

# **Complementary Methodologies: Internet versus Mail Surveys**

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DSS Research tested the hypothesis that Internet surveys provide comparable results to traditional mail surveys. We were able to draw two important conclusions from the analyses: Internet methodology is comparable to traditional mail methodology and Internet surveys can be used to augment or even replace mail surveys in certain circumstances.

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## Overview

DSS Research tested the hypothesis that Internet surveys provide comparable results to traditional mail surveys. We attempted to validate this hypothesis by using a well-tested mail survey that measures satisfaction of members with their healthcare plan. DSS Research has conducted thousands surveys using this questionnaire and the results have been shown to be both consistent and reliable over time. We chose this questionnaire as the basis for comparing Internet and mail methodologies.

## Internet Survey Experience

DSS has conducted a number of Internet surveys since October 1995. We program all surveys in-house, using proprietary software and questionnaire templates. We host all Internet surveys on our Internet server under one of 3 domain names registered to us. We have complete control over the design and operation of all Internet surveys, including tracking of referring sites to our surveys. Although DSS conducts research in a wide variety of industries, we chose to tap our vast experience in healthcare for this project.

## Survey Instrument

DSS has used the survey instrument frequently during the past 2 years. During the past 12 months, we have collected more than 40,000 surveys from members of 45 health plans nationwide. The questionnaire has provided useful, consistent and reliable results across a wide range of populations. It is primarily targeted at managed care health plans, but the questions are appropriate for any type of health insurance plan. The questionnaire contains 76 unique questions and takes about 10 minutes to complete via mail or Internet.

## Similarities between Internet and Mail Surveys

For this comparison, we attempted to administer the questionnaire via the Internet with as few changes as possible from the original presentation, wording and formatting of the mail survey document. We were successful in programming the Internet questionnaire forms to match the look and feel of the mail survey:

- ⇒ Presentations of attribute lists to be rated were identical between the Internet and mail surveys.
- ⇒ Order and grouping of questions was identical in both surveys.

- ⇒ Respondent instructions were virtually identical, except for minor wording changes to replace the actions of “check” and “circle” from the mail survey with “click” on the Internet survey.
- ⇒ The primary differences in the implementation of the survey for the Internet are:
  - *We took advantage of the Internet’s computer-driven format to handle skip patterns.* Whenever a particular question needed to be skipped, the Internet version automatically skipped the appropriate question(s). The mail survey lists every question with instructions for respondents to skip questions as necessary. Fortunately, there are only 5 skip patterns in the entire mail survey so the differences are minor. Past experience has shown that the vast majority of mail respondents understands the instructions and correctly self-administer the survey.
  - *We added 2 questions at the end of the survey.* With the mail survey, we send questionnaires to pre-determined members of a specific health plan. Because we do not know which health plan an Internet respondent will be reporting on, we added a question at the end of the survey which records the name of each respondent’s health plan. We also asked Internet respondents to specify the type of health plan they have (HMO, PPO, etc.) so we can identify managed care and traditional health plan members in the Internet sample.

## Recruiting Respondents - Sources

Mail survey respondents are selected to participate from health plan membership lists provided to DSS. We are not aware of any publicly available lists of health plan members with Internet access. As a substitute, we chose to recruit Internet respondents from 4 basic sources:

- ⇒ *Online advertising.* We purchased \$2,500 worth of advertising on the Excite Network. This amounted to a total of 170,000 impressions of our banner advertisement.
- ⇒ *Online search engines.* We listed the survey web page on 20 different search engines and Internet directories.
- ⇒ *Promoted on sites dedicated to sweepstakes and other contests.* We listed our survey and the corresponding sweepstakes giveaway on 14 different sites that link to sweepstakes available on the Internet.
- ⇒ *Listing on sweepstakes oriented newsgroups.* We posted a description of our survey and corresponding sweepstakes on an Internet newsgroup dedicated to promoting and discussing such sweepstakes on the Internet. A survey participant later posted our survey on a second newsgroup, dedicated to the same purpose.

## Recruiting Respondents - Incentives

Because this survey is at least 10 minutes long (on average) and Internet respondents have no compelling reason to participate (like a request from their current health plan or a personalized letter explaining the purpose of the survey), we offered an incentive to encourage participation. The online banner advertisement, listings on search engines, links from sweepstakes sites and posts on news-groups all mentioned \$500 in cash prizes to be given away to eligible survey participants. Eligible participants were defined as persons age 18 or older who had health insurance, completed the survey and supplied an email address at the end of the survey. Email addresses were used only for the purpose of contacting winners. We held the drawing 6 weeks after the survey began and gave away two \$250 gift certificates.

## Recruiting Respondents - Responses Received

### Online Advertising

Online advertising is the closest surrogate for a simple random sample of Internet users, because the majority of Internet users stop by a search engine on a regular basis. Search engines are analogous to random digit dialing in telephone research. They reach across all demographic and geographic boundaries found on the Internet.

We placed an advertisement in general rotation so every visitor to the Excite, WebCrawler and City.Net sites had an equal opportunity to view the ad. With over 30 million page views per month, the Excite Network has one of the broadest reaches of any site on the Internet.

The animated banner advertisement mentioned the purpose of the survey ("Tell us how your health plan is doing") and it mentioned the incentive offered to survey participants ("Win \$500 for completing survey"). There is no way to know how many of the 170,000 displays of our banner advertisement were actually noticed by Internet users. Although Excite displays the same banner ad at the top and the bottom of each page, the ad produced an exceptionally low response rate. Only 1% of all people who had an opportunity to view this banner advertisement, actually clicked on the ad and visited our Internet survey site. Approximately 20% of completed surveys came from banner advertisements.

### Online Search Engines

Search engines and Internet directories are starting points for most Internet surfers. We attempted to list our Internet survey on all of the most popular search engines (Alta Vista, Excite, Hot Bot, Lycos, Yahoo, etc.). We used keywords like win, win cash, prizes, healthcare survey, sweepstakes and contest. Yahoo was the only major site where our listing did not appear for at least 4 of the 6 weeks the survey was conducted. Despite this effort and the broad potential reach of these sites, the 20 search engines only resulted in 1% of all completed surveys.

## Sites Dedicated to Sweepstakes and Contests

We had tremendous success promoting our survey on various sweepstakes and contest oriented sites. These sites offer free links to contests and sweepstakes on the Internet where willing participants frequently visit to find the latest entries. Several of these sites receive more than 100,000 hits each month. Over 78% of the completed surveys came via referrals from these sites. Although these sources are definitely not representative of the Internet community as a whole, we will show later that results obtained from these sources are remarkably similar to results from the other Internet sources and mail survey results.

## Sweepstakes Oriented Newsgroups

Messages are posted to these newsgroups and interested people click on the corresponding links to sweepstakes and contests that interest them. Approximately 1% of all survey responses came from two newsgroups devoted to sweepstakes and contests. These respondents may also be atypical of Internet users, but they are valid healthcare users and their responses are comparable to other Internet users surveyed.

## Respondent Profiles

The greatest differences between mail and Internet respondents are with respect to demographic characteristics. Interestingly, gender is one characteristic that did not differ between the mail and Internet samples. The strong female response bias (typically at least 60% are female) found in most healthcare surveys is present in the Internet sample, even though most Internet users studies estimate that only 35% to 40% of current users are female.

Internet respondents are younger, more likely to be single, better educated and less likely to come from an African American or Hispanic background than mail survey respondents to this survey. However, if figures from the Georgia Tech Research Corporation are representative of typical Internet users, the sample of Internet respondents to this healthcare survey are much closer to the broad healthcare population than are Internet users in general.

Characteristic	Mail Survey	Internet Survey	Internet Population <sup>1</sup>
Female	65.8%	63.6%	40.5%
<b>Age</b>			
Under 35	25.4%	45.4%	46.5%
35 – 54	55.4%	47.2%	42.2%
55 or older	19.3%	7.4%	11.4%
<b>Ethnicity</b>			
Caucasian/White	88.3%	87.8%	90.4%
African American	6.4%	3.5%	2.3%
Asian American	1.2%	3.5%	2.2%
Hispanic background <sup>2</sup>	7.1%	3.4%	2.3%
<b>Marital Status</b>			
Married	71.5%	60.2%	51.0%
Single	12.6%	26.1%	37.1%
Divorced	11.5%	10.9%	8.8%
<b>Education</b>			
High School graduate	25.9%	12.3%	12.4%
Some college	32.6%	45.0%	39.7%
College graduate	17.8%	21.7%	28.0%
Post graduate work	17.8%	19.9%	17.9%

<sup>1</sup>Internet population figures come from the Graphics, Visualization and Usability (GVU) Center, College of Computing, Georgia Institute of Technology Eighth Internet study published January 1998. Copyright 1998, Georgia Tech Research Corporation.

<sup>2</sup>Hispanic background was asked as a separate question from ethnicity in the Mail and Internet surveys, but it was included as a category in the Gvu survey.

While it is not surprising that the younger Internet population would report fewer visits to doctors and hospitals, it is remarkable that Internet respondents appear to be in worse health than the typical mail respondent.

Healthcare Item	Mail Survey	Internet Survey
Number of doctor visits in past year	4.5	4.1
Hospitalized in past year	11.3%	12.2%
General health is "Excellent" or "Very Good"	63.0%	59.9%
<b>Diagnosed With:</b>		
Hypertension	19.5%	16.9%
Heart disease	3.9%	4.1%
Diabetes	5.4%	5.5%
Cancer	3.1%	3.4%
Migraines	14.2%	19.8%
Arthritis	22.8%	19.6%
Sciatica or back problems	16.0%	19.1%
Vision problems	9.1%	11.0%
Chronic lung disease	5.6%	9.5%
Depression	10.8%	19.2%
Deafness or hearing problems	7.9%	7.2%
Limitation of arm or leg	7.5%	9.7%
Ever smoked 100 cigarettes	45.2%	48.5%
Currently smoke	20.0%	27.6%

## Statistical Analysis of Results

To test the validity and consistency of survey responses, we applied numerous statistical tests and developed a comprehensive statistical model to predict overall satisfaction. Despite some differences between the Internet and mail survey results, the statistical tests show results from the two methodologies to be surprisingly similar.

### Consistency and Reliability

We used three basic test statistics to measure the reliability and consistency of two large groups of customer satisfaction items. One group consists of 9 items related to the quality of health care received (Group 1) and the other group consists of 6 items related to health plan administration (Group 2).

- ⇒ *Cronbach's Alpha*. Cronbach's Alpha measures the internal consistency between a group of attributes based on the inter-correlation between each item. The stronger the correlation between a group of items, the greater the likelihood that those items measure the same underlying

construct. The results for the Internet and mail survey versions show a very high degree of consistency (alpha is close to 1.0):

- 0.936 – Cronbach's Alpha for Internet survey Group 1.
  - 0.872 – Cronbach's Alpha for Internet survey Group 2.
  - 0.937 – Cronbach's Alpha for mail survey Group 1.
  - 0.869 – Cronbach's Alpha for mail survey Group 2.
- ⇒ *Guttman Split-Half*. The Guttman Split-Half statistic divides a list of attributes in half and compares the correlation within each group of attributes. Once again, the statistic shows a very high degree of consistency between the split attribute lists, despite the small number of items in each list:
- 0.932 – Guttman Split-Half for Internet survey Group 1.
  - 0.793 – Guttman Split-Half for Internet survey Group 2.
  - 0.925 – Guttman Split-Half for mail survey Group 1.
  - 0.799 – Guttman Split-Half for mail survey Group 2.
- ⇒ *Strict parallel test*. The strict parallel statistic tests the assumption that all the items in the list have equal variance and equal means. The Chi-square tests for the items in Group 1 and the items in Group 2 are both significant at the 0.00005 level or better for both the Internet and mail surveys.

## Factor Analysis

We ran Pearson correlations on all survey questions to identify the items most correlated with overall satisfaction with a health plan. The 18 questions most correlated with overall satisfaction were then subjected to factor analysis. Factor analysis attempts to identify underlying constructs (factors) that explain inter-relationships between various questions being examined. Factor analysis of the 18 questions produced recognizable constructs or factors where the inter-relationships are both logical and intuitively fit our expectations of how these questions are related. Therefore, the factor analyses provides an additional form of statistical and face validity for both samples. The specific results are:

- ⇒ *Internet survey*. Using criteria that accepts all factors with eigenvalues greater 0.6 produced a 6-factor solution. Although it is common for researchers to use an eigenvalue of 1.0 as the cut-off point, we have had better experience using values between 0.6 and 0.7. These 6 factors explain 79.9% of the variation in the 18 ratings factored.



- ⇒ *Mail survey.* Using the same eigenvalue criteria for mail responses also produced a 6-factor solution. The six factors from the mail survey explain 74.7% of the variation in the 18 survey questions.
- ⇒ *Comparison of Internet and mail results.* The identified factors in these two data sets are remarkably similar. Both surveys produced 6-factor solutions that explain at least three-quarters of the variation in the original data. The questions correlated with each factor are nearly identical in both factor analysis solutions. The Internet and mail survey results only differ on one variable (time spent on claims), which is the most peculiar of the 18 attributes considered. Respondents are asked to rate their time spent on claims even though most managed care plans require no paperwork for claims processing. The relevancy of this question to respondents most likely contributed to it being associated with different factors in the Internet and mail survey factor analyses. In each factor solution, this question does not correlate well with any of the factors. In the Internet survey it has a correlation of 0.33 with Factor 2 and 0.49 with factor 4. In the mail survey, time spent on claims has a correlation of 0.53 with Factor 2 and 0.44 with Factor 4. Every other question in the analysis has a correlation of 0.75 or greater on the factor it is most associated with.

## Analysis of Variance

We performed numerous Analyses of Variance (ANOVA) to determine whether statistically significant differences exist between the distribution of Internet and mail survey respondents on each question. Among the 76 survey questions, 54 of the ANOVA F-tests are significant at the 0.05 level (95% confidence). Most of the differences between mail and Internet responses are very small, but they are statistically significant due to the large sample sizes in each survey (40,000 mail and 4,000 Internet surveys).

- ⇒ *Differences in all areas.* Statistically significant differences were found among every type of question:
  - Use of healthcare services (doctor visits, hospital visits, etc.).
  - Ratings of physician care.
  - Ratings of member services delivered by health plan.
  - Waiting times for various healthcare services.
  - Incidence of health-related problems (depression, vision, heart disease, etc.).
  - Demographic characteristics of respondents (age, education, marital status).
- ⇒ *Small average difference.* Across all 76 questions, the average difference between mail and Internet surveys is only 0.6%. We calculated the percentage difference in average ratings for

each question (mail rating – Internet rating/ mail rating), summed these percentages and divided by 76 to arrive at the 0.6% figure. Internet ratings were lower than mail survey results on 49 of the 76 questions and higher on the other 27 questions.

- ⇒ *Random samples show fewer differences.* As a test, we took random samples of 1,000 mail and 1,000 Internet surveys and compared them. Running the same ANOVA tests on these two smaller data sets showed only 39 out of 76 tests to be statistically significant. The average difference in ratings between these two data sets drops to only 0.2% using the smaller, random samples.
- ⇒ *Weighting on age and education does not change results.* Internet respondents are much younger and better educated than respondents in the mail survey (see respondent profiles for more information). Weighting Internet respondents to match the joint distribution of age and education found in the mail survey does not alter the statistical tests. The ANOVA still reveals 54 significant F-tests at 0.05 level or lower. Fifty of the 54 statistical tests found to be significant before weighting the Internet data are still significantly different after weighting.
- ⇒ *Internet respondents more likely to report dissatisfaction.* Average ratings by Internet respondents are consistently lower than those of mail survey respondents. This is due to having a greater percentage of negative ratings rather than to having less positive ratings. Among Internet respondents, 13 of the 18 average satisfaction ratings are significantly lower than ratings by mail respondents and the remaining 5 ratings show no significant differences. Top 2 box scores (percent Excellent and Very Good ratings combined) tell a different story. Top 2 box scores among Internet respondents are very similar to those who completed the mail survey and in many cases the Internet scores are higher. Only 4 of the 18 Top 2 box scores are significantly different (2 higher and 2 lower) between Internet and mail respondents. However, Internet respondents are less likely to rate their health plan as “Good” and they are more likely to rate their plan “Fair” or “Poor.” These differences in the bottom portion of the rating distribution lead to statistically significant differences in the ANOVA F-tests. We hypothesize that computer-driven surveys (specifically Internet surveys) give respondents a greater feeling of anonymity that leads to more honest, and often more critical, answers.
- ⇒ *Internet respondents have less experience with health care providers.* Internet respondents report having had their coverage a significantly shorter period of time, having made significantly fewer visits to a doctor in the past year, and they are much more likely to report having no experience on the provider and health plan questions.
- ⇒ *Internet respondents are in poorer health.* Internet respondents report being in significantly poorer health (although the differences are small). They report more physical and mental limi-

tations on health assessment questions (including the standardized SF-12<sup>®</sup> assessment tool). They report higher incidences of migraines, back problems, vision problems, chronic lung disease and depression.

## Statistical Modeling

Statistical modeling of satisfaction results shows Internet responses to be more consistent, reliable and predictable than mail survey responses. First, we factor analyzed satisfaction ratings most correlated with overall health plan satisfaction. Then, regression analysis and discriminant analyses were used to predict overall satisfaction with health plans based on computed factor scores.

- ⇒ *Regression analyses.* Making the assumption that the 7-point overall satisfaction rating (1 = Completely Satisfied, 7 = Completely Dissatisfied) represents a pseudo-interval scale, we used the factor scores as independent variables and overall satisfaction with the health plan as the dependent variable in the linear regression model. Data from both the Internet survey and the mail survey are very predictive of overall satisfaction. But, almost every method of evaluating the statistical results shows the Internet survey data produces a better fit than does the mail survey data. Internet survey data explains 54% of the variation in the dependent variable (R-square) while the mail survey explains 48% of the variation. Removing outliers from both data sets (roughly 2% of all survey responses in each data set) improved the R-square of the Internet sample to 67% and improved the R-square of the mail survey to 60%. In both the Internet sample and the mail sample, all 6 regression coefficients are significant at the 0.0005 level or greater. The relative magnitude of the regression coefficients in each model are very similar, showing once again that the Internet and mail survey methodologies appear to be measuring the same basic constructs.
- ⇒ *Discriminant analyses.* For the discriminant model, we compressed the 7-point overall satisfaction scale into 3 groups: delighted (those rating their health plan a “1” or “2”), satisfied (rating of “3”), dissatisfied (rating of “4”, “5”, “6” or “7”). The discriminant model does an excellent job of predicting both Internet and mail survey respondents who belong in the “delighted” category, but the “satisfied” and “dissatisfied” respondents are not accurately predicted by either survey group. The discriminant model predicts 94.2% of Internet respondents and 94.8% of mail survey respondents who fell into the “delighted” group based on their overall satisfaction with their health plans. In the “satisfied” group, only 13.0% of Internet respondents were correctly classified and 21.2% of mail respondents were correctly classified. Of those “dissatisfied” with their health plan, the discriminant model correctly predicted 61.9% of this group in the Internet sample, but only 40.7% of those from the mail sample. Using discriminant analysis to predict only the “delighted” and “dissatisfied” groups produces similar results. In the Internet sample, 99.2% of the “delighted” respondents and 56.3% of the “dissatisfied” respondents were correctly clas-

sified. In the mail sample, 98.7% of the “delighted” and 50.3% of the “dissatisfied” respondents were correctly predicted. Once again, results are very similar between the two data sets, with the Internet sample showing better predictability on every measure.

**Percentage of Correctly Classified Respondents  
Using Discriminant Analysis on 3 Categories of Overall Satisfaction**

<b>Overall Satisfaction</b>	<b>Internet Sample</b>	<b>Mail Sample</b>
<b>Delighted</b> – <i>Completely or Very Satisfied</i>	94.2%	94.8%
<b>Satisfied</b> – <i>Somewhat Satisfied</i>	13.0%	21.2%
<b>Dissatisfied</b> – <i>Neither, Somewhat Dissatisfied, Very Dissatisfied or Completely Dissatisfied</i>	61.9%	40.7%

**Percentage of Correctly Classified Respondents  
Using Discriminant Analysis on 2 Categories of Overall Satisfaction**

<b>Overall Satisfaction</b>	<b>Internet Sample</b>	<b>Mail Sample</b>
<b>Delighted</b> – <i>Completely or Very Satisfied</i>	99.2%	98.7%
<b>Dissatisfied</b> – <i>Neither, Somewhat Dissatisfied, Very Dissatisfied or Completely Dissatisfied</i>	56.3%	50.3%

## Conclusions

We draw two important conclusions from the analyses:

- ⇒ Internet methodology is comparable to traditional mail methodology.
- ⇒ Internet surveys can be used to augment or even replace mail surveys in certain circumstances.

The first conclusion is a natural extension of previous research techniques to the new medium of the Internet. Disk-by-mail surveys have been used for many years to collect more detailed information or handle issues where the survey must be tailored to each respondent’s preferences and interests. These computer-based surveys are nearly identical in form and functionality to Internet surveys. Computer-driven surveys have been shown to give respondents a greater feeling of anonymity, which can translate into more honest responses. Respondents also seem to provide more thought to their decisions when completing Internet surveys, which is seen by the statistical consistency of Internet results compared to mail survey results.

This test of methodologies shows that a non-random, non-representative sample of Internet respondents can produce results very similar to mail surveys on a universal topic like healthcare. The comparability of the mail and Internet samples may be difficult to repeat in other industries where opinions differ more by age and income level. Past experience has shown that satisfaction levels in healthcare do not differ widely among by gender, age or income levels. The rapidly growing base of users should

bring the Internet demographic characteristics on par with most of the general population within a few years.