Public Opinion Quarterly, Vol. 69, No. 1, Spring 2005, pp. 124–157

COMPARATIVE ANALYSIS OF WITHIN-HOUSEHOLD RESPONDENT SELECTION TECHNIQUES

CECILIE GAZIANO
Research Solutions, Inc., Minneapolis

Abstract A probability sample of households frequently must be translated into a sample of persons representing characteristics of the adult population. Researchers have developed at least 14 within-household respondent selection procedures or their variants to accomplish this task. Although probability methods are preferable, they often increase nonresponse. Quasi-probability and nonprobability techniques have been devised to increase cooperation and decrease costs, although they sacrifice the advantages of randomness. The purpose of this paper is to analyze the results of 16 studies that have compared within-household respondent selection procedures, with respect to demographic representativeness, cooperation or response rates, and costs. Although there is an increasing need to hold down costs yet maintain quality and accuracy as response rates are falling, little systematic, accessible evidence exists to guide choice of respondent selection method.

Survey research usually assumes probability sampling of households and a second stage of random sampling of respondents within households to represent characteristics of the adult population (Groves 1989; Kish 1949).[1] In theory, the random methods of respondent selection should reduce noncoverage, but in practice, they may increase nonresponse by not obtaining the cooperation of the selected respondent. Those methods that allow all eligible members of a household to be listed so that one can be sampled randomly tend to take the

I am especially grateful to Paul J. Lavrakas, Robert W. Oldendick, Scott Keeter, Allan McCutcheon, and Charles E. Denk for comments and encouragement on earlier versions of this article. I deeply appreciate the insightful suggestions of the editor, Peter Miller, and three anonymous reviewers. An earlier version of this paper was presented to the 2001 annual meeting of the Midwest Association for Public Opinion Research. Address correspondence to the author; e-mail: cgaziano@prodigy.net.

1. Usually, samples are weighted by the inverse of the probability of selection to obtain unbiased estimators (Groves and Kahn 1979).

doi:10.1093/poq/nfi006

most time and run the greatest risk of alienating informants. The informant is the person first contacted by the interviewer, and the respondent is the person selected for interviewing (Groves and Kahn 1979). Quasi-probability and nonprobability methods have been developed to overcome these potential problems.

Survey researchers have used at least 14 selection procedures and their variants. Which methods of respondent selection within households are best? Which methods that violate some degree of randomness produce acceptable results, especially with respect to response or cooperation rates,[2] demographic representativeness, substantive results, and costs? This report describes the methods, draws conclusions about the evidence to date, and suggests avenues for future research.

Description of the Methods

The following methods of selecting adult respondents within households have been used in these studies.

PROBABILITY METHODS

Probability methods offer the advantages of having consistent, nearly unbiased estimates of survey population statistics (with appropriate weighting) and of having the property of measurability (the ability to estimate the sampling variance of the estimate using only the sample data). The number of persons in a given household must be known in order to compute the probability of selection, so all eligible household members must be listed. The main drawbacks of probability methods, such as Kish, include the length of time to administer (Hagan and Collier 1982, 1983; Paisley and Parker 1965), the intrusiveness of the questions (O'Rourke and Blair 1983; Salmon and Nichols 1983; Troldahl and Carter 1964), and the impact of the questions on the rapport between the interviewer and the respondent, all of which may increase refusals.

The Kish Method. The Kish technique (1949) often is cited as a true random procedure; however, it does not allow all members of households with more than six adults to have equal chances of selection (Kish 1949; Lavrakas 1993). (Kish estimated that in the late 1940s 1 percent of selected households would include more than five adults.) Developed when most interviews were conducted in person, this method is relatively rigorous and still utilized in telephone surveys.[3] The interviewer lists by name all men in the household

2. "Completion rate," "contact rate," "response rate," "cooperation rate," and the like were used as the authors defined them and did not necessarily match the standardized definitions developed by the American Association for Public Opinion Research (2004), particularly since most of the studies predated standardization.

3. A small study adapted the Kish procedure to a mail survey with less than ideal results (Reich, Yates, and Woolson 1986).

and their relationships to others in order of decreasing age, then similarly lists all women.

The Kish procedure is less problematic for two-person households than for larger households. Asking about age is not necessary in one-adult households or in one female/one male households. The informant's answers allow choice of the appropriate respondent among eight selection tables with rotations of possible combinations of sex and age. Four of the patterns have a relative frequency of use one-sixth of the time and four patterns have a frequency of one-twelfth. Németh (2001) argues, however, that the Kish selection sheets need to be updated to account for changes in the distributions of households by number of adults, especially in Europe. (See appendix A for examples of Kish selection question wording.)

Age-Order. A recent, seldom compared variation on Kish's method is to list adults by age, called "age only" or "age-order" (Denk and Hall 2000; Forsman 1993). Denk and Hall (2000, p. 8) asked, "How many adults live in this household and can be reached here?" (thus excluding those who were generally away and unable to be interviewed). Interviewers then list the household's adults in order of age, generate a random number from one to the total in the household, and choose the individual to whom that number corresponded (e.g., "the second-oldest person"). (See appendix A for more question wording examples.) Compared with Kish's more complex technique, a disadvantage of this method is that it does not produce gender stratification in dual-sex households.

Full Enumeration. Full enumeration appears in the comparative literature only twice. Srinivasan, Christiansen, and Tortora (1996) did not provide details about their use of this technique. Denk and Hall's (2000, p. 8) question was "How many adults live in this household and can be reached here?" Interviewers itemized each adult by name, generated a random number, and designated the appropriate respondent according to the number matching that person on the list (e.g., if the random number were "3" for a four-adult household, the third-listed person would be the respondent required). The interviewer then would ask, "May I speak with [the selected respondent's name]?" The informant would indicate whether this was himself/herself or another person. (See Piazza [undated] for a similar protocol.)

QUASI-PROBABILITY METHODS (BIRTHDAY)

Quasi-probability birthday methods allow interviewers to sidestep a potentially lengthy and intrusive listing process to obtain respondent cooperation, although research so far indicates that birthday procedures do not necessarily work accurately or result in true probability samples.

Next Birthday. Salmon and Nichols (1983) proposed a next birthday technique and compared it with three other methods. The interviewer simply asks to speak to the adult household member with the next birthday. Theoretically,

this method allows all household members to have an equal probability of selection, regardless of household size, and is easy to administer.

Salmon and Nichols (1983) assumed that the occurrence of births is random and that the next birthday method can be viewed as a two-stage process with birth as the first stage and selection for interviewing as the second stage. This should result in a probability sample, they argued. In some cases, however, the survey variable of interest may be an attribute related to the day or season of the year, such as voting—persons who turn 18 in December 2004 cannot vote for president until 2008 when they are 21 years of age, and therefore, the attributes would not be random with respect to birthday.[4]

Last Birthday. Salmon and Nichols (1983) reported some respondent confusion about the next birthday question, however, and recommended that specifying who had the *last* birthday might be more comprehensible. The last birthday (or "most recent birthday") method was the most prevalent among the comparative studies.[5] (See appendix B for examples of question wording.)

NONPROBABILITY, QUOTA, AND TARGETED SELECTION METHODS

These techniques were developed to streamline the selection process, thereby decreasing costs. The intended outcome is age and gender distributions that approximate the general population, although they sacrifice randomness. Age and gender variation are of greater concern than many other demographic variables because most households are relatively homogeneous with respect to education, race, and religion (Lavrakas 1993). Although these techniques may maintain the marginal age and gender distributions, they may not preserve other distributions. Of particular concern are distortions in gender by household composition.[6]

Troldahl-Carter (T-C). Troldahl and Carter (1964, p. 72) modified Kish's procedure to require only two questions: "How many persons 18 years or older live in your household. . . counting yourself?" and "How many of them are men?" The interviewer had just four matrices to use, allowing selection only of the oldest or youngest man or woman. Adults in households with more than two adults of the same gender whose ages fall in between the oldest and the youngest have no chance of being selected. In three-adult households the four versions of the selection table would allow one of the three eligibles to be designated as respondent twice. Troldahl and Carter (1964) believed these violations of random sampling were quite minor.

4. An anonymous reviewer pointed this out.
5. In some geographic areas, births may not be distributed randomly across months of the year. Population data from Sweden for 1921 through 1971 at ten-year intervals showed higher percentages of births in March, April, and May, as well as lower percentages in October, November, and December (Forsman 1993). O'Rourke and Blair (1983) also reported somewhat skewed distributions in Illinois birthdays.
6. An anonymous reviewer pointed this out.

Paisley and Parker Stanford Modification. Paisley and Parker (1965) thought selection error was 5 percent in the T-C procedure and offered the "Stanford modification," requiring 60 computer-generated tables to satisfy a necessary condition of maintaining equal selection probabilities for households of up to five adults.[7] They estimated net selection error at two-tenths of 1 percent for households of more than five adults.

Bryant's Correction for Too Many Females (T-C-B). The distribution of females and males within households changed between 1960 and 1970, although the proportion of men to women remained unaltered, and young males also were increasingly more likely to be away from home. Bryant (1975) saw no solution for the problem of unavailable young men but thought a violation of random selection in the T-C method could better represent females. She recommended using the fourth T-C matrix only half as often as the other three (1, 2, 3, 4, 1, 2, 3, etc.). This approach frequently is called Troldahl-Carter-Bryant (T-C-B, referred to below as T-C-B/men).

Groves and Kahn's Modification (T-C/women). Groves and Kahn (1979) compared face-to-face interviewing, where the sampling frame is dwelling units, and telephone interviewing, where the sampling frame is phone lines. They chose Kish for in-person interviews and T-C for telephone interviews. After pretesting T-C, they decided to ask for women first and then for men.[8] Seeking to solve a problem of informants' forgetting to include young adults living in their residence, Groves and Kahn (1979) ultimately chose to implement Kish in telephone interviews also, finding that Kish improved respondent selection and did not harm response rates.

Czaja-Blair-Sebestik (T-C-B/women). Czaja, Blair, and Sebestik (1982) tested Kish, T-C-B, and a T-C-B modification, asking for women instead of men. The sequence of tables in the T-C-B/women condition was 1, 2, 3, 4, 2, 3, 4, etc., as opposed to the sequence described for T-C-B/men.

Hagan-Collier "Alternative." Hagan and Collier (1983) introduced a simplified variation on the T-C methods that did not ask for household composition. Four forms, distributed randomly to interviewers, ask for (a) the youngest man in the household, (b) the oldest man, (c) the youngest woman, and (d) the oldest woman (using forms A, B, and C two times out of seven and form D one time out of seven). If no such person is present, then the

7. According to Paisley and Parker's table 2 (1965, p. 435), one example of question wording, from the third of the 60 versions, is "First, would you tell me how many persons in your home are over 18 and no longer in school—(Circle number in first column below). How many of them are women—(Circle number in second column below). . . . Then, according to my instructions, I'm supposed to interview the (person indicated above). Is (he, she) available now . . . ?" If seven-adult households were accommodated, 420 tables would be required.

8. The telephone survey wording was "We need to talk to a man in some households and a woman in others. First, could you tell me how many people 18 years or older live there?" After obtaining the answer, they asked, "How many of these are female?" (p.60).

interviewer asks for the opposite sex of the same age group.[9] The Hagan-Collier method has the same bias as T-C (Lavrakas 1993); however, Krótki and Porcellini (1995) analyzed census data and concluded this bias is unlikely to influence overall results.

Youngest Male/Oldest Female (YMOF). An abbreviated Hagan-Collier variant is "youngest male/oldest female," or YMOF (Hill, Donelan, and Frankel 1999; Keeter and Fisher 1997, 1997–98; Srinivasan, Christiansen, and Tortora 1996). This method asks for one or the other of two possibilities, usually specifying "now at home"—for example, "I'd like to ask a few questions of the youngest male, 18 years of age or older, who is now at home" (Keeter and Fisher 1997, p. 2). If this person is not at home: "May I speak with the oldest female, 18 years of age or older, who is now at home?" If this person is not at home, or in case of refusal, or if the selected respondent is home but unavailable, the call is terminated, and the household is contacted again later with the same selection protocol. According to Srinivasan, Christiansen, and Tortora (1996), the YMOF procedure compensates for nonresponse biases by age and gender, and it is advantageous only if gender quotas of equal proportions are maintained. Keeter and Fisher (1997) recommended always asking first for the youngest male to improve representation of males.

ARBITRARY CONVENIENCE METHODS (NONRANDOM)

These methods include interviewing any adult who answers the phone, that is, no selection, or alternating male and female heads of household.[10] They lack representativeness because the most cooperative and available people will be interviewed, particularly older adults and women, and especially in urban areas where there are more woman-headed, single-parent families (Lavrakas 1993). Arbitrary convenience methods are popular, nevertheless, because they tend to obtain higher response rates and reduce costs.

9. The question wording was "May I please speak to the 'youngest man'?" in version A, etc. (Hagan and Collier 1983, p. 549). Variant wording is in Lavrakas (1987, p. 95) : "For this survey, I need to speak with the *youngest adult male* in your household over the age of 17, if there is one." If none, "Then may I please speak with the youngest adult female?" (Also see discussion in Lavrakas 1993, pp. 114–15.) It is a good idea to add words stating that the person wanted is not the one who happens to be at home at the time but is instead the one who lives in the household (Lavrakas 1987, 1993). Interviewers can be confused because a woman in a one-person household qualifies either as the "youngest woman" or the "oldest woman," for example, and they need to be instructed that the "youngest man" in a household can be an 80-year-old man. Informants also can think the interviewer wants an old man or a young woman, for example.

10. See Lavrakas (1993, p. 117) for an example of a selection sheet for heads of household.

The Comparative Studies

There are at least 17 comparative studies, of which 6 were journal articles, 1 was published on the Internet, and 10 were papers presented at annual meetings of the American Association for Public Opinion Research (AAPOR).[11] (One of these was also on the Internet in an abbreviated form; see Keeter and Fisher 1997, 1997–98). Four additional studies were solely on "last birthday" issues. The one in-person survey is described only briefly and is omitted from most of the analysis (Goyder, Basic, and Thompson 2001).

Table 1 provides characteristics of the comparative studies that may help readers assess them. All but one were telephone surveys. Most concerned completed interviews. Others focused on where respondents dropped out during screeners (Binson, Canchola, and Catania 2000), the telephone portion of a phone-mail survey to obtain mailing information (Hagan and Collier 1983), or steps in the process where handoffs were required (Denk, Guterbock, and Gold 1996; Denk and Hall 2000). A handoff occurs when the informant nominates another household member who fits the requested respondent criteria. Many reports did not give exact wording of the selection question.

Two studies were Canadian (Goyder, Basic, and Thompson 2001; Prairie Research Associates 2001), one was Swedish (Forsman 1993), and the rest were in the United States. Five U.S. surveys were nationwide, six were statewide or regional, and the rest were on county or community levels.

Two studies specified that the YMOF method applied to those household members *at home* when the screening call occurred (Keeter and Fisher 1997, 1997–98; Srinivasan, Christiansen, and Tortora 1996). Two other studies allowed substitutions. Zukin, Carter, and Schulman (1987) interviewed the household member with the next most recent birthday if the designated member in the last birthday sample was not at home after three callbacks, and Forsman (1993) made substitutions in 15 percent to 20 percent of the households sampled by three methods (age-order, last/next birthday combined, and T-C/women).

All the studies were field experiments that randomly assigned cases to two or more conditions, except for one that compared separate samples interviewed a few days apart (Zukin, Carter, and Schulman 1987) and another that compared three samples more widely separated in time (Forsman 1993). Most reported unweighted data. Those weighting results by number of adults in the household were Czaja, Blair, and Sebestik (1982), Hagan and Collier (1983), and Hill, Donelan, and Frankel (1999). Czaja, Blair, and Sebestik (1982) also weighted by the reciprocal of number of phone numbers in the household. Keeter and Fisher (1997–98) presented results weighted by 1993 Current Population Survey (CPS) data with a final adjustment for region; their 1997

11. Some of these are in the *Proceedings of the Survey Research Methods Section, American Statistical Association*, available online at http://www.amstat.org/sections/srms/Proceedings/ (accessed December 2004).

Table 1. Survey and Sample Characteristics

Authors	Survey Dates	Location	Number of Completed Interviews	Population	Survey Topics	Number of Callbacks	Interview Method	Respondent Substitutions Allowed?
Binson, Canchola, and Catania 2000[a]	July–Dec. 1992	USA (48 contiguous states)	Last birthday: 701 Next birthday: 736 Kish: 702	Adults, 18–49, English-speaking	Public health, sensitive topics (e.g., AIDS)	Not given	Random digit dialing (RDD)	No
Czaja, Blair, and Sebestik 1982	Not given	Cook County, IL (Chicago and suburbs)	Kish: 899–904 T-C-B/men: 408–11 T-C-B/women: 480–83	Adults, 19+, English-speaking	Neighborhood crime, traffic, health hazards	Up to 10	RDD	No
Denk, Guterbock, and Gold 1996	Not given	Charlottesville, VA, and surrounding counties	No selection: 125–136 Last birthday: 232–60 Kish-like:[b] 285–301	Adults, 18+	Behavioral risk factors	Up to 5	RDD	No
Denk and Hall 2000	1. Fall 1998	Connecticut, Missouri, Minnesota, Washington, DC	Kish-like:[b] 376 Full enumeration: 335	Adults (analyzed only 2–3 adult households)	Alcoholic beverage consumption, regulation	Did callbacks, number not given	RDD	No

Table 1. *(Continued)*

Authors	Survey Dates	Location	Number of Completed Interviews	Population	Survey Topics	Number of Callbacks	Interview Method	Respondent Substitutions Allowed?
			Age-order: 378 Last birthday: 658					
	2. Spring, Summer 1999	USA, mainly communities dominated by colleges and universities	Kish-like:[b] 321 Full enumeration: 359 Age-order: 779 Last birthday: 334	Adults, excluding full-time students in household	Alcoholic beverage consumption, regulation	Did callbacks, number not given	RDD	No
Forsman 1993	1. Dec. 1992	Sweden	Age-order:[c] 994	Adults, 16+	Omnibus survey	Not given	Telephone, directory-based	Yes, 15–20% were substitutes
	2. Jan. 1993		Last/next birthday:[d] 990					
	3. May 1993		T-C/women: 995					

Goyder, Basic, and Thompson 2001	Oct. 2000–July 2001	Kitchener-Waterloo Metro Area, Ontario, Canada	Next birthday:[e] 142 No selection: 188	Adults, 19+	Occupations prestige, smoking[f]	Up to 5	In-person interviews; follow-up by mail	No[f]
Hagan and Collier 1983	Not given	USA national (continental not specified)	"Alternative" method: 1,236 T-C-B/men: 1,237	Adults, 18+	General values and lifestyles	Up to 3	Reported phone portion of phone-mail survey	Not given
Hill, Donelan, and Frankel 1999	1998	USA national (continental not specified)	YMOF: 2,545 Last birthday: 2,329	Adults, 18+	Caregiving to incapacitated friend or family	11+	RDD	Not given
Keeter and Fisher 1997, 1997–98	1. July 1996 2. Nov. 1996 3. April–May 1997 (13–19 days each)	Virginia, statewide	Last birthday: 402 YMOF: 401 Last birthday: 387 YMOF: 416 Last birthday: 367 YMOF: 436	Adults, 18+	Omnibus and political topics	20+	List-assisted RDD	YMOF sample was asked for respondent now at home

Table 1. (*Continued*)

Authors	Survey Dates	Location	Number of Completed Interviews	Population	Survey Topics	Number of Callbacks	Interview Method	Respondent Substitutions Allowed?
Lind, Link, and Oldendick 2000	Jan. 2000	South Carolina, statewide	Last birthday: 500 Next birthday: 500	Adults, 18+ (analyzed only 2–3 adult households)	Growth and development of state	Not given	RDD	Not given
Oldendick et al. 1988	1. June 1983[g]	Ohio, statewide	Kish: 492 Last birthday: 487	Adults, 18+	Public affairs issues, economy, etc.	6+	RDD	No
	2. Oct. 1983	Ohio, statewide	Kish: 406 Last birthday: 393		Public affairs issues, economy, etc.			
	3. Nov. 1984	Hamilton County, OH	Kish: 594 Last birthday: 621		Local policy issues			

O'Rourke and Blair 1983	June 1982	Illinois, two strata: Chicago metro area and rest of state	Kish: 499 Last birthday: 557	Adults, 18+	Omnibus: roads, traffic safety, energy, health, higher education, city government	Up to 10	Telephone, directory-based, some RDD	No
Prairie Research Associates 2001	March 27–31, 2001	Manitoba, Canada	No selection: 402 Next birthday: 402	Adults, 18+	Consumer habits, media behavior, attitudes toward a corporation	At least 1 for next birthday condition	RDD	Not given
Salmon and Nichols 1983	Not given	Jefferson and Oldham Counties, KY (Louisville area)	No selection: 72 Male-female alternation: 46 Next birthday: 69 T-C: 43	Adults	Political attitudes	Up to 3	Telephone, directory-based	Not given

Table 1. (Continued)

Authors	Survey Dates	Location	Number of Completed Interviews	Population	Survey Topics	Number of Callbacks	Interview Method	Respondent Substitutions Allowed?
Srinivasan, Christiansen, and Tortora 1996	Jan. 18–Feb. 1, 1996	USA, national (continental)	Full enumeration: 334 Last birthday: 337 YMOF: 343	Adults, 18+	Omnibus, many topics	3+	List-assisted RDD	YMOF sample was asked for respondent now at home
Tarnai, Rosa, and Scott 1987	1986[h]	Four counties in southwest Washington State	Kish: 862–77 Last birthday: 934–50	Adults, 18+	Socioeconomic well-being, job training[h]	Up to 4[h]	RDD, stratified by county	Not given

Zukin, Carter, and Schulman 1987	July 1986 (2 waves in 11 days)	New Jersey, statewide	1. Last birthday: 400 2. No selection: 400	Adults, 18+, only residents of the state	Taxes, political, and policy issues	Up to 3 (birthday)	RDD	After 3 call-backs, chose next most recent birthday; gender quota

[a] Results of study were for screeners only.
[b] These studies include a selection method that is like Kish, which authors call "inventory-based" or "age + gender." Their studies focus on handoffs.
[c] Author reported on "modified Kish" method that is more like "age only," or "age-order" used by Denk and Hall (2000).
[d] No difference was found between next birthday and last (most recent) birthday results, so the two samples were combined.
[e] This was a variation on next birthday, specifying a particular month.
[f] Information not in the paper, obtained by e-mail to the author from John Goyder on October 19, 2001.
[g] Dates not in article, provided by Robert Oldendick in a letter to the author of December 11, 1987.
[h] Information not in paper; obtained in phone call by the author to John Tarnai on May 11, 1988.

paper included unweighted data as well. Others weighting by certain demographics were Goyder, Basic, and Thompson (2001) and Hill, Donelan, and Frankel (1999). The latter study also presented unweighted data. Srinivasan, Christiansen, and Tortora (1996) and Prairie Research Associates (2001) compared some demographics with census data, and Oldendick et al. (1988) compared demographics with the census in text discussion only. No studies made time at home adjustments as described by Politz and Simmons (1949, 1950).

Reporting of completion, cooperation, or refusal rates varied widely among the studies, many of which were carried out before AAPOR developed standard definitions. Definitions were chosen to be as comparable as possible; figure 1 shows some key comparisons. Four reports gave information allowing computation of AAPOR's cooperation rate 3: number of completed interviews / (number of completed plus number of partial interviews) plus refusals. Those studies were Binson, Canchola, and Catania (2000, screeners only), Czaja, Blair, and Sebestik (1982), Oldendick et al. (1988), and O'Rourke and Blair (1983). Reports with enough information to compute only a "simple completion rate" were Denk, Guterbock, and Gold (1996), Forsman (1993), Hagan and Collier (1983), Hill, Donelan, and Frankel (1999), Keeter and Fisher (1997), Prairie Research Associates (2001), Salmon and Nichols (1983), Srinivasan, Christiansen, and Tortora (1996), and Tarnai, Rosa, and Scott (1987). A simple completion rate means the number of completed interviews divided by the completed interviews plus refusals. This does not conform to AAPOR's (2004) standard definitions but is the best that can be developed for comparisons.

Comparisons will be discussed under the following subheadings: (1) last birthday and Kish methods, (2) last birthday and YMOF techniques, (3) next birthday method and any other technique, (4) T-C and its modifications, and (5) no selection and other methods.

LAST BIRTHDAY AND KISH TECHNIQUES

Only Oldendick et al. (1988) described use of the Kish method in detail, illustrating its table A, although not referring to the interval of rotation of the eight selection tables. The protocols of Denk and Hall (2000) and Denk, Guterbock, and Gold (1996) specified random selection of an adult informant after an inventory of adults in the household, ordered by gender and age. The other studies in this group did not describe the number or rotation order of selection tables.[12]

12. An anonymous reviewer questioned whether these comparative studies replicated the correct frequencies for the Kish tables, which might explain some gender imbalance in results. It is impossible to answer this question because of the lack of information about implementation of procedures in most of the studies that used Kish. Only Czaja, Blair, and Sebestik (1982) provided a full description.

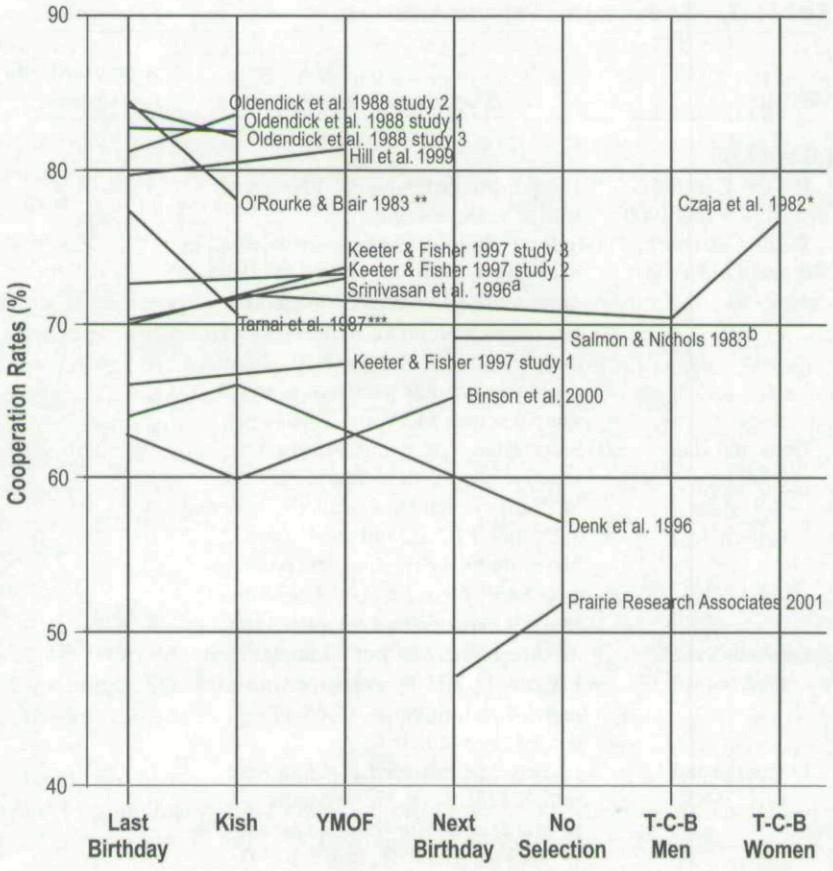

Figure 1. Cooperation rates or simple completion rates for the most frequently studied respondent selection methods by study (see text for definitions). YMOF means youngest male/oldest female; T-C-B means Troldahl-Carter-Bryant.

[a] Srinivasan, Christiansen, and Tortora (1996) also compared full enumeration (76 percent).

[b] Salmon and Nichols (1983) also compared Troldahl-Carter (41 percent) and male-female alternation (43 percent). Overall test of the four methods, $\chi^2 = 31.06$, $df = 3$, $p < .001$ (two-tailed).

* $p < .05$ (two-tailed test), $\chi^2 = 10.62$, $df = 4$.

** $p < .01$ (two-tailed test), $\chi^2 = 7.82$, $df = 1$.

*** $p < .001$ (two-tailed test), $\chi^2 = 15.06$, $df = 1$.

Demographic Representativeness. Both the last birthday and Kish samples overrepresented women in the Denk, Guterbock, and Gold (1996) report (table 2). Denk and Hall's (2000) analysis of two-to-three-adult households indicated that their Kish-type method was the best of four methods in reducing

Table 2. Demographic Representativeness

Methods	Demographic Results	Compared with Census?
LB and Kish		
Binson, Canchola, and Catania 2000	No significant demographic differences; studied screeners only.	No
Denk, Guterbock, and Gold 1996	Gender: Females overrepresented overall in both samples (60.5%, LB; 60.3%, Kish). More females represented in larger mixed-sex households in the Kish-type sample (60% vs. 53.8%). 52.0% of mixed couple households were female in LB sample versus 54.7% in Kish sample.	Yes
Denk and Hall 2000 (analyzed 2–3 adult households)	Gender: Kish-type method was best in reducing overall inclusion of women in 2 surveys, among 4 methods, including age-order, LB, and full enumeration. States study: 4 experimental conditions $\chi^2 = 7.45$, $df = 3$, $p = .101$. Community study: 4 experimental conditions (n.s.).	No
Oldendick et al. 1988	Race: More blacks in 1 of 3 samples in the LB sample, 10.6%, compared with 6.0% in the Kish sample. $\chi^2 = 5.63$, $df = 1$, $p < .05$ (two-tailed).	Yes
O'Rourke and Blair 1983	Age: Fewer people aged 18–29 in Kish sample (25.3% vs. 32.9%); more people aged 60+ in Kish sample (20.6% vs. 18.3%); $\chi^2 = 7.36$, $df = 2$, $p < .05$ (two-tailed).	No
Tarnai, Rosa, and Scott 1987	Demographics were not described.	No
LB and NB		
Binson, Canchola, and Catania 2000	No demographic differences; studied screeners only.	No
Lind, Link, and Oldendick 2000	Demographics not reported; focused only on 2–3-adult households.	No
LB and YMOF		
Hill, Donelan, and Frankel 1999	Gender: LB overrepresented females (63% vs. 53.9%). $\chi^2 = 41.22$, $df = 1$, $p<.001$ (two-tailed). Race, ethnicity: When weighted, LB had larger proportion of Hispanics and blacks (n.s.).	No

Table 2. (*Continued*)

Methods	Demographic Results	Compared with Census?
Keeter and Fisher 1997, 1997–98 (data pooled for 3 surveys)	Gender: LB had more females (58.3%), compared with YMOF (52.4%), $\chi^2 = 8.14$, $df = 1$, $p < .01$ (two-tailed).	Unweighted YMOF data closer to CPS; weighted LB data closer to CPS.
	Age within Gender: Fewer males under 45 in LB sample than YMOF (pooled data); $\chi^2 = 12.73$, $df = 3$, $p<.01$ (two-tailed).	LB sample closer to CPS, weighted or not.
	Region: LB had smaller proportion in northern Virginia (DC suburbs) than YMOF, among five regions; $\chi^2 = 11.27$, $df = 4$, $p < .05$ (two-tailed).	Weighted LB data closer to CPS.
	Race: LB sample included more blacks (n.s.).	Closer to CPS, weighted or not.
Srinivasan, Christiansen, and Tortora 1996	Gender: Cannot compare, because YMOF had a gender quota.	Yes, CPS
	Race: LB sample contained more blacks (n.s.).	
No Selection and LB		
Denk, Guterbock, and Gold 1996	No selection sample overidentified females to a greater degree than Kish-type or LB samples. $\chi^2 = 9.00$, $df = 2$, $p < .05$.	Yes
Zukin, Carter, and Schulman 1987	Had gender quota; no significant differences in other demographics.	No
No Selection and NB		
Prairie Research Associates 2001	No difference in gender, age, or income.	Yes
Salmon and Nichols 1983	No selection sample had significantly more females than the other three methods compared. NB oversampled females but n.s.	No
T-C Variations		
T-C, NB, Male-Female Alternation, No Selection		
Salmon and Nichols 1983	No selection sample had significantly more females than the other three methods (NB, male-female alternation, T-C), $p < .05$, comparing sum of percentage differences from pooled data and from that subsample only.	No

Table 2. (*Continued*)

	T-C had significantly more aged 50+, $p < .05$, comparing the sum of percentage differences from the pooled data (but not from that subsample only).	
T-C/women, Kish, combined LB/NB		
Forsman 1993	No significant differences in gender (only one demographic comparison given).	Yes
Kish, T-C-B/men, T-C-B/ women		
Czaja, Blair, and Sebestik 1982[a]	Gender: T-C-B/men had the highest proportion of men; Kish had the lowest proportion of men. T-C-B/women fell in between. $\chi^2 = 5.63$, $df = 1$, $p < .06$	No
T-C-B/men and Hagan-Collier Alternative		
Hagan and Collier 1982	No significant demographic differences.	Yes

NOTE.—Data unweighted unless noted otherwise. LB = last birthday; NB = next birthday; YMOF = youngest male/oldest female; T-C = Troldahl-Carter; T-C-B = Troldahl-Carter-Bryant; CPS = Current Population Survey.

[a] Data weighted by the number of adults in the household and reciprocal of number of phone lines in the household.

the overall inclusion of women in two surveys.[13] Oldendick et al. (1988) found significantly more blacks in one out of three surveys (closer to the census). The last birthday sample was significantly younger than the Kish sample in the O'Rourke and Blair (1983) article. Denk, Guterbock, and Gold (1996) compared their gender by household size with the census.

Simple Completion and Cooperation Rates. Last birthday samples had higher cooperation rates or simple completion rates than Kish samples in four surveys (Binson, Canchola, and Catania 2000; Oldendick et al. 1988, survey 3; O'Rourke and Blair 1983; Tarnai, Rosa, and Scott 1987), two of which were statistically significant (O'Rourke and Blair 1983; Tarnai, Rosa, and Scott 1987).[14] Denk and Hall (2000) found more informant self-selection for procedures that did not specify gender. The more intrusive methods did not result in

13. Carr and Hertvik (1993) compared one survey utilizing Kish with another survey of a different topic utilizing most recent birthday, both in Ohio, finding that the former included a greater proportion of females and that the latter was closer to 1990 census figures. They suspected that there was male clustering in households that affected gender distributions and representativeness.

14. Respectively, $p < .01$ (two-tailed test), $\chi^2 = 7.82$, $df = 1$; $p < .001$ (two-tailed test), $\chi^2 = 15.06$, $df = 1$.

higher refusal rates; however, nonresponse was considerable when two consents were needed to obtain interviews in multi-adult households, regardless of method.[15] Binson, Canchola, and Catania (2000) found that the largest proportion of screener informants dropped out in the Kish condition, followed by those in the last birthday condition. They singled out interviewers' expectations that respondents would find Kish difficult as the primary reasons for their results—more dropouts occurred in the Kish condition *before* interviewers reached the respondent selection questions. They thought this might explain other studies' results. Findings of O'Rourke and Blair (1983) are similar.[16]

Cost. Last birthday appeared to be more economical than Kish or else fairly comparable (Denk and Hall 2000; Tarnai, Rosa, and Scott 1987) (table 3). Taking a number of factors into account, Denk and Hall (2000) determined that, among four methods, the one with the highest handoff rate cost about 6 percent more than the baseline comparison (age-only method). The Kish-type method in their states study and full enumeration in their community study achieved the most handoffs.

LAST BIRTHDAY AND YOUNGEST MALE/OLDEST FEMALE (YMOF)

Demographic Representativeness. Last birthday overrepresented females in two reports (Hill, Donelan, and Frankel 1999; Keeter and Fisher 1997) (table 2).[17] The third study had a 50/50 gender quota (Srinivasan, Christiansen, and Tortora 1996). Fewer males under 45 years of age were in the last birthday pooled data for three studies by Keeter and Fisher (1997), closer than the YMOF sample to the Current Population Survey. Last birthday samples contained larger proportions of blacks than the YMOF samples (Keeter and Fisher 1997; Srinivasan, Christiansen, and Tortora 1996), and when weighted, Hill, Donelan, and Frankel (1999). Although nonsignificant, this pattern occurred in all three studies. Srinivasan, Christiansen, and Tortora (1996) compared their demographic results to census data, also.

Simple Completion Rates. All five surveys using YMOF achieved slightly higher simple completion rates with YMOF than with last birthday (Hill, Donelan, and Frankel 1999; Keeter and Fisher 1997; Srinivasan, Christiansen, and Tortora 1996) (all not significant). Keeter and Fisher (1997, 1997–98)

15. Denk and Hall (2000) did not report enough information to calculate cooperation or response rates.

16. They stated that preselection refusal rates for the two methods were very different —10.3 percent for Kish and 6.9 percent for last birthday. The investigators expected that informants would be more unwilling to enumerate people in the household than to identify persons with the most recent birthdays. Their expectation could have been communicated unconsciously to their interviewers.

17. An analysis of a last birthday sample in a rural Pennsylvania county without a comparison group found overall completion rates among females to be higher than among males and married males to be underrepresented in particular (Beach and Musa 1997).

Table 3. Costs and Interviewer Productivity by Method

Methods	Costs and Interviewer Productivity (measured variously, as indicated)			
LB and Kish				
Tarnai, Rosa, and Scott 1987	LB took less time than Kish to complete (no detailed information).			
Denk and Hall 2000				
Relative Cost[a]	LB	Kish-type	Full Enumeration	Standard: Age Only
States Study	1.075	1.059	1.019	1.000
Community Study	0.967	1.060	1.133	1.000
LB and YMOF				
Hill, Donelan, and Frankel 1999	LB	YMOF		
Average number of calls to caregivers	5.10	5.04		
Average number of calls to non-caregivers	4.75	4.33*		
Percentage completed on first call	25.4	26.3		
Keeter and Fisher 1997[b] (data pooled for 3 surveys)	LB	YMOF		
Mean calls per completion	4.13	3.76		
Percentage completed on first call	29.6	31.0		
Percentage completed on first 3 calls	59.9	63.2		
Percentage of refusals converted	25.2	26.5		
Efficiency: Completes/total numbers	34.6	37.4		
Srinivasan, Christiansen, and Tortora 1996[b]	LB	YMOF	Full Enumeration	
Percentage completed interviews on first call	76.0	79.0	74.0	
Percentage completed interviews in first 2 contacts	91.0	95.0	92.0	
Average length of contact in minutes	15.12	15.05	16.46***	
Standard deviation	0.81	0.69	0.64	

Table 3. (*Continued*)

LB and No selection				
Zukin, Carter, and Schulman 1987	LB	No Selection		
Interviewing hours	388.0	337.0		
Average length of contact in minutes	20.4	20.3		
Completed interviews per interviewing hour	1.03[c]	1.19		
Difference = $943.50 @ $18.50 per hour per 400 interviews	$7,178.00	$6.234.50		
NB and No Selection				
Prairie Research Associates 2001	NB	No Selection		
Interviewer hours	179.25	141.50		
Average length of contact in minutes	7.5	7.0		
Numbers called	1,805	1,782		
Efficiency: Completes/total numbers	22.3	22.6		
Salmon and Nichols 1983	NB	No Selection	T-C	Male/ Female Alternation
Average length of contact in minutes	2.6	2.3	2.8	2.4

NOTE.— LB = last birthday; NB = next birthday; YMOF = youngest male/oldest female; T-C = Troldahl-Carter.

[a] In this instance, cost comparisons are based on a formula developed by Denk and Hall (2000) to determine the relative cost of different respondent selection methods, other things being equal. Values greater than the reference (1.000) represent higher costs.

[b] YMOF required fewer callbacks because it specified "at home right now."

[c] Eighty percent of LB interviews were completed on first call, even with screening for correct respondent.

* $p < .05$.

*** $p < .001$

also converted more refusals in the YMOF sample in two of the three studies they reported (not significant).

Cost. YMOF had some cost advantages over last birthday in mean numbers of calls, completions on the first call, and completions by three to four calls (Hill, Donelan, and Frankel 1999; Keeter and Fisher 1997), although Srinivasan, Christiansen, and Tortora (1996) concluded the two techniques were similar in cost (table 3). (YMOF and last birthday methods both entailed a significantly lower average length of contact than full enumeration, according to Srinivasan, Christiansen, and Tortora 1996.)

NEXT BIRTHDAY VERSUS OTHER TECHNIQUES

Demographic Representativeness. Salmon and Nichols (1983) reported that their next birthday sample included disproportionately more females, as did their no selection sample. Prairie Research Associates (2001) observed no significant differences.[18] Binson, Canchola, and Catania (2000) detected no significant differences among their next birthday, last birthday, and Kish samples. Only Prairie Research Associates (2001) presented population statistics for comparison.

Simple Completion Rates. The next birthday and no selection plans produced similar simple completion rates that were better than T-C and male-female alternation (Salmon and Nichols 1983). The no selection completion rate bested the next birthday completion rate in the Prairie Research Associates (2001) report. Swedish surveys showed no difference between next birthday and last birthday samples in average selection time and refusals (Forsman 1993).

Cost. Salmon and Nichols (1983) noted that next birthday and T-C took longer per interview than no selection and male-female alternation but not by much; however, their reported length of contact was quite short. Next birthday was less efficient than no selection in the Prairie Research Associates (2001) study.

BIRTHDAY METHOD ISSUES

Informant Nomination. As household size increased, the likelihood of informants not knowing all household members' birthdays increased (Lind, Link, and Oldendick 2000; Tarnai, Rosa, and Scott 1987). The distribution of birthdays of respondents in households with two or more adults can be skewed toward the months just before the interviews (Lavrakas, Bauman, and Merkle

18. The in-person/mail survey (Goyder, Basic, and Thompson 2001) found that a no selection sample in Canada was significantly less representative with respect to age, household size, and migration status (Canadian-born or foreign-born), compared with a sample selected with some alterations in the next birthday technique. The next birthday request apparently was difficult to communicate in foreign-born households.

1993; O'Rourke and Blair 1983; Salmon and Nichols 1983), which would be of concern mainly if birthdays had a relationship with survey topics. For instance, Grandjean et al. (2004) found that the last birthday method led to selection bias for the targets of interviews in the case of a policy issue associated with the topic of birthdays.

Fine-Tuning the Last Birthday Question. Yost (1997) experimented with three forms of last birthday question wording, finding few differences among them for refusals or interview length (see appendix B). Version C, which contained both accuracy and social utility appeals, led to identification of the correct respondent in multiple-adult households more often than the other two (not significant). Version A led to the most handoffs (35 percent), but it also was responsible for the most incorrect handoffs.

It is important to ensure that informants understand birthday selection questions, that the respondent is correctly selected, and that both day and month of birth are measured (Lavrakas, Bauman, and Merkle 1993). Informant misunderstanding of the selection question may contribute to within-unit coverage problems, particularly among larger households, the less educated,[19] and the foreign-born (Goyder, Basic, and Thompson 2001; Lavrakas, Bauman, and Merkle 1993; Lavrakas, Harpuder, and Stasny 2000; Lind, Link, and Oldendick 2000). Sometimes, respondents wrongly chose themselves because they wanted to do the survey (Forsman 1993; O'Rourke and Blair 1983). Interviewers perceived the next birthday method to be easier for informants to understand, although the last birthday method led to more correct nominations of respondents (Lind, Link, and Oldendick 2000). Informants may mistakenly nominate the youngest eligible member of the household as the one with the last birthday (Binson, Canchola, and Catania 2000).

TROLDAHL-CARTER AND ITS MODIFICATIONS

Few studies have contrasted T-C and its variants with other methods, and none of these are recent. New studies might produce different results because of demographic changes over time. Salmon and Nichols's (1983) T-C sample was significantly older than their other three samples. As mentioned, T-C resulted in slightly longer interviews than two other methods.

Both T-C-B/men and T-C-B/women had an advantage over Kish in gender representation (Czaja, Blair, and Sebestik 1982). The T-C-B/men sample contained the highest proportion of married-person households and a lower proportion of one-adult households, likely linked to the gender differences and possibly to a lower cooperation rate. T-C-B/women had the most advantages, including better completion rates[20] and interviewer preference. Czaja, Blair,

19. Are lower SES households less likely to celebrate birthdays because of a potential association of celebrations with increased costs for presents and parties? Some anecdotal evidence suggests this may be the case.

20. Comparison of the three methods, $p < .05$ (two-tailed test); $\chi^2 = 10.62$, $df = 4$.

and Sebestik (1982) noted some differences between their results and those of Groves and Kahn (1979). One reason may have been that the former study employed T-C-B/women, and the latter used T-C/women without Bryant's correction. No gender differences occurred in the Forsman (1993) study, which included T-C/women, Kish, and combined last birthday/next birthday comparisons. No studies of a T-C method used census data as a yardstick except for Forsman (1993) and Hagan and Collier (their 1982 convention paper, not their 1983 article).

T-C-B/men and the Hagan-Collier "alternative" technique were equivalent in demographic composition and completion rates in a national survey (Hagan and Collier 1983). The alternative sample had about a 5 percent lower telephone refusal rate. (See Kennedy 1993, for a hypothetical comparison of T-C-B/men and Hagan-Collier with other techniques.)

NO SELECTION VERSUS OTHER METHODS

Demographic Representativeness. The no selection method tends to overidentify females (Denk, Guterbock, and Gold 1996; Goyder, Basic, and Thompson 2001; Salmon and Nichols 1983), although not always (Prairie Research Associates 2001). Zukin, Carter, and Schulman (1987) could not compare their no selection sample because they implemented a sex quota. The last two studies did not find significant differences on other demographic variables.

Simple Completion Rates. No selection contributed to a higher simple completion rate than next or last birthday methods in one case (Prairie Research Associates 2001), about the same in another (Salmon and Nichols 1983), and a lower rate in a third (Denk, Guterbock, and Gold 1996). Although Zukin, Carter, and Schulman (1987) did not report specifics, they said their last birthday method resulted in six in ten refusals, higher than their no selection method ($p < .001$).

Cost. No selection was more efficient than last birthday (Zukin, Carter, and Schulman 1987) and next birthday (Prairie Research Associates 2001) in terms of interviewer hours, average length of interview, numbers called, and dollar cost.

SUBSTANTIVE RESULTS

Surprisingly little difference among methods emerged in five of the eight studies that investigated substantive results (Hill, Donelan, and Frankel 1999; Oldendick et al. 1988; O'Rourke and Blair 1983; Prairie Research Associates 2001; Tarnai, Rosa, and Scott 1987). Two comparisons of last birthday and YMOF detected a few differences (Keeter and Fisher, 1997; Srinivasan, Christiansen, and Tortora 1996),[21] as did one of last birthday and no selection

21. Of 143 substantive comparisons, Keeter and Fisher (1997) found that 2 were significant at .01, 4 at .05, and 10 at .10. They concluded that these results matched what would be expected by chance, but see the following note.

(Zukin, Carter, and Schulman 1987).[22] A significant difference on affirmative action in one of the Oldendick et al. (1988) surveys might have been related to the significantly greater representation of blacks in that survey.

INTERVIEWERS' ATTITUDES

Many authors discussed interviewer attitudes toward selection methods although they did not study interviews systematically (Czaja, Blair, and Sebestik 1982; Forsman 1993; Keeter and Fisher 1997, 1997–98; Lind, Link, and Oldendick 2000; Oldendick et al. 1988; O'Rourke and Blair 1983; Salmon and Nichols 1983; Tarnai, Rosa, and Scott 1987). The more systematic work of Binson, Canchola, and Catania (2000) strongly pointed up the possibility that interviewers' attitudes may be a confounding variable in many reports.

In fact, Lavrakas and Traugott (forthcoming) call into question all the studies that compare the effects of within-household respondent selection methods on cooperation rates. They contend that these studies should control for interviewer effects on responses by randomly assigning interviewers to only one experimental condition in addition to randomly assigning cases across interviewers. Designs that best meet this situation involve telephone surveys from one centralized location. If telephone surveys are administered from more than one location, they argue, the pool of interviewers across the different locations either should be randomly assigned to a location/group as well or else researchers should control statistically for location. Interviewers should be blind to the experimental purpose of the study. None of the comparative studies met these requirements.

Conclusions

The most important dependent variables to study are demographic representativeness, response/cooperation/refusal rates as defined by AAPOR (2004) guidelines, field efficiency and costs, substantive findings, and interviewer attitudes and behavior. Demographic analyses should provide census data for comparison. They also should include bivariate examination of gender by marital status, age, household size, and relationship to head of household (Beach and Musa 1997; Carr and Hertvik 1993; Denk and Hall 2000; Keeter and Fisher 1997, 1997–98). Nonprobability methods such as YMOF may need to be more rigorous in execution and analysis. Reports also should include information about sample dispositions (including pre- and postselec-

22. Of 75 substantive questions available for analysis, 7 showed differences at the .05 level of significance, and 4 showed differences at the .10 level—essentially no more than would be expected by chance, Zukin, Carter, and Schulman (1987) stated. An anonymous reviewer emphasized, however, simultaneous tests on 75 variables from the same survey, many of which would be correlated in their response patterns, are not independent. From Zukin, Carter, and Schulman (1987), p. 16, overall mean = .41, SD = .28, $N > 500$.

tion refusal rates), whether respondents were nominated accurately by informants, any conversion of refusals, and any substitution of respondents. A closer look at reasons for refusals by method is desirable.

Other considerations: Urbanicity may be important to study because cooperation rates tend to be lower in larger metropolitan areas, especially inner cities, compared with more rural areas (Groves and Couper 1998). Labor force status could be studied further, especially with respect to gender representation (Denk, Guterbock, and Gold 1996). Samples should be large enough to have adequate power.

Substantive Questions. Substantive measures need much more systematic study, especially when the question topic may be related to demographics. An example is the comparison of polling results across studies, especially those concerning the distribution of partisan affiliations and prospective vote choice in preelection surveys. As the number of callbacks increased in one analysis, the sample became increasingly male, younger, and Republican (Traugott 1987). This suggests that a relation between some types of respondent selection techniques and some kinds of political substantive measures might increase as callbacks increase in this example.

Best Methods To Study. The most useful methods to compare in future research are full enumeration, Kish, T-C-B/men, T-C-B/women, Hagan-Collier, and last birthday. Future studies should take particular care in interviewer training, question wording, accuracy of respondent selection, and accuracy of the informant's or the respondent's understanding of the selection question, especially in the case of birthday methods.

Despite all the attempts to improve upon Kish, the Kish method remains popular because it is very nearly a probability method. Experienced, skilled, rigorously trained interviewers may compensate for potential intrusiveness of Kish questions (Groves and Kahn 1979; Lavrakas 1993). Kish also may be less intrusive than previously thought (Binson, Canchola, and Catania 2000; Denk, Guterbock, and Gold 1996; Denk and Hall 2000; Groves and Kahn 1979).[23] In one-adult or male-female-pair households, Kish is simpler to implement than birthday methods. More thought may be given to updating Kish's selection tables (Németh 2001). Methods asking for a specific gender of desired respondent allow less room for informants to self-select as respondents (Denk, Guterbock, and Gold 1996); however, accuracy of respondent nomination in samples selected by techniques other than last or next birthday has not been assessed.

Last birthday tends to have advantages over Kish in cooperation rates and costs, though evidence on costs is sparse. Last birthday tends to overidentify women but may better represent blacks and younger males. Next birthday, studied much less frequently than last birthday, appears to be more confusing

23. Denk, Guterbock, and Gold (1996) looked at reasons for refusals, finding a suggestion of a slightly higher level of perceived threat to the respondent with the Kish-type method; however, only a very small number of respondents cited such reasons.

to informants, and upcoming birthdays may be more difficult for informants to remember. Both birthday methods appear to have more problems with accuracy than methods requesting respondents by name, age, and/or gender. What birthday methods gain in respondent cooperation, they may lose in representativeness (Lavrakas 1993).

YMOF is slightly cheaper to administer than last birthday, slightly better than last birthday in cooperation rates, and roughly equivalent in demographics when marginals for gender, race, and age are examined. It may not be as close to population statistics, however, when age within gender or other bivariate distributions of demographics are considered. Future research on YMOF should compare it with a probability method. The only study with data on both YMOF and a probability method produced a full enumeration sample with a higher SES skew than YMOF or last birthday samples, perhaps related to substantive and marital status results (Srinivasan, Christiansen, and Tortora 1996). Those authors cautioned, however, that their results could reflect a short field period and limited design.

T-C-B/men should be studied further as it may represent males better than T-C-B/women or Kish (Czaja, Blair, and Sebestik 1982). It may produce samples that are closer to census data than YMOF or T-C-B/women, although it may also lead to lower cooperation rates than T-C-B/women.

Handoffs. Both of the birthday methods and the inventory types of methods tend to run into problems in households with three or more adults. Inventory methods may be easier than birthday techniques for respondents in larger households to understand, however. Inventory methods that should yield probability samples may also produce a larger proportion of handoffs, but the lower completion rates associated with them can decrease this advantage (Denk, Guterbock, and Gold 1996). The Kish-like method generated more handoffs than the last birthday method in the Denk, Guterbock, and Gold (1996) analysis. Requesting respondents by name or gender may increase the handoff rate by 20 to 35 percent (Denk and Hall 2000).

Denk, Guterbock, and Gold (1996) presented a mathematical model that depended on heterogeneity of households, individuals, and methods. It led them to conclude that within-household respondent selection procedures requiring handoffs may decrease cooperation by about 14 percent, change the distribution of household types by no more than 3 percent in any category they examined, reduce the proportion of women by 7 percent, and increase the proportion of respondents less likely to answer the phone by 30 percent. Telephone answering behavior may explain disproportionate representation of women; the main contribution of respondent selection methods that specify gender may be to counter this behavior differential (Denk, Guterbock, and Gold 1996).

Rizzo-Brick-Park Method (R-B-P). A new approach (Rizzo, Brick, and Park 2004) offers a simplified, minimally intrusive, accurate means of within-household respondent selection that is easy to use in CATI random digit dial surveys and results in a probability sample of eligible persons. Their method

requires knowledge only of the number of adults in one- to two-person households, estimated to be about 85 percent of all U.S. households. In larger households, the method ascertains whether or not the informant is sampled. If not, then another method, such as Kish or last birthday is recommended. Rizzo, Brick, and Park (2004) called for experimental comparative studies of selection methods in multi-adult households as a next step.[24]

Rizzo, Brick, and Park (2004) chose the last birthday technique for multi-adult households but found informants lacked birthday information in 5 percent of three-adult households, 7 percent of four-adult households, and 16 percent of households with more than four adults. They then implemented the Kish method in households with five adults or more. These results argue more for a choice of Kish or other methods specifying age and gender than of last birthday, given other accuracy and representativeness problems of the last birthday method.

The efficiency and nonresponse problems of probability techniques could be reduced when combined with R-B-P in multi-adult households. If researchers require more drastic cost-cutting shortcuts that sacrifice probability, however, T-C-B/men, T-C-B/women, and Hagan-Collier appear to yield more representative samples than YMOF or the birthday methods. More rigorous studies comparing within-household respondent selection methods are needed. It is not realistic to expect to reduce both costs and errors simultaneously since reducing one increases the other (Groves 1989); nevertheless, surveyors can still work toward understanding how to balance them better. Many survey projects present opportunities to include comparisons of respondent selection procedures in addition to the chief objectives of those surveys.

24. Question 1 is "May I speak to a member of this household who is at least 18 years old?" When the appropriate person is on the line: (Question 2) "Including yourself, how many people aged 18 or older currently live in this household?" If the informant is selected, the interview begins. If the informant is not selected in a two-adult household: "The other adult in the household has been selected to participate in the next part of the study. What is the other adult's name?" If the informant is not selected in a multi-adult household: "The computer has randomly determined that one of the [Question 2 answer minus 1] adults other than yourself should be selected for the rest of the interview." Proceed with selection questions, such as Kish or last birthday. (Rizzo, Brick, and Park 2004, p. 270)

Appendix A

Examples of Kish Question Wording

The following are all of the examples of question wording found for the Kish method. For an example of a Kish survey instrument cover sheet, see Groves and Kahn (1979, p. 33) or Lavrakas (1993, p. 109).

1. Denk and Hall (2000, p. 8) did not specify that they used Kish, but their protocol was Kish-like:
   "How many adults live in this household and can be reached here? [Exclude those generally away, unable to be interviewed.] How many of those are [random fill: male-female]? [Generate random number from 1 to Num_adult. Identify selected household member according to method (age + gender): Example: 'the youngest male'].''
2. O'Rourke and Blair (1983, p. 430): "In order to determine whom to interview, I need to list household members who currently live in this household. I just need their age and sex—not their names—and how they are related to you. Let's start with you. How old are you? Now, can you tell me the sex and age of all other current household members and how they are related to you? *[Record on chart]*. Now I'm going to number the people in your household to determine whom I should interview. The total number of persons is __, so I am to interview person #__, who is *(relationship)*."
3. Oldendick et al. (1988, p. 308) gave wording and a chart for interviewers:

"In order to select the right person to interview, we need to list all the people living in your household who are 18 years of age or older. First, could you tell me the ages of all the *males* living in your household who are 18 years of age or older—that is, from the oldest to the youngest?" [List below all males 18 or older in order from oldest to youngest.]

"Next, could you tell me the ages of all the *females* living in your household who are 18 years of age or older—that is again, from the oldest to the youngest?" [List below all females 18 or older in order from oldest to youngest.] [Interviewers assign a number to each person listed, in order from oldest to youngest males and then oldest to youngest females. A selection table is consulted to identify the correct respondent.]

The following studies characterized their wording as applying to the Kish method but appear to describe better a variation called "age-only" or "age-order" (Denk and Hall 2000):

1. Lavrakas (1993, p. 109): "In order to randomly pick one person in your household whom I can interview I need to begin by listing all persons in your household 18 years old or older. Could you just tell me their relationships to each other, not their names. [*After listing persons in column 1 below continue, unless only one adult, then determine age and go to q1*:] Now I need to know the age of each person. [*After listing ages in column 2 continue*:] Now it will take me just a few seconds to use a selection chart I have here to determine the person I'm supposed to interview in your household."
2. Forsman (1993, p. 3): "How many persons 16 years and older (including yourself) live in your house/apartment? Who is the oldest one? Who is the second oldest?" [And so forth until all household members were listed, then the computer selected one randomly.]
3. Also see Tom Piazza (undated). This discussion appears to concern full enumeration rather than the Kish method mentioned in his title, however.

Appendix B

EXAMPLES OF WORDING OF "BIRTHDAY" QUESTIONS

1. Denk and Hall (2000, p. 8): "How many adults live in this household and can be reached here? [Exclude those generally away, unable to be interviewed.] The rest of the questions are for the person who most recently celebrated a birthday. What is that person's first name? May I speak with [name]? [Informant indicates whether this is self (no handoff) or other (handoff).]."
2. Forsman (1993, p. 3): "How many persons 16 years and older (including yourself) live in your house/apartment? In order to determine who to interview, could you tell me, of the people who currently live in your household who are 16 and older—including yourself—who had the [most recent/next] birthday?" [Half the sample was asked about the next birthday and half, the last birthday.]
3. Keeter and Fisher (1997, p. 2): "According to our selection procedure, I need to speak with the adult living in your household who is 18 or older and has had the most recent birthday." [If the selected respondent was not at home, an appointment was made for callback.]
4. Lavrakas, Bauman, and Merkle (1993, p. 2): "For this survey, I'd like to speak with the person in your household, 18 years of age or older, who had the last birthday." [They further provide the wording used by Oldendick et al. (1988), see number 6 below, but viewed that version as more cumbersome and difficult for some respondents to understand. But see Yost (1997) below.]
5. Lavrakas, Harpuder, and Stasny (2000, p. 3): "For this survey, I'd like to interview the person in your household who is at least 18 years of age *and* who had the last (i.e., most recent) birthday."
6. Oldendick et al. (1988, p. 309): "In order to determine who to interview, could you tell me, of the people who currently live in your household who are 18 or older—including yourself—who had the most recent birthday? I don't mean who is the youngest adult, but rather, who had the most recent birthday?" [If informant does not know all the birthdays:] "Of the ones you do know, who had the most recent birthday?" [If this is not the informant, the interviewer asks to speak with the nominated person, who, if reached, is asked complete birthday information to further ascertain correct interviewee.]
7. O'Rourke and Blair (1983, p. 430): "In order to determine whom to interview, could you tell me, of the people who currently live in your household who are 18 or older, who had *the most recent birthday*? [*If don't know all birthdays*]: Of the ones that you *do* know, who had the most recent birthday?"
8. Yost (1997, p. 3), *Form A* (termed the "standard Last Birthday Method"): "First, in order to determine whom to interview, could you please tell me, of the people who currently live in your household who are 18 or older, who most recently celebrated a birthday?"

Yost (1997, p. 3), *Form B:* "In order for our results to be scientifically valid, we need to randomly pick someone within your household to interview. Of the people who currently live in your household who are 18 or older, who most recently celebrated a birthday?" [Intended to appeal to "respondents' sense of social utility, by indicating that the survey will further scientific pursuits"]

Yost (1997, pp. 3–4), *Form C:* "In order for our results to be scientifically valid, we need to randomly pick someone within your household to interview. So please take a moment to think about the birthdays of all the adults in your home. Of the people who currently live in your household who are 18 or older, who most recently celebrated a birthday?" [Social utility and accuracy appeals]

References

American Association for Public Opinion Research (AAPOR). 2004. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys.* 3d ed. Lenexa, KS: AAPOR.

Beach, Scott, and Donald Musa. 1997. "Analysis of Male Underrepresentation in an RDD Survey Using the Most Recent Birthday Method of Respondent Selection." Poster presented at the annual meeting of the American Association for Public Opinion Research, Norfolk, VA.

Binson, Diane, Jesse A. Canchola, and Joseph A. Catania. 2000. "Random Selection in a National Telephone Survey: A Comparison of the Kish, Next-Birthday, and Last-Birthday Methods." *Journal of Official Statistics* 16:53–59.

Bryant, Barbara E. 1975. "Respondent Selection in a Time of Changing Household Composition." *Journal of Marketing Research* 12:129–35.

Carr, Kathleen, and Joan Hertvik. 1993. "Within-Household Selection: Is Anybody Listening?" Paper presented at the annual meeting of the American Association for Public Opinion Research, St. Charles, IL.

Czaja, Ronald, Johnny Blair, and Jutta P. Sebestik. 1982. "Respondent Selection in a Telephone Survey: A Comparison of Three Techniques." *Journal of Marketing Research* 19:381–85.

Denk, Charles E., Thomas M. Guterbock, and Daniel B. Gold. 1996. "Modelling Selection of Respondents Within Household in Telephone Surveys." Paper presented at the annual meeting of the American Association for Public Opinion Research, Salt Lake City, UT.

Denk, Charles E., and John W. Hall. 2000. "Respondent Selection in RDD Surveys: A Randomized Trial of Selection Performance." Paper presented at the annual meeting of the American Association for Public Opinion Research, Portland, OR.

Forsman, Gösta. 1993. "Sampling Individuals Within Households in Telephone Surveys." Paper presented at the annual meeting of the American Association for Public Opinion Research, St. Charles, IL.

Goyder, John, Maryanna Basic, and M. E. Thompson. 2001. "Within Household Sample Selection: A Reassessment." Paper presented at the annual meeting of the American Association for Public Opinion Research, Montreal, Canada. (Revised post-meeting version.)

Grandjean, Burke D., Martha Garcia Leighty, Patricia A. Taylor, and Ying Xu. 2004. "Is Target Selection by Last Birthday 'Random Enough'? A Split Ballot Test." Paper presented at the annual meeting of the American Association for Public Opinion Research, Phoenix, AZ.

Groves, Robert M. 1989. *Survey Errors and Survey Costs.* New York: Wiley.

Groves, Robert M., and Mick P. Couper. 1998. *Nonresponse in Household Interview Surveys.* New York: Wiley.

Groves, Robert M., and Robert L. Kahn. 1979. *Surveys by Telephone: A National Comparison with Personal Interviews.* New York: Academic Press.

Hagan, Dan E., and Charlotte Meier Collier. 1982. "Respondent Selection Procedures for Telephone Surveys: Must They Be Invasive?" Paper presented at the annual meeting of the American Association for Public Opinion Research, Baltimore, MD.

——. 1983. "Must Respondent Selection Procedures for Telephone Surveys Be Invasive?" *Public Opinion Quarterly* 47:547–56.

Hill, Craig A., Karen Donelan, and Martin R. Frankel. 1999. "Within-Household Respondent Selection in an RDD Telephone Survey: A Comparison of Two Methods." Paper presented at the annual meeting of the American Association for Public Opinion Research, St. Petersburg, FL.

Keeter, Scott, and Kevin Fisher. 1997. "A Comparison of 'Last Birthday' and 'Youngest Male/Oldest Female' Respondent Selection Procedures." Paper presented at the annual meeting of the American Association for Public Opinion Research, Norfolk, VA.

———. 1997–98. "Comparison of Two Respondent Selection Methods." *National Network of State Polls (NNSP) Newsletter* 31 (Winter): 1–3. Available online at http://survey.rgs.uky.edu/nnsp/newsletters/nnsp31.pdf (accessed December 2004).

Kennedy, John M. 1993. "A Comparison of Telephone Survey Respondent Selection Procedures." Paper presented at the annual meeting of the American Association for Public Opinion Research, St. Charles, IL. Available online at http://www.indiana.edu/~csr/aapor93.html (accessed December 2004).

Kish, Leslie. 1949. "A Procedure for Objective Respondent Selection Within the Household." *Journal of the American Statistical Association* 44:380–87.

Krótki, Karol P., and Lorraine Porcellini. 1995. "Respondent Selection Bias in the Hagen-Collier *[sic]* Approach." *Proceedings of the Survey Research Methods Section, American Statistical Association* 694–96. Available online at http://www.amstat.org/sections/srms/proceedings/y1995.html (accessed December 2004).

Lavrakas, Paul J. 1987. *Telephone Survey Methods: Sampling, Selection, and Supervision.* Newbury Park, CA: Sage.

——. 1993. *Telephone Survey Methods: Sampling, Selection, and Supervision.* 2d ed. Newbury Park, CA: Sage.

Lavrakas, Paul J., Sandra L. Bauman, and Daniel M. Merkle. 1993. "The Last-Birthday Selection Method and Within-Unit Coverage Problems." Paper presented at the annual meeting of the American Association for Public Opinion Research, St. Charles, IL.

Lavrakas, Paul J., Brian Harpuder, and Elizabeth A. Stasny. 2000. "A Further Investigation of the Last-Birthday Respondent Selection Method and Within-Unit Coverage Error." Paper presented at the annual meeting of the American Association for Public Opinion Research, Portland, OR.

Lavrakas, Paul J., and Michael W. Traugott. Forthcoming. "Experimentation with Interviewer Effects in Survey Research." Chapter 7 of *Survey Research and Experimental Design.* Newbury Park, CA: Sage.

Lind, Katherine, Michael Link, and Robert Oldendick. 2000. "A Comparison of the Accuracy of the Last Birthday Versus the Next Birthday Methods for Random Selection of Household Respondents." Paper presented at the annual meeting of the American Association for Public Opinion Research, Portland, OR.

Németh, Renáta. 2001. "Respondent Selection Within the Household—A Modification of the Kish Grid." Paper presented at the sixth Austrian, Hungarian, Italian, and Slovenian Meeting of Young Statisticians, Ossiach, Carinthia, Austria. Available online at http://www.math.uni-klu.ac.at/stat/Tagungen/Ossiach/Nemeth.pdf (accessed December 2004).

Oldendick, Robert W., George F. Bishop, Susan B. Sorenson, and Alfred J. Tuchfarber. 1988. "A Comparison of the Kish and Last Birthday Methods of Respondent Selection in Telephone Surveys." *Journal of Official Statistics* 4:307–18.

O'Rourke, Diane, and Johnny Blair. 1983. "Improving Random Respondent Selection in Telephone Surveys." *Journal of Marketing Research* 20:428–32.

Paisley, William J., and Edwin B. Parker. 1965. "A Computer-Generated Sampling Table for Selecting Respondents within Households." *Public Opinion Quarterly* 29:431–36.

Piazza, Tom. Undated. "Respondent Selection for CATI/CAPI (Equivalent to the Kish Method)." Berkeley: University of California Survey Research Center. Available online at http://srcweb.berkeley.edu/res/rsel.html (accessed December 2004).

Politz, Alfred, and Willard Simmons. 1949. "An Attempt to Get the 'Not at Homes' into the Sample without Callbacks." *Journal of the American Statistical Association* 44(245): 9–31.

Politz, Alfred, and Willard Simmons. 1950. "Note on 'An Attempt to Get the Not-at-Homes into the Sample without Callbacks.'" *Journal of the American Statistical Association* 45(249): 136–37.

Prairie Research Associates, Inc. 2001. "Comparing Two Respondent Selection Methods in Telephone Surveys." Manitoba, Canada. Available online at http://www.pra.ca/resources/birthday.pdf (accessed December 2004).

Reich, James, William Yates, and Robert Woolson. 1986. "Kish Method for Mail Survey Respondent Selection." *American Journal of Public Health* 76:206.

Rizzo, Louis, J. Michael Brick, and Inho Park. 2004. "A Minimally Intrusive Method for Sampling Persons in Random Digit Dial Surveys." *Public Opinion Quarterly* 68:267–74.

Salmon, Charles T., and John Spicer Nichols. 1983. "The Next-Birthday Method of Respondent Selection." *Public Opinion Quarterly* 47:270–76.

Srinivasan, Rajesh, Elaine H. Christiansen, and Robert Tortora. 1996. "Comparative Study of Three Respondent Selection Techniques for Telephone Survey Research." Paper presented at the annual meeting of the American Association for Public Opinion Research, Salt Lake City, UT.

Tarnai, John, Eugene A. Rosa, and Lesli Peterson Scott. 1987. "An Empirical Comparison of the Kish and the Most Recent Birthday Method for Selecting a Random Household Respondent in Telephone Surveys." Paper presented at the annual meeting of the American Association for Public Opinion Research, Hershey, PA.

Traugott, Michael W. 1987. "The Importance of Persistence in Respondent Selection for Preelection Surveys." *Public Opinion Quarterly* 51:48–57.

Troldahl, Verling C., and Roy E. Carter, Jr. 1964. "Random Selection of Respondents within Households in Phone Surveys." *Journal of Marketing Research* 1:71–6.

Yost, Berwood. 1997. "Improving Respondent Reporting for the Last Birthday Method of Respondent Selection." Poster presented at the annual meeting of the American Association for Public Opinion Research, Norfolk, VA.

Zukin, Cliff, Bob Carter, and Mark Schulman. 1987. "Trade-offs in Respondent Selection Methods: Theoretical Purity versus Real World Concerns." Paper presented at the annual meeting of the American Association for Public Opinion Research, Hershey, PA.