases are essentially self-selection biases, and that these can be either *coverage errors* or *non-response errors*. Coverage errors result from using sampling frames that are not representative (for example, online chat groups), whereas non-response errors occur when the invited sample is representative, but only a non-representative subsample actually responds. Coverage errors can

easily be avoided. Nowadays most internet panel companies recruit members using a wide range of recruitment avenues (the internet, mail, telephone, and so on), and keep their panel as representative of the national population as possible, being able to provide researchers with evidence their panel members reflect indicators such as Federal Census data. The data discussed in this paper was specifically compared to Federal Census data in Switzerland to ensure its representativity (see Bieger and Laesser 2005). Consequently, the question as to whether different formats of tourism surveys (regular mail, telephone, email, internet, and so on) produce valid, unbiased data for further analysis is essentially one of comparing the occurrence and effect of non-response bias.

Herein is the potential contribution of this paper: we investigate — specifically for the tourism context — the comparative effects of paper versus online surveys. The present study builds on the framework proposed by Hwang and Fesenmaier, and extends Cole's work to a systematic comparison of survey mode effects to empirical studies investigating actual and potential tourists, rather than industry professionals.

The difference between Cole's work and the present study is a good illustration of the context dependence of survey modes. Industry professionals, for instance, must use the internet daily, so a sample of industry professionals might more reliably be captured through an online survey than a sample of tourists.

This study applies a novel research approach comparing paper and online surveys, specifically investigating respondents who self-select to respond to either online or paper versions. This approach highlights how any bias resulting from alternative survey formats comes from the choice of a representative group invited to participate to either (1) not complete any survey (format-independent non-response bias), (2) not complete an online version independent

of the content of the questions (online-related non-response bias), or (3) not complete a paper version independent of the question content (paper-related non-response bias).

The use of two or more alternative survey modes brings about differences in results between the modes due to different subsamples within the population making the choice to participate or not. For example, younger people more familiar with the internet might have a higher tendency to complete online surveys, whereas retired people supposedly have a higher tendency to complete a paper survey in written form. Therefore, survey mode bias is inherently linked with self-selection bias. Rather than pretending (through random assignment of respondents to a survey mode) that each member of a population has the same *a priori* probability to participate in either an online or mail survey, this study attempts to simulate the reality that some people within a population have a higher tendency to respond to a certain survey mode. Our study design therefore addresses online-related and paper-related non-response biases *independent of context*.

The results of our study are of practical importance because they can guide empirical tourism researchers about the preferable mode of data collection for response rate, representativity, and data quality.

## RESEARCH QUESTIONS

The research methodology (see Methodology section) gave members of the selected sample three options: (1) not participating in the survey, (2) participating and using the online version of the questionnaire, and (3) participating and using the mailed paper version of the questionnaire. This paper refers to “online respondents” as the subset of the representative sample of the



population who actually responded to the online survey (behavior-based definition). In making this choice, these online respondents actively chose not to refuse participation, and actively chose not to participate in the paper survey version with the same content.

Using established criteria for survey mode comparisons (discussed in detail in the literature review), the following hypotheses resulting from prior work are tested in the context of an empirical tourism study:

(H1) Online respondents have lower response rates than mail respondents.

(H2) Online respondents are less representative of the population than mail respondents.

(H3) Online respondents produce higher quality data than mail respondents (with respect to the number of omitted answers as well as response styles).

(H4) Online respondents, as compared to mail respondents, behave differently as tourists/travelers, and thus give different answers to tourism behavior-related questions.

Based on the findings with respect to these hypotheses, the dangers of single-mode tourism surveys, both online and paper, are assessed.

The study is conducted in the Swiss context, because Switzerland can be considered a prototypical mature travel market: first, their travel shoppers are experienced as well as sophisticated (Hopkins, Rodi, and Vincent 2002) and their domestic buying environments are highly evolved (in Switzerland, the net travel propensity amounts to well above 75%; Bieger and Laesser 2005). Second, the share of frequent tourists in that country is well above the proposed threshold for a mature market (50% — in the case of Switzerland this number amounts to 68%; refer to Bieger and Laesser 2005). Subsequently — and not surprisingly — growth in such markets (and in Switzerland) is close to nil (D'Souza and Rao 1995; Ehrenberg, Barnard, and

Scriven 1997; with regard to Switzerland: Bieger and Laesser 2005). Finally, Switzerland has the highest population-to-computer ratio in Europe, and also one of the highest levels of internet penetration (in terms of use of the web as a day-to-day media), with more than 75% of the population older than 14 years using the web on a regular daily base (ICT 2005). The selection of such a sample serves a dual purpose. First, Switzerland serves well as an example for a study on tourism survey behavior within a mature market, and is indicative of behavioral patterns of other European countries with a similar market maturity (such as Germany, France, the UK, and the Benelux countries). Second, due to the high internet penetration, we expect that minimal behavioral differences would be noticeable between test persons filling out paper compared to online surveys.

## **PRIOR WORK: ONLINE VERSUS MAILED PAPER SURVEYS**

In the last decade, a vast number of studies set out to assess whether online surveys represented a viable alternative to traditional mail surveys, by directly comparing empirical results obtained from surveys administered by both modes (see Appendix). Most early studies conclude that online response rates were significantly lower than mail response rates, and that the level of undeliverable surveys was significantly higher.

### *Studies prior to 2000*

Schuldt and Totten (1994) compared online and mail surveys using the membership directory of the Academy of Marketing Science as a sampling frame. They found that the traditional mail format led to a significantly higher response rate, while the online version led to quicker

responses. Kittleson (1995) compared response rates of postal and online surveys using an international email directory of health educators as a sampling frame. All respondents were sent a postcard as well as an email. The mail response rate (77%) was more than double the online response rate (28%). The author concludes that online surveys must be followed up by reminders to increase the response rate, otherwise they would be strongly affected by non-response bias.

Weible and Wallace (1998) compared surveys administered through four different modes: mail, fax, email, and web. The sample comprised of MIS professors chosen randomly from a faculty directory, and questions related to internet usage. The researchers found that the email and web modes resulted in the responses being returned twice as fast as the mail and fax modes, and concluded that the mail mode suffers significant cost disadvantages, being three times more expensive than web and email. Similarly, Jones and Pitt (1999), in their study sampling employees at English universities on their health behaviors, found the email and web mode resulted in superior response speed and cost, as well as requiring less post collection processing.

The response rate for the postal version (72%) was significantly higher than for the web (34%) and email (19%) versions. Shermis and Lombard (1999), who surveyed members of the National Council of Measurement in Education regarding their telecommunication needs, found the response rates for the mail and email versions were closer than in previous studies (36% and 30% respectively). They also concluded that the email mode of administration resulted in fewer item omissions and a greater willingness to respond to open-ended questions. On the other hand, Paolo et al. (2000) found no statistically significant differences between email and postal administration in terms of item omissions and quality of responses to open-ended questions. However, their conclusion supported the superiority of email in response speed, but the method had lower response rates (41% for mail, compared to 24% for email). Mavis and Brocato (1998)

distributed paper and electronic versions of a questionnaire to subscribers to a medical education listserv. In their study, the mail version had a significantly higher response rate (77%) than the email version (56%), although the rate of undeliverable addresses was similar for the two modes. The email version was returned at a faster rate than the mail, with 47% received within 24 hours of the survey being distributed. A follow-up reminder resulted in a better response from the mail participants, with twice as many additional mail surveys as new email surveys.

Mavis and Brocato also reported a considerable overall cost advantage for the email method, for both labor hours and survey materials: in their study the postal survey was nearly seven times more expensive than the email method. Concerning data quality, Mavis and Brocato reported no significant differences in item completion between the two modes of survey administration, including the rate of open-ended responses. Similarly, the two methods showed no significant gender bias or international/domestic subscription levels. Both groups exhibited similar levels of experience with the use of email. Mavis and Brocato concluded that while postal surveys appear superior to email surveys overall, choosing which is more appropriate is situation specific. Given no significant differences in data quality and representativeness, they suggest that the appropriateness of method may rest on response speed or cost requirements.

Bachmann, Elfrink, and Vazzana (1996) compared results from online versus mail surveys by assigning each version to 224 respondents. The assignment was not random, because those who received the paper version did not have their email address listed in the directory which was used as the sampling frame. While no difference in organizational characteristics was detected between paper and online respondents, the two survey formats led to significantly different results in other aspects: the response rate was higher for mail surveys (66%) than for email

surveys (59%); the cost was lower, the willingness to respond to open-ended questions higher, and the response times faster for the email survey (email responses were received 6.5 days earlier). The disadvantage of email was the high number of undeliverable emails (but this study was conducted over 10 years ago). Their update of the study, which followed the same design (Bachmann, Elfrink, and Vazzana 1999), confirmed the lower response rate and higher rate of undeliverable addresses of online surveys, but found no evidence of response bias in the online survey. However, it raised doubts about mail surveys, because responses from early and late respondents differed significantly, indicating the existence of response bias. The authors concluded that — on the positive side — online users better represented the general population in terms of socio-demographic profiles at that time, compared to when the study was conducted in 1995. On the negative side, the response rate to email survey requests declined.

Tse et al. (1995) compared email and mail surveys randomly assigned to Chinese students. The only difference detected was the higher response rate among the mail respondents. No significant differences in response speed were detected, and neither did the socio-demographic profiles and responses given differ.

Treat (1997) compared mail and email surveys using the US federal state agencies' census. That study found mail surveys had a higher response rate, raising the question whether the socio-demographic profiles would be negatively impacted by response bias.

Tse (1998) compared email and mail surveys, randomly assigning Chinese students to each of the two conditions, concluding that the online survey was faster; however, the response rate was higher for the mail survey. No differences between responses were detected.

Couper, Blair, and Triplett (1999) compared mail and email methods using a sample of employees from US statistical agencies. They looked at overall response rates, post-collection

processing, data quality, and cost. They found that mail surveys had a response rate nearly 30% higher than email, and that the email method was disadvantaged by the increased clerical effort involved in checking and editing returned questionnaires before they could be analyzed. While there was no significant difference between item missing rates for both modes in relation to attitude items, the mail surveys had a significantly higher rate of missing items on background measures. Finally, although not including a concise breakdown of the costs associated with each method, the authors state that due to large start-up costs, technical problems, and clerical actions related to the administering of the email survey, their study did not realize the costs savings expected from using the email mode of delivery.

Davis (1999) specifically examined the internal consistency of paper and web surveys using a sample of students at the University of Michigan. Using Cronbach's alpha, Davis concludes that the internal consistency of the web version was comparable to that of the paper survey. Davis also suggests that web questionnaires can lead to more honest and frank responses, because the web respondents reported more self-enforced reflection than those participating in the paper version.

Contrary to most early studies comparing online and mail surveys, Mehta and Sivadas (1995) conclude that the online survey was less expensive, produced considerably faster responses, and higher response rates. While they found no differences in the completeness of the surveys and the actual responses, they assessed the quality of email responses as higher. A possible reason for these findings is that the study used addresses from an online bulletin board. Online bulletin boards are discussion groups, and participants are very familiar with the internet and are willing to share their views with others through an electronic interface.

A very interesting study of slightly different nature was conducted by Sweeney et al. (1997). The authors did not compare survey responses, but focus groups, a research method typically used in the exploratory stage of a study. They compared a traditional focus group with a computer-based focus group, using a sample of 34 respondents assigned to two traditional and two email focus groups. The online respondents were more curious about the group composition, more interested in the research, more optimistic, more concerned about knowing what to say, and felt that they had contributed all they wanted to a higher degree. This group produced significantly more meaningful ideas, but felt they were not able to express their feelings related to the research topic to the same extent as the conventional focus group. In this study, the online focus groups were more expensive to conduct. The authors conclude that the mode of conducting focus groups should therefore be chosen according to the study circumstances. For example, the authors suggest that the online focus group method should be superior to traditional focus groups when projective techniques are used and when participants are geographically dispersed.

### *Studies after 2000*

More recent surveys continue to identify lower response rates for online surveys in general, but higher rates of undeliverables are reported less frequently and samples are generally improving in representativity. For instance, Bason (2000) studied differences between data collection using four techniques: telephone, email, online, and interactive voice recognition, using the representativity of resulting samples and response rates as evaluation criteria. The four conditions had 750 university students randomly assigned to each. While no significant differences in the representativity of samples were determined, the mail survey achieved the highest and the online survey the lowest response rates. Similarly, Raziano et al. (2001) found, in

a sample of 114 division chiefs among geriatric units in the US, that while email surveys were returned twice as fast as postal surveys, the response rate for the email version (58%) was again lower than that of the postal version (77%). They also concluded that email administration had a cost advantage. The conclusions that email is inferior in response rate, but superior in response speed and cost, are echoed by Ilieva, Baron, and Healey (2002), Moore, Soderquist, and Werch (2005), Shannon and Bradshaw (2002), and Truell and Goss (2002). Deutskens et al. (2006), Miller et al. (2002) and Schillewaert and Muelemeester (2005) also found that results obtained from online and offline modes were comparable. Deutskens et al. surveyed the customers of a manufacturer regarding their perceptions of the manufacturer's service quality, and claimed the generalizability of online studies will improve as people become more familiar with the internet. Miller et al. concluded that among their sample of undergraduate students, the web administration did not compromise the integrity of the data and that online surveys are a viable alternative to paper surveys. Schillewaert and Meulemeester surveyed online web panel members via four modes (telephone, mail, web panels, and pop-up web surveys) and concluded that although the modes resulted in four significantly different groups, they became comparable when socio-demographics were controlled. Cobanoglu, Warde, and Moreo (2001) compared mail, fax, and web survey methods, using response speed, response rate, cost, and data consistency as evaluation criteria. They contacted 300 university professors, of which 100 were randomly assigned to each of the three survey formats. In terms of response speed, fax ranked first, followed by online surveys and mail surveys. The researchers found the online survey to be significantly more cost-effective than fax or mail. The analysis of findings shows that results based on all three different survey formats lead to the same conclusions. Email had slightly higher rates of undeliverable addresses, but this effect was not significant.



Klassen and Jacobs' (2001) study also compared four different modes: mail, fax, disk by mail, and online. The response rate for the online version (14%) was lower than all other versions (which ranged from 20–23%). However, the researchers found the item completion rate was nearly 5% higher among the online respondents compared to the mail respondents. A study by Ranchhod and Zhou (2001) sampled UK marketing executives to determine whether online respondents differed from offline respondents in their knowledge of the internet and email communication, the extent of their email use, and time spent using email. The researchers conclude that although email surveys are considered more efficient, care is needed when selecting a suitable online population because the two participants groups differed in respect to their responses.

A study specifically comparing students' answers to sensitive questions (Knapp and Kirk 2003) found no difference between the response content of the three modes: email, internet, and touch phone. The three survey formats were randomly assigned among 352 students. McCabe et al. (2006) randomly assigned 7,000 undergraduate students to an online or mail format to report on secondary consequences of substance use, and report no differences in findings or in the socio-demographic profile of the students who completed the survey. McCabe et al. conclude that email is therefore a viable alternative to mail surveys. The study by McMahon et al. (2003) compared mail, fax, and email modes and found that email produced the lowest response rate, but the fastest response speed. Using a sample of physicians listed in the membership directory of the Georgia chapter of the American Academy of Pediatrics, the email method also resulted in the highest number of invalid addresses. Contrary to earlier studies, incomplete items was lowest among the email respondents, and the authors conclude that regular updating of membership email addresses would significantly improve the usefulness of the online administration method.

Quigley et al. (2000) compared mail and email modes through a survey administered to US Department of Defense active duty personnel, civilians working in a military setting, military spouses, and reserve members. Their overall sample of 36,293 participants was split into three groups: paper survey, paper survey with an invitation to complete online, and an online version with an invitation to complete on paper. Giving respondents the option to complete the survey online when receiving the paper version improved the response rate only slightly, with the response rate for the paper-only version reaching 40%, and the overall response rate for the paper version with online option was 42%.

In contrast to other studies, Quigley et al. did not find an overall faster response speed with the online version; instead finding that both versions exhibited similar response cycles. However, within the sample, response speed for the online version was much faster for some respondent groups: the active duty personnel and civilian employees. They conclude that the online method may provide a slight time advantage for particular groups.

Schonlau, Asch, and Du (2003) also gave their sample (college-bound high school students) a choice of two modes, asking respondents to respond via a web survey, but also giving them the option to request a hard copy version. Given the sample was high school students bound for college, and would be expected to be quite internet savvy, the researchers were surprised that only 35% of the sample completed the survey online. The researchers found that a phone call reminder had a significant effect on the web response rate, increasing it by 12%. This study also found that incentives were highly successful in increasing the response rate (nearly 6% without incentive compared to 31% with incentive) when sent out to non-respondents after the web survey had been available for a couple of months.

Smith et al. (2007) surveyed US military personnel concerning their medical history and health-related issues. Participants were also given the option between paper and online versions, and their preferences were evenly spread between the two, with 55% completing the online version and 45% completing the paper questionnaire. They found that men were more likely to complete the survey online, and the online respondents were more likely to be married, on active duty, and be in an occupation related to IT or other technical areas. The researchers found that both versions had equal completion rates (98%). Contrary to many other comparative studies, Smith et al. found the cost-effectiveness of using the online mode was reduced by significant initial costs in establishing web capability, security, and maintenance; although overall the web-based administration still returned cost savings. Finally, the researchers note that given the low overall response rate of 37%, the findings may not be representative of the US military population in general.

Yun and Trumbo (2000) used a random sample from members of the National Association of Science Writers to send paper surveys which contained a link to an online version, and these resulted in 45% returning the paper version and 19% completing the survey online. The online versions were received much faster than the paper versions, supporting the findings of most comparative studies. The topic of the survey was the respondent's use of email for professional purposes, and the researchers conclude that online respondents may have different characteristics to postal respondents because their response profile was significantly different. In a study by Roy and Berger (2005), respondents were also sent a paper version of a questionnaire, which included the link to an online version. The researchers used the Encyclopedia of Associations database as their sampling frame, with 95% of the respondents ( $n=403$ ) returning the survey by mail, and 5% by email. They also selected an additional 112 associations to receive an email invitation to

complete the online version, 12 of which were undeliverable. This email-only round produced a response rate of 11%. The researchers conclude that lottery incentives did not increase the response rate of online surveys. With a similar research design, Sax, Gilmartin, and Bryant (2003) randomly assigned freshman students to three groups: paper survey by mail, paper survey by mail with option to complete online, and online survey only. The group with the option to complete online had the highest overall response rate (24%) but only 20% of these actually completed the questionnaire. The mail-only version followed closely with a rate of 22%, and the web-only option had the lowest response rate of 18%. The researchers propose three reasons for the lower response rate of the web only group: that students do not check their emails as regularly as assumed, students may opt out due to privacy and confidentiality concerns, and the survey could have been too long. Among the group given the option of mode, males were more likely to complete the online version.

Carini et al. (2003) gave one group of university students an online survey to complete, and the other group the option to complete either a web or a paper survey. The total sample amounted to 58,288 students, unequally divided between groups. The researchers conclude that only small mode effects existed and that response rates were at similar levels. Sethuraman, Kerin, and Cron (2005) surveyed wireless telephone owners to identify new functional features of wireless telephone handsets. Overall, the internal consistency of the web sample was higher than that of the mail sample. The authors also state that the web-based conjoint analysis more closely represented the actual product preferences of the general wireless telephone user population compared to those resulting from the mail-based conjoint analysis.

Two studies (Ballard and Prine 2002; and Bandilla, Bosnjak, and Altdorfer 2003) compared mail and online survey administration modes using samples from the general population. Ballard

and Prine posted questionnaires to every household in Thomasville, Georgia (USA), investigating attitudes towards community policing. Households were also given the option to complete the survey online. Of the 9,400 surveys posted, 2,287 were returned, giving an overall response rate of 26%. Of these, 71% completed the mail version and 29% elected to complete it online. Ballard and Prine compared the demographics of the two groups and found that the online respondents were more likely to be white, younger, have higher incomes, be college educated, and wealthier than those responding by mail. However, the authors conclude that despite these differences in socio-demographics, the two groups were “more alike than different” (p. 487) in respect to their perceptions of community policing. However, Ballard and Prine also clearly state that neither respondent group were representative of the total population, which may be a reflection of the low overall response rate.

Bandilla, Bosnjak, and Altdorfer (2003) conducted their study among the adult population of Germany. The paper version was administered via a random selection process and resulted in a sample of 3,138 respondents. The online version was administered to members of an online research panel which is maintained by the forsa Institute to be representative of the general population. Similar to Ballard and Prine, a comparison of demographic characteristics revealed that online respondents were more likely to be male, younger, and better educated than mail respondents from the general population. Because of these demographic differences, the authors developed a weighting adjustment based on the general population to make the two samples comparative. After making weighting adjustments based on age, gender, and education, they found the differences between internet users and the general public were still significant, so they extracted two subsamples from the two groups that had comparable education levels. Based on these subsegments and constant demographic characteristics, Bandilla, Bosnjak, and Altdorfer

conclude the data collected online was almost identical to that collected using traditional offline methods.

In contrast to many recent studies, McDonald and Adam (2003) detected quite significant differences between online and mail surveys. They compared the two modes in terms of response level, speed, comparability of results, and respondents and data quality, using the membership list of a football club as their sampling frame. Emails were sent to the 3,900 members who stated that email was their preferred mode of communication; 1,026 other members were asked to complete the survey by mail. The online survey led to a large number of undeliverables and a significantly lower response rate than the mail survey, but the responses were received quicker with fewer sensitive items omitted. Differences in both the responses and socio-demographic profiles of respondents were detected. The authors thus conclude that online surveys cannot be used as a substitute for mail surveys.

Similar to Sweeney et al. (1997), Curasi (2001) examined techniques typically used in exploratory research: in-depth interview conducted online compared with those conducted face-to-face, assessing non-response rate, data quality, and depth and motivation. Twenty-four respondents were interviewed using each of the two modes. The online approach led to a higher non-response rate, and the results obtained from the internet were less detailed than the personal interviews. Nevertheless, the authors conclude that online interviews are a viable alternative if time, financial, or geographical constraints exist.

The only comparison of online and paper surveys published in the area of tourism (Cole 2005) studied the research question in the context of surveying travel agents, not tourists. While results are not directly comparable with tourist surveys, given that travel agents are much more likely to use the internet as an everyday communication tool, results indicated that the response

rate was lower for the online version of the survey, which also had higher levels of missing data, and suggested that web-respondents have a particular response style in answering the questions. The online survey was collected faster and less expensively, but had a response rate of only 11%, compared with 29% for the paper survey. The demographic profiles of the web and paper respondents differed slightly, with the paper version respondents having an average age four years older than the web respondents (55 and 51 years respectively). Also, the number of years the respondent's agency had been in business was significantly higher for paper respondents (23 years) than web respondents (18 years). While all the web respondents indicated their agency had a website, only 70% of paper respondents indicated the same. In terms of data quality, the web survey had significantly more missing items than the paper survey, with 38% of web respondents missing up to 10% of the items but only 25% of the paper respondents doing the same. Finally, the responses provided by the two groups differed in content. Those responding by mail were more likely to perceive that traditional travel retailers were reducing in number because of technological development. Web respondents did not believe the barriers to entry in the leisure industry were as high as the mail respondents perceived. Cole states that of the 72 items included in the survey, the two groups differed significantly on 11 items (15%).

### *Conclusions from prior work*

The review of prior work indicates no clear answer as to whether or not online surveys can be used as a substitute for traditional mail surveys. Different results were obtained, depending on the topic and the study population. Mostly, quite homogeneous samples (such as students) were surveyed. To date only two studies have investigated the general population. However, a few general tendencies emerge: online surveys are more prone to be undeliverable due to frequent

email address changes; higher numbers of undeliverable invitations cause lower response rates; low response rates in turn put at risk the representativity of online samples. Advantages mentioned include quicker responses, lower cost, greater willingness to respond to open-ended questions, increased data quality, fewer omissions of questions, fewer mistakes, and usefulness for dealing with sensitive topics. While a large number of the comparative studies focused on response rate, most of the above-mentioned advantages were not studied in any depth. Several previous studies (Ballard and Prine 2002; Carini et al. 2003; Quigley et al. 2000; Roy and Berger 2005; Sax, Gilmartin, and Bryant 2003; Schonlau, Asch, and Du 2003; Smith 2007; and Yun and Trumbo 2000) were designed to allow respondents to choose which type of survey they wished to complete. This is an important design feature, because it allowed the assessment of respondents' preferences.

The current methodologies being used in tourism studies also warrant discussion. A review of quantitative empirical studies published in the *Journal of Travel Research* and the *Annals of Tourism Research* from 2005 to 2007 (as this review included over 160 articles, the list of reviewed papers can be obtained by contacting the authors) indicates that postal surveys still dominate, with 37% of the reviewed studies using this method. Self-administered questionnaires follow, used in 25% of empirical tourism studies. Email or online administration occurs in only 10% of studies. Despite many of the comparative studies concluding that online survey administration has some advantages over the more traditional postal method, in the tourism context, researchers are still nearly four times more likely to use the postal method. Of concern is that 10% of the empirical studies reviewed did not clearly state their methodology, which indicates a dangerous lack of precision in empirical research reporting.



## METHODOLOGY

### *Survey administration and data*

The data were collected in Switzerland in 2004, including only Swiss residents, and data collection was administered by GfK, one of the leading market research companies in Europe.

In 2004 the study began with a sample from a panel representative of the Swiss resident population, covering 3,050 households and all their members. Participants were informed that they would be required to complete multiple questionnaires over a one-year period. Each questionnaire related to one vacation trip undertaken (business trips were excluded). Only respondents who indicated their willingness to participate throughout the entire year were included. Respondents received a reminder every three months asking them either to return completed questionnaires or declare that they had not undertaken any trips during the previous three months. Including people who had not traveled in the previous three months is perfectly legitimate in the context of the current study, because many empirical tourism studies are not only interested in current tourists but in potential tourists who currently are not taking vacations or are taking vacations at competing destinations.

The final sample (respondents who participated for the full year) consisted of 1,540 households, including 4,081 persons, and 11,245 person trips (a response rate of approximately 50%). Only one person per household completed the questionnaires.

At the beginning of the year all members of the representative GfK panel were given three choices: (1) not participating in the survey, (2) participating and using the online version of the questionnaire, and (3) participating and using the mailed paper version of the questionnaire. This procedure ensured that any self-selection that occurred was not content dependent, but survey-

format driven. Respondents were not explicitly given the option of switching between survey formats during the survey year, but could do so if they wished. No single respondent chose to do so.

The written questionnaire was structured and self administered, and included a wide variety of questions (the rationale and source of where the items/constructs stem from are given in brackets): basic socio-demographics (such as age, occupation, and household size), personal questions of psychographic nature (such as satisfaction with housing and living conditions in general — due to supposedly different travel behavior driven by such conditions, refer to Pas, 1984; Meyrat-Schlee, 1993; Blinde and Schlich, 2000), and items developed to capture personality dimensions (due to indication that personality strongly influences behavioral patterns; refer to Gountas and Gountas 2001; Gountas 2003, and the cited literature), as well as tourism-related questions. More specifically, these tourism related questions comprised the constituting elements of a trip (Bieger 2002; Freyer 1997; Inskeep 1991; Kaspar 1991): the number of travel companions within the household, the duration of the trip, the choice of destination, means of transport, and accommodation (differences in trip configuration likely result in differences with regard to behavior; refer to Bieger and Laesser 2005 and the cited literature).

### *Criteria for comparison*

Previous comparisons of alternative survey formats used numerous criteria. A review of empirical studies (see the Appendix for more details) shows that 56% of the studies used response rate, two of which declared this criterion to be non-response rate. Response speed was used by 42% of comparative studies, item omission by 19%, sample representativity by 25%,

and cost was investigated by 30%. Data quality was assessed in 11% of studies, and the same proportion looked at the amount of post-collection processing required and willingness to respond to open-ended questions. Each of the following criteria was used by only one or two studies: scale use, accessibility, convenience, computer anxiety, and knowledgeable sample.

The present study integrated most of the above criteria: (1) response rate, (2) representativity (based on socio-demographic profile of respondents), (3) data quality (operationalized as the number of items omitted and data contamination, represented by extreme response style and acquiescence response style), and (4) data comparability and consistency (responses to survey questions).

## RESULTS

### *Response rate*

The indicator used to assess the level of response rate was the dropout quota of respondents after the first three-month period of the study. Importantly, respondents were informed that their participation would entail completing questionnaires over a one-year period. Only respondents who committed to this procedure were included in the study. Optimally, all respondents would have completed surveys or declared that they had not traveled in the previous three months four times during the study period. The dropout rate was used as a response rate measure to test H1 (that online respondents have lower response rates than mail respondents), and was operationalized as the percentage of total respondents who discontinued completing questionnaires at any time during the one-year survey.

Analysis of the data does not support H1 — online respondents demonstrated lower dropout rates, with only 6% discontinuing participation in the survey, compared to 16% of the respondents who completed the paper version.

These findings contradict most of the online versus mail comparisons reported in the past that used response rate as an evaluation criterion (Bachmann, Elfrink, and Vazzana 1996; Bason 2000; Kittleson 1995; McDonald and Adam 2003; Treat 1997; Tse 1998; and Tse et al. 1995). This also supports the findings that resulted from the study by Mehta and Sivadas (1995), in which higher response rates were achieved under the online condition. In this study, addresses from an online bulletin board were used, which probably explains the atypical findings for 1995. The findings from the present Swiss study may have been similarly affected; Switzerland has a very high computer usage and regular internet usage rate, which puts this country into the top rank in terms of computer and internet use (ICT 2005), and may indicate that in prior studies the reason for the low response rate may have been the low usage and the familiarity level of respondents with the internet.

### *Representativity*

The representativity of samples was compared in two ways. First, differences between the socio-demographic profiles of online and paper respondents were tested to assess whether the two profiles differed. If not, they were either equally representative or neither was representative. If the profiles differed significantly, a comparison with the actual federal census data was needed to evaluate which of the two samples better matched the nation's socio-demographic profile. In the direct comparison of samples, personal characteristics beyond socio-demographics were also included, because socio-demographics alone might not assure representativity. For this purpose,

a set of variables in which respondents expressed their satisfaction with housing conditions as well as a battery of personality questions were compared across the two samples.

The direct comparison of the online and paper respondents led us to conclude that people who complete their questionnaire online live in larger households (for Pearson chi-square and p-values, see Table 1), they are more likely to be under 25, and less likely to be older than 55, their education level is higher, they are less frequently retired or housewives/husbands, and more frequently public servants, employees, and in middle management.

----- Insert Table 1 here -----

Those who chose the online surveys were less satisfied with their general living and housing conditions, particularly the space situation in their home, the cost aspect of their living and housing circumstances, and the external garden space of their accommodation, as well as with the possibility of designing the exterior area.

In terms of the self-description of respondents' personality, fewer online respondents (27%, compared to 47% among paper respondents) perceived themselves as down-to-earth, as liking the material things in life (28% of online respondents and 44% of paper respondents), as a very logical type of thinking person (27/38%), as a very objective person (16/25%), and as being very good at organizing work and time (26/36%). Perceiving that experience was more important than ideas was believed strongly by 48% of paper respondents, but only 31% of online respondents. Fewer online respondents (31%, compared to 37%) felt that the pleasures of good food and gastronomy were very important, but more (11%, compared to 8%) enjoyed daydreaming.

These results indicate that the samples do not have the same profile, which is further supported by the comparison of the samples using the same criteria as the Swiss Federal Census (see Table 2). None of the sample types was *a priori* more or less representative than the other; there were differences with regard to the majority of criteria compared. Online respondents were significantly over-represented in the French-speaking part of Switzerland and the German-speaking eastern midlands, in large cities and urban areas in general, among males as well as the younger population. Consequent highly significant differences between the samples were detected.

----- Insert Table 2 here -----

Comparing the profiles of both the paper and the online respondents with the Federal Census data does not allow a firm conclusion about which sample better represents the total Swiss population. Each sample outperforms the other with respect to approximately the same number of criteria. Consequently, H2 (online respondents are less representative of the population than mail respondents) has to be rejected. While significant differences between the samples exist, determining which of the two samples better represents the total Swiss population is not possible.

These findings support the results reported by McDonald and Adam (2003), but contradict those of Tse et al. (1995), Bason (2000), and McCabe et al. (2006) — none of which found significant differences in socio-demographic profiles. However, this may partly be because the samples investigated by some of these studies were very homogeneous (for instance, student samples). It is likely that no random split of a student sample would lead to much variation in socio-demographics. Bachmann, Elfrink, and Vazzana conclude in their 1999 study that online

users represent the general population in terms of socio-demographic profiles better in 1999 than in 1995, indicating that representativity of online samples is a dynamic phenomenon likely to change as computer and internet usage rates increase. In Switzerland the breaking point may soon be reached where online samples surpass mail samples in representativity. However, based on the data used for this study, this emerged as a hypothesis that should be tested later.

### *Data quality*

Two criteria were used to assess the quality of the data derived from the two different survey modes: (1) the number of omissions (non-responses to questions) was used as an indicator for low data quality, and (2) the contamination by two forms of response styles — extreme response style (ERS) and acquiescence response style (ARS) — as an indicator of low data quality.

The total number of omissions was computed by adding all missing values across the data set for each person. The resulting value is metric in nature. Higher values represent more omissions, and thus lower data quality. ERS was computed by adding all extreme responses across a set of questions for each respondent. Extreme responses were defined as the endpoints of the scale, and the questions used were the self-evaluation of their personality. These questions were chosen because: (1) personality questions have been shown in the past to be susceptible to response styles (Kampen and Swyngedouw 2000), and (2) Likert scales are known to be particularly endangered by response style manifestations (Cronbach 1950). The resulting value was of metric nature, with higher values indicating a higher probability of response style contamination. ARS was computed the same way as ERS, except that only the extreme positive response was counted. Again, the resulting variable is metric, with a high level indicating a higher probability of ARS contamination of the data.

In order to compare the number of items omitted, all variables from the initial questionnaire not dependent on a response to another question were selected — only items that should have been completed by all respondents were included in the comparison. Then, the number of variables not responded to was determined for each person. The total number of items in the questionnaire was 69. On average, nine questions were not answered.

The comparison of missing items was undertaken by analyzing variance, with online versus mail respondent status as independent, and the number of missing items as the dependent variable. The difference was found to be significant (ANOVA,  $F = 39.2$ , 1 df,  $p\text{-value} < 0.001$ ), with online respondents omitting on average seven questions, and mail respondents omitting on average 12 questions.

Regarding possible response style contamination of the two data sets, the levels of both ERS and ARS are low in both samples, with no systematic differences detectable between the online and the paper survey sample.

### *Data consistency and comparability*

In order to compare the tourism-related survey responses of the online and paper survey sample, the five constituting factors of travel were selected from among the survey items: destination, transport, accommodation, trip duration, and size of travel party.

Significant differences (chi-squared values, df, and p-values are provided in Table 3) were found with respect to the target destinations of online respondents, compared to those of paper respondents. Forty-seven percent of paper respondents spent a vacation in Switzerland, compared to only 35% of online respondents. Significant differences were also found regarding accommodation chosen, with paper respondents staying with friends and relatives more



frequently, while online respondents used five-star hotels and holiday residences more frequently. Paper respondents undertook significantly fewer vacation trips: 27% stated that they had not undertaken a single trip, compared to only 8% of online respondents. If they did travel, paper respondents spent fewer nights away from home, with 10% staying one night only, and 5% staying three weeks or more. The respective figures for online respondents are 7% and 11%. The above indicates that the travel behavior of online respondents is more adventurous. This notion is supported by the comparison of the methods used to organize trips by the two groups: 8% of paper respondents booked group packages with travel guides, compared to only 4% of online respondents, who preferred not to book any kind of package (72%). The significant differences in the means of transportation chosen are a likely consequence of online respondents being able to undertake more trips outside of Switzerland: 16% used airplanes, compared to only 9% of the paper respondents.

----- Insert Table 3 here -----

With respect to H4 (online respondents behave differently as tourists/travelers, and thus give different answers to tourism behavior-related questions from mail respondents), we conclude that significant differences exist with respect to the tourism-related behaviors of paper and online respondents, thus supporting H4. These results have major implications for empirical research in tourism, indicating the significant extent to which the administration of a survey can influence study findings.

## CONCLUSION

The aim of this study was to compare results from a tourism-related empirical survey across survey modes, including online and mailed paper versions. Four hypotheses emerging from prior work in the area were tested in relation to the following criteria: response rate, sample representativity, data quality, and response equivalence.

Contrary to the findings of prior studies, both the dropout quota and the number of omissions in the questionnaire were lower for online than for paper respondents. No difference was detected with respect to contamination by response styles.

Distinct differences were found between respondents who completed an online survey and those who returned a paper survey. Online respondents were found to live in larger households, be younger, and have higher education levels. They were less satisfied with their living conditions, perceived themselves as less down-to-earth, less interested in the material things in life, less oriented to logical thinking, less objective, and less organized than paper respondents. These differences were supported by a comparison with Swiss Federal Census data. While neither sample was more or less representative, the deviations indicate they are structurally different.

The differences in relation to tourism-related questions were quite substantial. Online and paper respondents differed in all major travel components: the destination they chose, the mode of travel, the type of accommodation, the length of stay, and the organization of the trip. This indicates that the choice of survey format in empirical tourism research may be particularly sensitive to the survey mode.

These results lead us to conclude that both mail-only and online-only surveys produce data sets containing non-response bias due to the self-selection of respondents to participate in the respective survey format conditions. The practical consequence from these findings is that multi-mode surveys should be used more frequently in tourism research to ensure the validity of results, not only with respect to socio-demographics, but also concerning less-evident traits such as tourism-related behavior and motivations. Multi-mode surveys allow respondents to choose their preferred mode of completing the survey. While this does, admittedly, produce more work in data collection, the present study demonstrates that multi-mode research can be implemented quite easily, and the cost of multi-mode research is not significantly higher than for single-mode empirical studies. As this exercise shows, a bi-modal approach (as chosen by this research) can result in lower costs than a one-modal mail-only survey. The tender submitted by the executing market research institute for the bi-modal approach was about 20% less than for the mail-only survey, basically because the process of online surveys is largely automated, and significant variable costs of the collection work are either delegated to the test persons or omitted altogether. Each questionnaire completed online, compared to paper, results in immediate cost reductions. Among those are postage and handling of the questionnaire, data recording (whether by hand or by scanner), or the clearing of ambiguous responses (which rarely occur with online surveys), and so on. The proposed multi-mode research approach could clearly be extended even further to include telephone and fax response options. However, process costs under such a framework would need to be analyzed beforehand.

Not all surveys must necessarily be conducted using a multi-mode approach. Often studies do not require representative sample, or researchers are interested in specific subsegments of the population. In both these cases, it may be legitimate to use a single survey format only. For

instance, if researchers wish to investigate rural and older persons, paper surveys are preferable, because this population has a comparably low affinity for online surveys. In contrast, the behavior of an urban and younger population can easily be recorded online; they clearly prefer that type of methodology when there is a choice.

## APPENDIX

Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
Bachmann, Elfrink, and Vazzana	1996	448	1995–96	~	~	male and female	compare email and mail survey methods	use of TQM processes	item omission — response speed — data quality — cost — willingness to respond to open-end questions	response rate — undeliverables	email can be a substitute for mail within certain populations
Bachmann, Elfrink, and Vazzana	1999	500	1998	business school deans and division chairpersons	~	male and female	to update 1995 study	use of TQM processes	cost — response speed — willingness to respond to open-ended questions	response rate — undeliverables	non-response is the major disadvantage for email surveys
Ballard and Prine	2002	2,287	1998	all citizens of Thomasville, Georgia, USA	~	male and female	compare internet and mail surveys	citizen perceptions of community policing	~	representativity	both samples were non representative, but there was little difference in response across two modes

Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
Bandilla, Bosnjak, and Altdorfer	2003	2,386	2000	adult population living in private households in Germany	18+	male and female, through resulted in disproportionate number of men	compare web and written self-admin surveys	orientations to the environment	~	representativity	online data collection comparable to offline data collection
Bason	2000	3,000	2000	university students	~	male and female	compare telephone, email, web and interactive voice recognition surveys	drug and alcohol use	generally representative	response rate — survey completion rates	web and IVR approaches are feasible alternatives to traditional methods
Carini, et al	2003	58,288	2000	university students	~	male and female	compare web versus paper modes	nature of college experience	~	potential for self-selection bias — non-response rates	mode effects were very small, not significant
Cobanoglu, Warde, and Moreo	2001	300	2000	hospitality professors	~	male and female	to compare fax, web and mail survey results	hospitality education	response rate — response speed — cost — coding efficiency	undeliverables	data consistent across three modes
Cole	2005	1,000	2002	travel agents	~	male and female	compare responses from web surveys and paper surveys	competitiveness of leisure travel retailers industry	response speed — cost	response rate — item omission	need for more research into internal scale consistency of modes

Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
Couper, Blair, and Triplett	1999	8,253	1997	employees in nine federal statistics agencies	~	male and female	compare email and mail surveys	organizational climate	item omission on background measures	response rate — representativity — post collection processing	~
Curasi	2001	48	2000	marketing research students	~	male and female	compare depth interviews conducted online to depth interviews conducted face to face	consumer loyalty and ecommerce web sites	post collection processing	non representative — response rate — detail in open-end questions	online methods are a viable alternative if there are time, financial or geographical limitations
Davis	1999	1,371		university students	17–26	male and female	compare internet and pencil/paper surveys	demographics, symptoms of negative emotion	willingness to respond — honesty in responses	~	internal consistency of online survey comparable to that of mail survey
Deutskens, et al	2006	1,957	2002	manufacturer's customers	~	male and female	compare online and mail surveys	service quality of office equipment manufacturer	cost	~	generalizability of email is comparable to mail, and will improve further as people become more familiar with the internet

Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
Ilieva, Baron, and Healey	2002	100	1999	central bank research department and/or board members	~	male and female	compare postal survey vs combined email/web survey	independence of central banks from central government	response rate — response speed — cost — sample control — post collection processing	~	~
Jones and Pitt	1999	500		university employees	~	male and female	compare postal, and email survey methods	exercise, teeth cleaning, and fruit consumption	cost — response speed — post collection processing	response rates	~
Kittleson	1995	306	1994	subscribers to the international email directory of health educators	~	male and female	comparing response rates of postal surveys and email surveys	involvement in professional conferences, subscription to professional health education journals	response speed	response rate	~
Klassen and Jacobs	2001	846	1997	senior production/marketing persons	~	male and female	compare web, PC disk by mail, fax, and mail surveys	forecasting practices	item completion	response rate — coverage error	~



Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
Knapp and Kirk	2003	1,077	~	university students	~	male and female	compare paper, internet, and touch tone phone	one sentence questions on a range of topics, varying in sensitivity	~	~	no significant difference in response content across modes, regardless of level of personal sensitivity
Mavis and Brocato	1998	400	~	subscribers to medical education listserv	~	male and female	comparison of postal and electronic mail surveys	perceptions of and experience with listserv	cost — response speed	response rate	two modes are comparable, but choice should be situation specific
McCabe et al.	2006	7,000	2001	undergrad students	~	male and female	compare web and mail surveys	student life characteristics and behaviors	~	~	minimal differences between two modes with respect to survey results
McDonald and Adam	2003	4,926	2001	members of Australian Rules Football Club	~	male and female	compare email survey to mail survey	club satisfaction survey	response speed — item omission on sensitive items — cost	undeliverable — response rate — scale use	respondents in the two groups differ significantly in their demographics and responses given

Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
McMahon, et al	2003	987	~	pediatric physicians	~	male and female	compare postal, fax, and email modes of survey	rotavirus vaccine	response speed — item omission	response rate — undeliverables	~
Mehta and Sivadas	1995	663	1994	people posting articles on Newsgroup bulletin boards	~	male and female	compare mail and email surveys	attitudes towards internet commercialization	cost — response speed — response quality	representativity	little difference in responses between modes
Miller, et al	2002	225	~	undergraduate students	18–29	male and female, predominantly female	compare mail and email surveys	alcohol use/abuse	~	~	data sets comparable between two modes — web surveys do not compromise integrity of data
Moore, Soderquist, and Werch	2005	116	2003	college students	18–25	male and female	examine effect of mode on data quality, and interaction effect of mode and gender	binge drinking	accessibility — convenience — post collection processing — response speed — cost	representativity	no significant differences in measured outcomes between delivery modes
Paolo, et al	2000	114	~	4th year medical students	~	101 men, 63 women	compare mail and email educational evaluations	clerkship experiences	response speed	response rate — item omissions	~

Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
Quigley, et al	2000	36,293	2000	employees and their spouses of department of defense	~	male and female	compare response rates from web and paper survey modes	info sources and needs, familiarity with info technology, use of internet, privacy concerns, internet use while deployed	~	response rate	~
Ranchhod and Zhou	2001	1,000	~	UK marketing executives	~	male and female	compare response rates of email and mail surveys	knowledge of internet communication, extent of email use, length of email use	~	response rate	use of web survey must take into account the characteristics of likely participants
Raziano, et al	2001	114	~	chiefs of geriatric medical divisions/teaching programs	~	male and female	compare mail and email/web surveys	prevalence and characteristics of ACE units among academic geriatric programs	cost — response speed	response rate	~
Roy	2005	451	~	executives listed in the Encyclopedia of Associations database	~	~	test for factors affecting overall response rates of email and mixed mode surveys	association information, bonding, and affiliations among members, reasons for membership	~	response rate	~

Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
Sax, Gilmartin, and Bryant	2003	4,498	2001	college students	~	male and female	compare response rates between mail and email surveys	attitudes to/experiences of first year of university	~	response rate	~
Schillewaert and Meulemeester	2005	543	~	online web panel members	~	male and female	compare results from telephone, mail, web user panels, and pop-up web surveys	media behavior, leisure activities, personal habits, lifestyle attitude, technology adoption, internet usage	~	representativity	the four modes resulted in significantly different groups of respondents
Schonlau, Asch, and Du	2003	352	2001	college bound high school students	~	male and female	compare response rates between mail and email surveys	future employment financial incentive packages	~	response rate	phone reminders are most effective in improving the response rate for web surveys
Schuldt and Totten	1994	543	1992	marketing faculty members	~	male and female	compare mail and email surveys	shareware attitudes	response speed	response rate	~

Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
Sethuraman, Kerin, and Cron	2005	1,000	~	wireless telephone owners	25–44	male and female	compare online and offline data collection	incorporation of new functions into wireless telephone models	internal consistency — representative sample	~	the two modes can produce substantially different results
Shannon and Bradshaw	2002	377	~	members of an educational research association	~	male and female	compare mail and email surveys	use of technology for general and research purposes	response speed — cost	response rate — undeliverables	~
Shermis and Lombard	1999	1,170	~	members of national council on measurement in education	~	male and female	compare mail and email surveys	use of various electronic media, attitudes towards professional electronic services	response speed — item omission — willingness to respond to open-end questions	response rate	~
Smith	2007	77,047	2001/2003	US military personnel	~	male and female	to evaluate the characteristics of participants who choose web survey submission over mail submission	Millennium Cohort Study covering medical symptoms, diagnosed conditions, and other related health issues	data quality — cost — more complete data	representativeness	~

Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
Sweeney, et al	1997	34	~	research panel members	35–54	male and female	compare traditional focus group with computer based focus group	cognitive dissonance	more meaningful responses	cost	~
Treat	1997	7,198	~	federal statistics agencies	~	male and female	compare mail and email surveys	organizational climate	~	response rate — non response rate	~
Truell and Goss	2002	256	~	business education leaders	~	male and female	compare email and postal surveys	not stated	response speed	response rate	
Tse	1998	500	~	admin and teaching staff at Chinese university	~	male and female	compare email and mail surveys	China's impending control over Hong Kong	response speed	response rate	no significant difference in responses from two modes
Tse, et al	1995	400	~	admin and teaching staff at Chinese university	~	male and female	compare email and mail surveys	business ethics	~	response rate	response speed and quality was not significantly different between the two modes

Authors	Publication Year	Sample Size	Year of Study	Type of Respondents	Respondent Age	Gender	Aims of Study	Topic of Questionnaire	Email superior in...	Email inferior in...	Other findings
Weible and Wallace	1998	800	1997	MIS professors	~	male and female, predominantly female	compare results from mail, fax, email, and web form	Internet use	response speed — cost	response rate — undeliverables	~
Yun and Trumbo	2000	360	1999	members of national assoc of science writers	~	male and female	compare characteristics of post, email, and web site surveys	online communication and attitudes	response speed	representativeness	few observable differences in data quality between modes Web respondents had different characteristics to mail respondents

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## TABLES AND FIGURES

**TABLE 1**  
**STATISTICAL TESTS RESULTS FOR REPRESENTATIVITY**

ITEM	PEARSON CHI-SQUARED VALUE	DF	P-VALUE
Household size	32.4	8	<0.001
Age	44.5	7	<0.001
Education	68.8	9	<0.001
Occupation	87.5	15	<0.001
Satisfaction with living and housing conditions	10.1	3	<0.001
Space situation at home	16.8	3	<0.005
Cost of living and housing circumstances	22.6	3	<0.001
External garden space and accommodation	25.7	3	<0.001
Possibility of designing exterior area	14.9	3	<0.005
Personality: down to earth	47.4	4	<0.001
Personality: liking tangible things in life	32.4	8	<0.005
Personality: logical type of thinking person	29.6	4	<0.001
Personality: very objective person	19.9	4	<0.001
Personality: good at organizing work and time	20.3	4	<0.001
Personality: experience more important than ideas	32.1	4	<0.001

Personality: pleasures of good food are important	20.9	4	<0.001
Personality: enjoy daydreaming	20.7	4	<0.001



**TABLE 2**  
**COMPARISON OF SOCIO-DEMOGRAPHIC PROFILES**

GROUP	FEDERAL CENSUS (%)	PAPER (%)	ONLINE (%)	CHI-SQUARE P-VALUE (ONLINE VERSUS PAPER)
Area of residence: French speaking part of Switzerland	23.6	22.9	<b>28.7</b>	
Area of residence: Alps and pre-alpine areas	22.1	<b>26.5</b>	20.7	
Area of residence: Western Midlands	22.4	<b>25.8</b>	20.7	
Area of residence: Eastern Midlands	27.4	24.9	<b>29.4</b>	0.009
Degree of urbanization: Agglomeration; population >200,000	33.3	25.0	<b>38.0</b>	
Degree of urbanization: Agglomeration; population of 50,000–199,999	19.7	23.4	<b>27.3</b>	
Degree of urbanization: Agglomeration; population of 20,000–49,999	12.3	10.7	<b>12.2</b>	
Degree of urbanization: Agglomeration; population of 10,000–19,999	1.9	<b>2.9</b>	0.7	
Degree of urbanization: Municipality; population of 5,000–9,999	4.7	<b>4.4</b>	3.7	
Degree of urbanization: Municipality; population of 2,000–4,999	11.5	<b>14.2</b>	9.0	
Degree of urbanization: Municipality; population of 1,000–1,999	7.5	<b>8.7</b>	5.4	
Degree of urbanization:	9.1	<b>10.7</b>	3.7	0.000

Municipality; population of <1,000				
Gender: male	48.8	49.6	<b>50.4</b>	
Gender: female	51.2	<b>50.4</b>	49.6	0.823
15–24 years	11.8	10.6	<b>12.7</b>	
25–34 years	13.5	9.0	<b>14.4</b>	
35–44 years	16.4	14.7	<b>19.5</b>	
45–54 years	15.4	15.6	<b>18.0</b>	
55–64 years	11.7	<b>16.0</b>	12.4	
>64 years	14.2	<b>14.3</b>	3.4	0.000

**Bold: Shares within group (paper and online) higher than federal census**

*Source for Federal Census Data: GfK Vademecum (2004); Database Travel Market Switzerland*

**TABLE 3****STATISTICAL TESTS RESULTS FOR DATA CONSISTENCY AND COMPARABILITY**

ITEM	PEARSON CHI-SQUARED VALUE	DF	P-VALUE
Vacation in Switzerland	219	9	<0.001
Accommodation	191	15	<0.001
Number of vacation trips	630	4	<0.001
Duration of stay	198	5	<0.001
Travel booking behavior	314	5	<0.001
Means of transport	230	11	<0.001