

Appendix 2: Research Methods

The data collection methods were tightly integrated at the design phase and analyzed in tandem through a mixed-methods research framework.

Surveys

The survey instrument was developed by translating candidate indicators culled from the literature or nominated by the expert committee into questions that could be easily answered by public access computing users. The survey development process took place in three stages. First, the initial language for the survey questions was developed in conjunction with the project expert committee. This stage was followed by an extended period of refinement as we developed the structure of the survey and tested it informally. Finally the survey instrument underwent two types of formal pretesting: cognitive interviews with public access computing users to test the respondents' understanding of the questions, and testing under field conditions to detect problems with the logic and flow.

The survey included standard demographic questions that were asked of all survey respondents, as well as specific questions about library technology use asked only of those who had used public computing resources or services in the past year. Public access computing users were defined as someone who had either used a computer in a public library to access the Internet or had used a public library wireless Internet network to access the Internet using their own computer in the past 12 months. Both the telephone and web surveys were translated and made available in Spanish. The telephone survey instrument can be found in Appendix 4 and the web survey can be found in Appendix 5. Both survey instruments are essentially the same with some minor differences in format to account for the web platform.

Telephone survey

The telephone survey employed a dual frame probability sample of households that combined a list assisted random digit dialing (RDD) sample procedure with a cell phone exchange sample. In addition to these frames, a nonresponse follow-up study was used to explore nonresponse bias. Calls were placed by Telephone Contact, Inc. (TCI) from April 28, 2009 through August 1, 2009. A minimum of ten attempts were made to contact sampled numbers which were released in representative replicates. Upon contact, interviewers asked to speak with the member of the household age 14 and above who had the most recent birthday. The final disposition of the telephone survey is presented in Table 9.

Table 1: Telephone survey final disposition

	Number of interviews
Qualified users	1,131
Non-users	2,045
Total complete	3,176
Partial non-users ¹	1,347
Total	4,425

Web survey

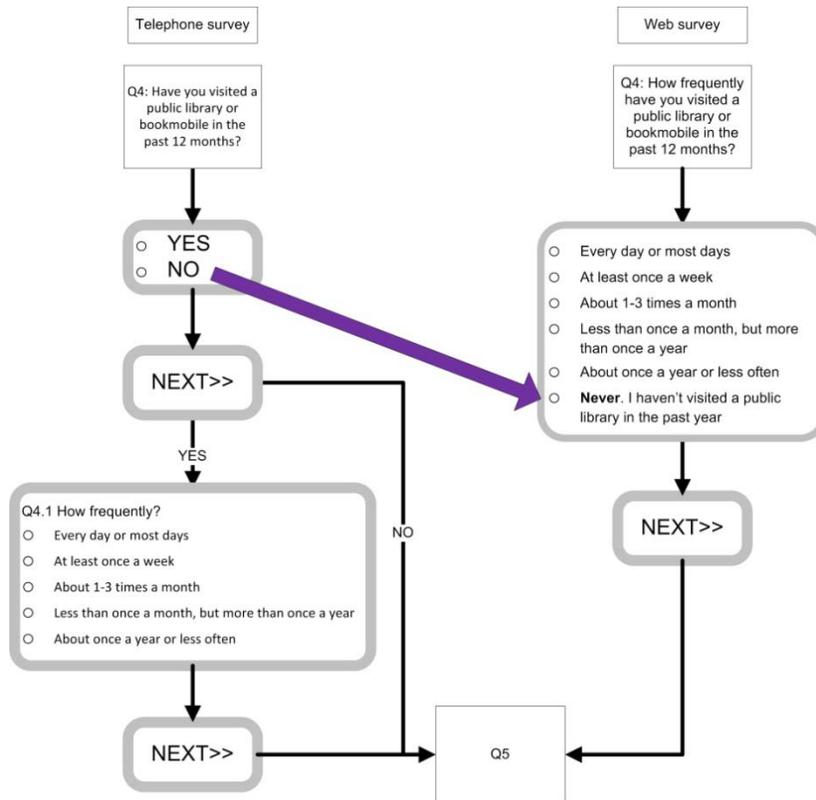
The U.S. IMPACT Study web survey was meant to be a cost-effective supplement to the telephone survey and was intended to allow for a smaller, less costly, telephone sample. Though Internet-based surveys are still largely experimental, they offered a promising method of reaching library-user populations we suspected would be missed in the telephone survey, specifically homeless persons and youth, but also lower income persons and others who are more likely to live in cell phone only households (Blumberg & Luke, 2008). The main drawbacks to using web surveys is the self-selection (convenience sampling) of survey participants and the difficulty in calculating response rates and adjusting for non-response bias, all of which affect the validity of inferences made from the data.

The web survey contained the same questions as the telephone survey, with some adjustments to account for the different platforms and the way the user experiences the survey. Overall, the changes that occurred in the transformation were aimed at moving the respondent through the survey as efficiently as possible and specifically to minimize the number of page transitions.

The most significant transformation made to the survey in order to accomplish this is demonstrated in Figure 23. By rephrasing the question to ask how frequently a particular activity is engaged in and adding the response option of “never,” the number of clicks required to go from one frequency-type question to the next has been reduced to just two irrespective of answer choice, one for selecting the correct answer and one for clicking the “next” button. In the telephone survey, this type of question was presented in two parts, with those who had not engaged in the activity skipped past the related frequency questions.

¹ These calls with nonusers were terminated before demographic data were collected.

Figure 1: Comparison of clicking paths and telephone to web survey mapping



The web survey was administered through public library systems selected using a stratified probability proportionate to size (PPS) sampling procedure, with the measure of size being the population of the library service area (LSA) as reported in the 2006 *Public Libraries Data Files*. The probability proportionate to size sample was necessary to ensure that the survey was deployed in communities with populations large enough to yield the target number of completed surveys. The sample stratified these libraries between self-representing libraries,² single-outlet systems, and multiple-outlet systems, and an oversample of libraries serving fewer than 5,000.

The Chief Officers of State Library Agencies (COSLA) association and state librarians assisted in encouraging libraries to make the web survey available to patrons through library websites and public access computers. Libraries were offered a customized report of the responses from their libraries as an incentive for their participation. During the recruitment phase of the web survey, a number of libraries that were not selected for participation asked to be included. These 34 “volunteer” libraries, along with the libraries that ultimately agreed to participate, totaled 401 and yielded 44,881 valid responses (Table 10).

² The self-representing strata threshold equals 75 percent of the sum of the legal service area populations divided by 580 library systems (number of sampled libraries not including the small library over-sample).

Table 2: Web survey library and interview disposition

	Participating libraries	Qualified users	Total completed interviews
Self representing	91	19,671	28,263
Multiple outlet systems	153	8,954	12,445
Single outlet systems	76	1,863	2,469
Small systems	47	473	524
Volunteer systems	34	876	1,180
Total	401	31,837	44,881

The sampled libraries were randomly assigned to one of 10 two-week fielding periods beginning in April and running until the second week in June, 2009. After agreeing to participate, the libraries were given their assigned fielding period, issued a URL to connect to the web survey, and were directed to the online project Codebox to find options and HTML code for linking to the survey from the library's website. The code created one of several types of links, appropriate for libraries with different types of websites and technical proficiency. Embedded in the URL was the library's Federal-State Cooperative System (FSCS) key, a unique identifier assigned to libraries by the Institute of Museum and Library Services (IMLS). This unique URL allowed survey responses to be linked to their originating libraries, though no information was collected that could identify the patron or branch location where the survey was completed. In addition, libraries were asked to change the homepage on their public access computer terminal Internet browsers to the survey welcome screen and to create a shortcut link to the survey on the terminal desktop.

Survey weighting and analysis

Prior to statistical analysis, the telephone and web survey data were merged into one dataset using a crosswalk that mapped the survey questions and answer choices between the two instruments. The data underwent extensive quality tests to ensure the data were correctly matched across the two datasets and to reconcile the minor structural differences described in the previous section. The UW Center for Studies in Demography and Ecology (CSDE) aided in the development of the testing frameworks and preparation of the data for analysis.

To reduce the errors introduced as a result of sampling error and noncoverage, the merged survey dataset was weighted using a propensity scoring technique to adjust for unequal sampling probability and an iterative proportional fitting technique to match the sample to population parameters.

Propensity score adjustment (PSA) described by Lee and Valliant (2009) is a weight applied to responses from a Web survey based on a reference survey. The reference survey in our case is the telephone survey. One major assumption of PSA is that the combined sample can accurately estimate the probability of being in the Web survey. A logistic regression model that included covariates collected in both the Web and telephone surveys was used to estimate the probability that an individual had completed the Web survey rather than the telephone survey. The covariates in the PSA model were the year the respondent was born, the respondent's sex, the level of education of the respondent, whether

the respondent used library computers or Internet connection in the past year, the level of importance for the community the respondent placed on library computers and Internet connection, the size of the respondent's family, the total number of cell phones owned by family members, whether there was a telephone landline in the household, and the household's level of poverty. Where there were missing values for any of these covariates, estimated values were imputed using SAS (version 9.2) software's MI procedure for a single imputation employing a Markov chain Monte Carlo method. It should be noted that the dataset with imputed values was used for the sole purpose of deriving the PSA, not for developing an imputed dataset for general analysis.

After fitting the logistic regression model, the estimated probabilities of inclusion in the Web survey, also called the propensity scores, were ordered and divided into five classes with an approximately equal number of respondents in each class. For each class, the following PSA weight was derived.

$$f_c = \frac{\frac{n_c^R}{n^R}}{\frac{n_c^W}{n^W}}$$

where

f = adjustment factor

c = class { 1, 2, 3, 4, and 5 }

R = reference survey (telephone)

W = Web survey

n = count of respondents

For example, n_c^R represents the number of respondents in class c that completed the reference (telephone) survey, while n^R represents the number of respondents overall that completed the reference survey. By applying the above factor, the estimated population count from the Web survey is distributed among the classes according to the distribution from the reference survey. The PSA weight (f_c) is applied to the observations for respondents completing the Web survey, while respondents completing the telephone survey remain self-weighted: observations are weighted by an inconsequential factor $f = 1$.

The second stage of weighting was the calibration adjustment (also referred to as post stratification weighting) which applied weights to match national parameters for gender, age, race, and library use using a special iterative weighting adjustment to balance the distribution of these variables. Proposed by Deming and Stephan (1940), iterative proportional fitting (IPF) is a method for estimating cell values from a contingency table where the marginal totals stay fixed. Starting with a "seed" table containing original cell values of a contingency table, and then obtaining the marginal totals garnered from a separate source, the iterative algorithm computes and re-computes cell values until they satisfy the set

convergence criteria. The result is a contingency table containing adjusted values that conform to the fixed marginal totals.

For the second stage of weighting, we employed the IPF algorithm provided by Tomlinson and Hunsinger (2009) and used by the Alaska Department of Labor and Workforce Development for adjustment of a three-dimensional contingency table. For our purposes, the three dimensions corresponded to 1) an categorical age variable (14-18, 19-24, 25-34, 35-44, 45-54, 55-64, 65-74, or 75+), 2) a race variable (white, black, native Hawaiian or Pacific islander, Asian, American Indian or Alaskan native, or more than one race), and 3) a gender variable. The seed table was derived from the combined web and telephone survey data. Where there were missing values for any the three variables, imputation was performed as described previously. For the marginal totals, data was taken from the U.S. Census Bureau’s Civilian Noninstitutionalized Population (October 2009) estimates to represent population totals.

The final stage of weights was based on those that reported having visited the library at any time during the past 12 months. Using the weighted telephone survey as an approximation for our general population over 14 years old, we adjusted the final weights to reflect the estimated 69.5% that reported visiting the library compared to the 30.5% that reported not visiting the library.

Optimally, researchers would like a study sample size that furnishes enough power to successfully test their hypotheses by limiting sampling design variability. A simple random sample is the most efficient way to minimize sample size while limiting variability. Like many large studies, the practical conduct of this survey precluded carrying out a simple random sample. Rather, a complex sampling design including unequal weighting was employed to ensure coverage and representation. The study design effect (DEFF) is a measure of the consequence of a complex study design on variability compared to that of a simple random sample. The design effect for an estimate is the ratio of the actual variance (estimated based on the sample design) to the variance of a simple random sample with the same number of observations.

$$DEFF = \frac{Var(p)}{Var_{SRS}(p)}$$

$$= \frac{n \sum_{i=1}^n w_i^2}{\left(\sum_{i=1}^n w_i \right)^2}$$

Here p is the estimated proportion for a variable, $Var(p)$ is the estimated variance of that proportion, $Var_{SRS}(p)$ is the estimated variance of the proportion under simple random sampling, n is the unweighted number of observations, and w_i represents the weight on observation i . Based on user observations and weights, the design effect for the U.S. IMPACT Study survey is 5.07.

The design effect is also a factor in the computation of the study’s overall margin of error. Here, the margin of error is computed as an adjusted standard error associated with the widest possible 95% confidence interval.

$$\pm \left(\sqrt{DEFF} \times 1.96 \times \sqrt{\frac{p(1-p)}{n}} \right)$$

To maximize the adjusted standard error, we assume the estimated proportion (p) is equal to 0.50. Given the entire sample, the margin of error tells us that the estimated proportions will differ no more than this amount of percentage points from their true values in the population under study. The margin of error for an estimate based on public access technology users is ± 1.0 percent.

Besides sampling design variability, other forms of error are likely introduced in the analyses of data from most survey samples. Bias in selection of respondents, measurement error, and violation of modeling assumptions can all have an influence on variance computations. It is recommended, therefore, that the margin of error be interpreted conservatively.

Case studies

In order to provide insights into the study's research questions that are not amenable to quantitative investigation and provide greater context for interpreting and validating findings, we selected four public libraries for case studies based on their balance of region, library type, community demographics, and size:

- **Fayetteville Public Library:** Single outlet library in Fayetteville, Arkansas (population 57,491).
- **Enoch Pratt Free Library:** Multiple outlet library system in Baltimore, Maryland (population 632,941). In addition to the central building, the branches studied included South East Anchor and Orleans.
- **Marshalltown Public Library:** Single outlet library in Marshalltown, Iowa (population 30,353).
- **Oakland Public Library:** Multiple outlet library system in Oakland, California (population 431,634). In addition to the central building, the branches studied included Asian, Cesar Chavez, Eastmont, and Rockridge.

In addition to these libraries, a pilot case study was conducted at the Mount Vernon City Library in Washington State.

The case study teams conducted interviews and focus groups with public access technology users during one-week site visits between March and May 2009. Key library staff, administrators, board members, as well as representatives of local government agencies and community service organizations also participated in interviews and focus groups. Table 11 shows the number and types of interviews conducted at each site.

Table 3: Case study interview disposition

	Qualified users	Library staff	Community stakeholders	Total
Fayetteville	41	8	18	67
Enoch Pratt	38	16	6	70
Marshalltown	43	6	16	65
Oakland	42	30	16	88
Total	164	60	56	280

Interview guides for public access computing users employed open-ended questions and were intended to elicit the qualities and outcomes of public computing resources use that the respondent valued most. Library staff and community stakeholder guides focused on gathering perceptions of how public access to computers and the Internet in libraries affects individuals, families and communities and how it affects their organizations. Community stakeholders included local agency staff, policy makers/elected officials, and staff or volunteers at other community Internet access locations and were interviewed either individually or in focus groups. Adult public access computing users were interviewed individually, while youth users age 14-18 were interviewed in focus groups. Librarians provided referrals to users who were less likely to be reached through conventional survey methods, including youth, low-income and homeless persons, immigrants, Hispanics and members of other minority groups; the case study teams also approached adult users at computer terminals or on laptops and requested interviews. Participants, youth and adults, received \$20 for their assistance with this study.

Case study analysis

All of the case study interviews and focus groups were recorded and later transcribed. Two types of analysis were applied to the transcripts: the first is a traditional qualitative approach to content analysis where transcripts from administrator and community stakeholder interviews analyzed and probed for emergent themes. The second was a directed content analysis which applied codes derived from the surveys to the public access computing user transcripts.

A traditional approach was used to analyze the community stakeholder and library staff transcripts drawing on Strauss's (1987) "coding from the data" method where data were analyzed as they were collected (progressing from open to selective to axial coding, depending on the concept) and supplemented with memos.

The user transcripts were analyzed using a directed approach to content analysis. Directed content analysis is also referred to as "closed coding" and "selective coding" in the literature (Kondracki, Wellman, & Amundson, 2002; Curtis et al., 2001). In contrast to conventional content analysis which derives codes from the text data itself, and summative content analysis which attempts to understand the contextual use of words based upon frequency and comparisons of quantified keyword use, directed content analysis defines initial codes according to theory, conceptual frameworks, or previous research findings (Hsieh & Shannon, 2005). Directed content analysis can validate or invalidate theory, extend conceptual framework, and provide relevant context to previous research findings.

We call the directed coding process used in the U. S. IMPACT Study *telecoding*. As seen in **Error! Reference source not found.**, the survey questions were transformed into answer statements and assigned a code that was applied to user interview transcripts using Atlas.ti software. Since the telephone survey was based on current understanding and theory of public access computing use discussed in the background section, the situated logic model described in Figure 22, and previous research findings, the method of telecoding is a directed approach to content analysis. While originating codes directly from a telephone survey may be a novel approach of the U. S. IMPACT project, the method aligns with the standards of directed content analysis as described in the Health Sciences and Communication Research literature.

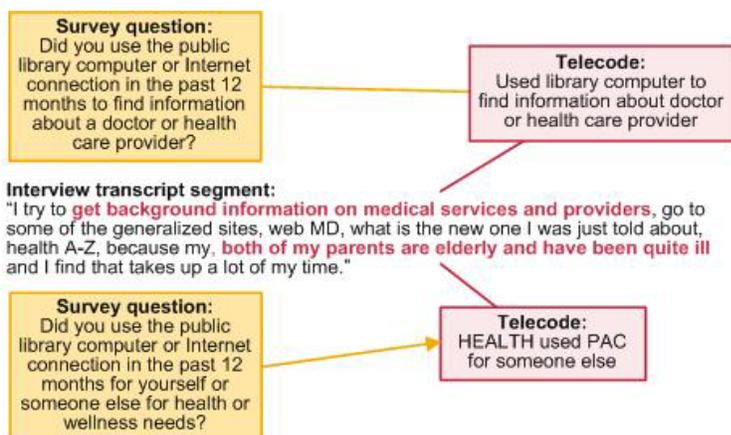


Figure 2: Telecoding example

The directed approach in this study allows the qualitative findings from the case study interviews and focus groups to inform, validate, and provide critical context for the quantitative findings of the survey component of the study. For example, about 25 percent of public access computer and Internet users responding to the surveys reported that they had used public computer resources to search for a job opening or career opportunity in the past year; the corresponding telecode was found in about 33 percent of the case study interview transcripts, providing additional content and context that can be used to understand more about how, why, and in what ways people use public computing resources in their employment searches. In addition, this approach allowed for easy identification of transcript passages that illustrate a particular quantitative finding. The final coding scheme was tested using intercoder agreement methods recommended by Miles and Huberman (1994). The intercoder agreement rate achieved during the final stages of analysis was 90 percent. Comments left by survey respondents regarding other types of use and suggestions for improvements were coded similarly.