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Longitudinal Surveys

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Longitudinal studies are a useful tool for measuring change in a population. In this type of study, repeated observations are collected over time from the same sample units, such as individuals, households, or organizations. This entry focuses on longitudinal surveys, which use questionnaires as a main tool for collecting observations from sample members. Nonsurvey examples of longitudinal studies exist as well, for example, health studies that collect data primarily through medical tests rather than survey interviews, and many of the concepts discussed in this entry pertain to those studies as well.

Key Features of Longitudinal Surveys

Longitudinal surveys can be characterized through several key features. Table 1 enumerates these features, defines them, and describes three prominent U.S. longitudinal surveys.

Table 1. Key features of longitudinal surveys, their definitions, and three examples of U.S. longitudinal surveys.

Feature	**Definition**	**National Longitudinal Survey of Youth, 1997 Cohort**	**National Social Life, Health and Aging Project, cohort 1**	**Survey of Income and Program Participation**
Research topic	Primary research questions to be answered through the survey.	Effect of early life experiences on labor force experiences throughout the life course.	To understand the well-being of older, community-dwelling Americans by examining the interactions among physical health and illness, medication use, cognitive function, emotional health, sensory function, health behaviors, social connectedness, sexuality, and relationship quality.	Provides a continuing measure of the economic condition of the United States.
Population represented	To whom can survey findings be generalized?	Individuals born 1980–1984 and living in the United States in 1997.	U.S. individuals born 1928–1947.	Each panel features a nationally representative sample of U.S. households, including multiple adults within the household.
Duration and frequency of survey	Survey inception year and periodicity of follow-ups.	Initial recruitment in 1997. Annual or biennial follow-up rounds ongoing as of 2020.	Wave 1 in 2005–2006. Additional waves 2010–2011, 2015–2016, and scheduled for 2020.	Each panel is interviewed over a multiyear period lasting approximately 4 years.

Feature	Definition	National Longitudinal Survey of Youth, 1997 Cohort	National Social Life, Health and Aging Project, cohort 1	Survey of Income and Program Participation
Samples	Number of individuals in survey sample and the method of sample selection.	A nationally representative sample of almost 9,000 individuals was recruited using an area-probability design in 1997 and has participated in 19 interviews since that time. Oversamples of Black and Hispanic individuals.	In 2005–2006, Wave 1 used a national area probability sample of community residing adults born between 1920 and 1947, including an oversampling of African Americans and Hispanics. The 3,000-person sample was built on the foundation of the national household screening carried out by the Health and Retirement Study (HRS) in 2004.	For 2014 panel, initial recruitment of nationally representative set of 53,000 households, including oversamples of households in areas of high concentration of low-income. Follow-up samples include all initial household members 15 years and over and anyone living with them at the time of a follow-up round.
Questionnaire content	Primary topics covered in questionnaire.	Domains affecting or affected by labor force participation, including schooling, family formation, employment, income and assets, migration, physical and mental health, child care, and criminal activity/ experiences with the correctional system.	Physical health and illness, medication use, cognitive function, emotional health, sensory function, health behaviors, social connectedness, sexuality, and relationship quality	Changes in many topics including economic well-being, family dynamics, education, assets, health insurance, childcare, and food security.
Supplemental data	Any nonsurvey components included in the survey design.	Parent interview in initial wave. Armed Forces Qualifying Test in initial wave. High school and college transcript information Two surveys of local high schools available for linkage to the NLSY97 survey data.	Each wave includes an interviewer-administered questionnaire, collection of a wide array of biomarkers, and a leave-behind self-administered questionnaire.	All data are collected through surveys.

Feature	Definition	National Longitudinal Survey of Youth, 1997 Cohort	National Social Life, Health and Aging Project, cohort 1	Survey of Income and Program Participation
Companion surveys	A survey may be in a series that allows further comparisons.	The National Longitudinal Survey of Youth, 1979 Cohort uses a similar design for U.S. individuals born 1957–1964.	The National Social Life, Health and Aging Project sample includes many pairs of spouses and partners. Another cohort was begun in 2015–2016.	The Survey of Income and Program Participation family of surveys includes 8 samples selected from 1983–2014, with each sample active for 2.5–4 years.
Sponsor and reference	The funding agency and/ or conducting organization.	Sponsored by the Bureau of Labor Statistics, U.S. Department of Labor: www.bls.gov/nls	Conducted by researchers at NORC and the University of Chicago: www.norc.org/Research/Projects/Pages/national-social-life-health-and-aging-project.aspx	Conducted by the U.S. Census Bureau: www.census.gov/SIPP

Comparing Longitudinal to Repeated Cross-Sectional Surveys

One contrast to a longitudinal survey is a series of repeated cross-sectional surveys. While in a longitudinal survey, the same people will provide data over time; in a repeated cross-sectional survey, one population is studied, but different samples are selected each year to represent that population. For studying change over time, repeated cross-sectional surveys are the most direct alternative to longitudinal surveys. From an analytic perspective, longitudinal surveys permit estimation of both gross change and net change, while repeated cross-sectional surveys support only net change. Gross change counts all individuals who experience a change, for example, from employment to unemployment, while net change might count the total gain in employed workers without differentiating how transitions into and out of employment may have contributed to that gain. In addition, collecting data from the same individuals allows more precise estimation of change.

From a cost perspective, the relative merits of longitudinal versus repeated cross-sectional surveys are less clear-cut. In surveys that must identify and recruit rare populations, longitudinal surveys can be less costly because a survey sample need only be recruited once. If the population is widely available but migrates frequently, repeated cross-sectional surveys may be easier to design cost-effectively. The success of the longitudinal survey depends on retaining sample members over time, so if survey participation declines in a longitudinal survey, it can be more damaging to the survey than a single weak round of a repeated cross-sectional survey. Enhancements to surveys such as linkages to administrative data or collection of biomarkers are generally more beneficial in longitudinal surveys, where a single supplemental activity benefits the life of the survey rather than just a single round of data.

Questionnaire Design for a Longitudinal Survey

In a longitudinal survey, multiple waves of questionnaires may be designed or at least planned at once. For some research purposes, the questionnaire may change only minimally from wave to wave, with the entire emphasis on capturing change in a fixed set of constructs. This might be the case, for example, in a survey on health behaviors and outcomes, where the same behaviors and outcomes are collected each time, so that over-time relationships can be studied between patterns of behaviors and associated outcomes, for example, exercise and diet behaviors with obesity as an outcome. For other research purposes, the survey design may call for individuals to answer somewhat different questions over time, perhaps having an emphasis on schooling and delinquency in adolescence, with more questions about employment and family formation in early adulthood.

Prospective data collection is a critically valuable feature of longitudinal surveys. Respondents report life events at different points in time, improving the quality of timing information and reducing the likelihood of retrospective bias. For example, the National Longitudinal Survey of Youth, 1997 Cohort (NLSY97) asked adolescents about their relationships with their parents. In later life, respondents report on the quality of their marriages and marriage-like relationships. The separation in time allows analyses of how parent–child relationships in adolescence may affect individuals' partnered relationships in adulthood. A cross-sectional survey asking adults to recall relationship quality in adolescence may suffer from retrospective recall bias. Those on the brink of divorce may more intensely recall strife with parents, while those in successful relationships may have allowed recall of difficult parent–child relationships to soften over time, weakening the causal mechanisms across the 2 time periods.

An efficiency of longitudinal surveys is that time-invariant characteristics, such as race and ethnicity or year of birth need only be collected once from sample members, freeing up more administration time in the later interviews for collecting new information.

Reference Period

One choice facing designers of questionnaires for longitudinal surveys has to do with the reference periods associated with survey items. In more complex surveys, many of these options may coexist within the questionnaire, depending on topic and the associated cognitive complexity.

Point in Time

Questions in each wave may be asked at the time of interview, such as, "Overall, would you say your health is excellent, good, fair or poor?" Such questions then would comprise a series of points in time, although data would be unavailable between these points. This reference period is especially appropriate for attitude and opinion questions, where a retrospective report may be cognitively difficult for the respondent to provide. For example, imagine the challenge of answering a question like, “On March 1st of this year, what was your opinion of the president’s performance?”

Recent Period Defined by Calendar Time or Events

In other cases, it may be appropriate to ask questions of a calendar period of time because it facilitates respondent recall: “In the past 7 days, how often have you eaten fruits or vegetables?” or “In the past 12 months, how much did you earn in income from your job?” Another alternative is a recent period defined by an event, “Since you complete college, have you had any job interviews?”

Bounded Recall Period

One advantage of a longitudinal design is the ability to construct a continuous record by updating all events since the prior interview. Questions of the form, “Since the date of last interview, have you ever changed your legal marital status?” are valuable for high salience events that are important to capture comprehensively (rather than just at the interview dates) and where respondents are likely to be able to report the requested details. By bounding the reference period by the prior interview, designers reduce the likelihood of double counting or undercounting events due to recall errors in dates.

Lifetime

Questions can be structured about a respondent’s life, for example, “Have you ever owned a gun?” This question type makes only limited use of the longitudinal survey design.

Longitudinal survey data can exhibit a phenomenon known as “seam effect” in which estimates of change over time are greater when calculated across two consecutive survey interviews than within a single interview. For example, a respondent uncertain of the date of a recent minor surgery may have reported the surgery in a wave t interview, but then reported it again during the ($t + 1$) interview. One technique for addressing seam effect is to use dependent interviewing techniques that remind the respondent of the status at the last interview: “In March 2008, you reported that you had an appendectomy. Since that time, have you had any other surgeries?”

Interview Spacing

A crucial aspect of longitudinal survey design, not present in cross-sectional surveys, is determining the amount of time between interviews, or interview spacing. This design feature has wide-ranging consequences for the survey, affecting its cost, data (or response) quality, and its suitability for various types of analysis. Longer interview spacing means, for a survey of a given length, fewer interview rounds and hence lower cost. Against these cost savings, however, the implications for response quality and data analysis must be weighed. Many types of analysis depend on outcome measures being measured in some temporal proximity to an event of interest.

As mentioned earlier, one of the chief advantages of a longitudinal survey is to mitigate recall errors associated with retrospective questions. In longitudinal surveys, the recall period for a given wave is effectively “bounded” by the last time the respondent was interviewed. Hence, interview spacing defines the recall, or reference period, which in turn affects the likelihood of recall error. In cross-sectional surveys, the reference period is unbounded and will typically be specified in the question (e.g., “How many weeks have you been employed *in the past year*?”). The length of the reference period of retrospective questions in cross-sectional surveys is generally limited to a year or less.

Bounding helps to cope with a type of recall error known as “telescoping,” whereby survey respondents will tend to report events as occurring in a given reference period when in fact they occurred well before. Longitudinal surveys that impose bounding will discount events that are reported as having occurred in the current reference period if they had been reported in a previous interview round. In general, the longer the spacing of interviews (i.e., the recall period), the more likely telescoping will occur.

Similarly, respondents are more likely to simply forget to report events that occurred in the more distant past (i.e., errors of omission). Although the length of the recall period plays an important role in the incidence of these recall errors, other factors, such as the salience of a given event, matter as well.

While longitudinal surveys reduce recall burden on respondents by setting bounds on reference periods, repeated interviews can give rise to another type of error, unique to longitudinal surveys, in which respondents are more likely to report changes in status at the “seam” between two references periods than within a given reference period. This greater tendency to report changes, often inaccurately, at the seam between reference periods is known as “seam bias.” For example, respondents, asked about when since their last interview they stopped participating in a government program, might have a tendency to assign the timing of that change in status to beginning of the current reference period (i.e., immediately following their last interview), even though the change occurred well into the current reference period. The result is that their participation status would be recorded as nonreceipt for the entirety of the current reference period, when in fact part of the reference period was spent in receipt and part spent in nonreceipt.

Longitudinal Survey Data Collection

Longitudinal surveys resemble cross-sectional and other surveys in many aspects of data collection. There are, however, some aspects that are distinctive in longitudinal surveys:

- *One-time screening/recruiting costs*. In longitudinal surveys, researchers need not conduct a screening phase or determine eligibility for sample members, since the sample is brought forward from the initial round of data collection. This can be a significant cost advantage for surveys of rare populations, where the costs of screening and recruiting a sample can far exceed the costs of interviewing the population of interest.
- *Tracing/locating activities*. Tracing or locating respondents between survey waves is done both to

maintain accurate contact information for sample members and often also to maintain a sense of engagement and connection to the survey, so that sample members are more likely to continue their survey participation in later rounds. The consequences of inadequate tracing of respondents can include higher survey costs in later waves, higher nonresponse in later waves, and at worst, degradation of the survey sample due to high levels of systematic attrition from the sample.

- *Respondent incentives.* Respondent incentives can play an important role in maintaining survey participation in longitudinal surveys. Since additional cases cannot be easily recruited in many survey designs, spending more per interview among existing sample members can be cost-effective. The literature on incentives in panel surveys is relatively limited but it appears that the vast majority of survey respondents can be persuaded to maintain participation through survey salience and psychic and societal benefits of participation (with modest incentives), while a significant minority of sample members will require pecuniary persuasion (through greater incentive payments) in order to continue participation.
- Analyses of the NLSY97 sample indicate that paying modestly higher incentives to individuals who have previously demonstrated reluctance to participate can be effective at converting recent nonparticipants into participants in a cost-effective manner. Another finding in the NLSY97 has been that decreases in incentive amounts do not necessarily damage response rates. Together, the two findings mean that a recent nonrespondent can be induced to return to the survey with an increased incentive payment but will often continue participation in later rounds at a lower payment level. Although this finding has been repeatedly demonstrated in the NLSY97 and in other studies, it contradicts commonly held wisdom that respondents will always insist on receiving their highest prior payment amount.
- *Difficulties optimizing survey costs over time*. While one-time surveys can optimize their survey designs through approaches such as clustering or use of external data sources to improve initial eligibility rates, data collection costs for longitudinal surveys can be harder to optimize, since initially clustered samples will become less clustered over time, and the location of the sample at wave t cannot be controlled through design choices as it might be for a one-time survey at time t.
- *Ability to tailor and target data collection approaches*. An advantage for longitudinal surveys is that their practitioners accumulate extensive survey data and data collection paradata about sample members over time. The term “paradata” refers to information about the data collection process, such as the number of required contacts to gain cooperation, the time of day when contacts most often occurred, or reasons the respondent has given for avoiding or agreeing to the survey interview. This information typically greatly exceeds what would be available to practitioners in other survey contexts and often leads to more extensive tailoring of data collection approaches.

Another significant choice in implementing longitudinal surveys pertains to who will be sought for an interview in a given wave. In theory, all respondents from the first wave could be respondents to all remaining waves. In some cases, respondents may exit from the population of interest, for example, in a labor force survey by becoming disabled and exiting the labor force, or in a study of a country’s student population if the respondent moves to another country. Commonly, some individuals may have passed away, and others may be sufficiently hostile refusers that it is not possible to continue attempting to include them in later survey waves. Some surveys discontinue respondents in the sample who decline to participate in multiple consecutive interviews. The choice to exclude persistently difficult-to-interview respondents from the sample can significantly reduce data collection costs and increase reported response rates, although these members' absence from survey participation can still undermine the representativeness of the survey data.

Consider the case of the NLSY97, which refields all living cases each round without requirements of recent participation and reports a response rate that includes all living respondents. Even with this quite strict fielding policy, the NLSY97 continues to report response rates that approach 80% even after 20 years of data collection. Without the study's policy of refielding all cases each round, these rates would be even higher but the sample would be less representative.

Understanding Quality in Longitudinal Surveys

When one thinks of the quality of longitudinal survey data, one can apply similar concepts as for other survey data. Importantly, one can consider *bias*, which means survey data that systematically misreport the underlying truth, and *precision*, or the accuracy with which the survey data can support an estimate. Unbiased data are an indicator of high quality, as is a high level of precision (also described as small standard errors). The sources of bias and lack of precision can come from the initial sampling, nonresponse over time among sample members, measurement error in how respondents perceive and answer questions, and processing errors that come about during data entry, coding, and other postdata collection activities, possibly through to analytic errors. These are generally the categories of concern for quality in any survey. Of particular relevance to longitudinal surveys is that the initial sample is selected and recruited only in the initial round and then perpetuated for the life of the survey. Thus flaws in that original round of recruitment can have a long life and impact on the study (alternatively, one can think of a single heavy investment in an initial round of data collection paying dividends for many subsequent years of the study's life).

The representativeness of a longitudinal survey sample generally cannot improve over the initial wave of recruitment unless further data collection or supplementation is conducted. After the initial round, survey participants are requested to participate in follow-up rounds. When participants decline to participate because of refusal, inability to be contacted, or other obstacles, the result is unit nonresponse to the survey round for that participant. Overall rates of unit nonresponse are of great concern in longitudinal surveys, with their converse being the round-specific response rate, which is generally the number of completed interviews divided by the number of individuals eligible to be interviewed in a given round. In terms of analytic results, what matters most is the extent to which unit nonresponse is systematic—for example, if less-educated individuals are missing from an economic survey or older women attrit from a fertility survey. If the unit nonresponse is high but the nonparticipants are somewhat randomly drawn from the sample, then analytic estimates will have lower precision (because of reduced numbers of interviews) but still be unbiased. In reality, unit nonresponse (attrition) is often systematic and therefore a considerable focus of longitudinal survey practitioners.

Longitudinal survey responses can have all of the features of other survey types, including interviewer effects and possible misunderstanding or misreporting by respondents. Specific to longitudinal surveys is the concept of "panel conditioning," wherein the mere fact of having participated in the survey leads respondents to change their behavior or to report their behavior differently in subsequent rounds. Behavior change might occur if, for example, answering interview questions about different types of scholarship programs the respondent might have applied to gives the respondent ideas of how to better seek college funding in the future. Changes in reporting might arise if a respondent realizes that every reported term of college leads to an additional 5 min of questions and therefore decides to skip reporting one or two terms in order to wrap up the interview more quickly.

Clustering of survey samples can result in loss of effective sample size (also known as design effect), which means that the same number of interviews would yield greater precision under simple random sampling than it does with a clustered sample. The survey methods literature is ambiguous as to magnitude of design effects over time in a longitudinal survey, with some studies indicating that as clustering declines (due to natural migration of sample members), the design effect also declines, while other studies show increases in the magnitude of design effects. Regardless, design effects typically vary by type of question, sample subgroup, and domain of interest, so must generally be estimated in a specific analytic context.

Analysis of Longitudinal Survey Data

Sampling Weights

Longitudinal survey data often are produced with multiple sampling weights for use in analysis to represent the population of interest. A wave-specific weight may allow for use of one wave's data to represent the inferential population, taking into account unit nonresponse experienced during that wave. A panel weight may take into account patterns of nonresponse across multiple survey waves.

Dynamic Analysis

Longitudinal surveys can measure change at both the group and individual levels. In particular, they permit the researcher to follow change over time for individuals. Repeated cross-sections permit measuring change over time of certain groups, but not of the same individual (save by random chance, as each cross-section samples anew from the population). Group-level measurements can mask changes in group in- and outflows. For example, a repeated cross-sectional study can produce estimates of the poverty rate at different points in time, and hence an estimate of the change in poverty over time. But such a study cannot reveal whether individuals (or families, or households) remain in poverty over multiple sampling periods, or whether individuals tend to cycle in and out of poverty. In other words, unlike repeated cross-sections, longitudinal survey designs can shed light on whether poverty is a relatively permanent, chronic condition or whether it tends to be transitory. Measurement of this kind of income mobility has been one of the major analytical contributions of longitudinal surveys like the NLSY.

Longitudinal studies can also establish a sequence of events. For example, while cross-sectional studies in the 1990s had observed that teen mothers often were also high-school dropouts, leading to suspicions that motherhood led to dropping out. Timing data from the NLSY allowed researchers to see that girls tended to drop out of high school even before becoming pregnant, contradicting the hypothesized mechanism.

Controlling for Unobserved Variables

Another analytical advantage of longitudinal data lies in the opportunity to control for unobserved variables that can often confound the identification of causal relationships. For researchers interested in estimating a causal relationship between two variables (e.g., between a treatment and outcome variable) using ordinary least squares (OLS) regression, the presence of unobserved variables that are *correlated with* the treatment variable would bias—or render inconsistent—the estimator of the treatment effect if the unobserved variables are not controlled for in the model. Technically, the estimator would be biased [a finite- or small-sample result] if the presence of unobserved variables, not included in the regression model, caused the conditional mean of the population error of the regression model to be nonzero; i.e., $E\left(v_{it}|X\right) \neq 0$. With multiple observations on the *same* sample units over time, longitudinal data allow the researcher to apply methods that eliminate the potentially confounding effect of unobserved *time-invariant* individual characteristics.

As a simple example, suppose a researcher was interested in estimating whether a causal relationship exists between an outcome variable, y_{it}, and a treatment variable, x_{it}. The researcher, having recourse only to cross-sectional data, might estimate, for any given period t, an OLS regression of y_{it} on x_{it},

$$y_{it} = \beta_0 + \beta_1 x_{it} + \alpha_i + \epsilon_{it}$$

for the $i = 1, \ldots, N$ individuals in the cross-sectional sample at hand. The error term in this regression model, u_{it}, which captures the unobserved characteristics of individual i affecting her outcome y_{it}, can be decomposed into a time-invariant and a time-varying component: α_i and ϵ_{it}, respectively. In large-sample (or asymptotic) analysis, the OLS estimator, $\hat{\beta}_1$, will be inconsistent if x_{it} is correlated with any part of the error term ($u_{it} = \alpha_i + \epsilon_{it}$). Even if one assumes that x_{it} is uncorrelated with the time-varying component of the error term—that is, $\text{Cov}\left(x_{it}, \epsilon_{is}\right) = 0$ for any t and s—the OLS estimator, $\hat{\beta}_1$, will be inconsistent as long as $\text{Cov}\left(x_{it}, \alpha_i\right) \neq 0$ holds. This means that the probability limit of $\hat{\beta}_1$ can be expressed as:

$$plim\ \hat{\beta}_1 = \beta_1 + \underbrace{\frac{\mathrm{Cov}(x_{it}, \alpha_i)}{\mathrm{Var}(x_{it})}}_{\neq 0}$$

where $\beta_1$is the population parameter to be estimated. Hence, correlation between the time-invariant individual heterogeneity,α_i, and x_{it} renders $\hat{\beta}_1$inconsistent.

With longitudinal data at hand, the researcher can address inconsistency in the parameter estimates arising from the time-invariant unobserved heterogeneity. With multiple observations on the same individual, the researcher can take the difference of the first equation from two different time periods to eliminate the time-invariant unobserved heterogeneity, α_i:

$$y_{it+1} - y_{it} = \beta_1(x_{it+1} - x_{it}) + \epsilon_{it+1} - \epsilon_{it}$$

Note that when taking differences, the intercept in the original equation is eliminated along with the unobserved individual heterogeneity, as are any other time-invariant explanatory variables in the model (e.g., variables capturing the race or gender of the individual). With multiple time periods, the fixed effects estimator can also be employed to eliminate time-invariant unobserved heterogeneity.

The depth of information about each respondent also means that missing data due to unit or item nonresponse can often be imputed in longitudinal surveys, making the problem of missing data less injurious to analyses in longitudinal survey than in cross-sectional surveys.

Implications of Technological Change on Longitudinal Surveys

Data Collection

Technologies have expanded and improved longitudinal surveys in almost every facet of data collection, including questionnaire design, questionnaire administration, data processing, and respondent contacting. While many technological survey innovations have benefited surveys generally, some innovations are particularly beneficial to longitudinal surveys. Computer-assisted questionnaires can flexibly collect a much broader set of information for the same interview length than a one-size-fits-all paper questionnaire. Techniques mentioned earlier, such as bounded interviewing and confirming responses from prior rounds, are much easier to implement electronically.

While a variety of computing technologies have enabled the methodology of longitudinal surveys to advance, so too have computing technologies created new barriers to successful implementation of longitudinal surveys. Cell phone numbers in the United States are much harder to link to individuals than landlines are, and tools such as privacy blockers on phones and doorbell cameras at the front door allow respondents to evade data collection efforts. These factors have impeded all types of surveys, but as explained in this entry, the greatest indicator of the quality of a longitudinal survey is its ability to accurately represent the population of interest. A survey's representativeness can never improve on its initially recruited sample, and damage to the sample is multiplicative in nature, so that every wave of lower survey participation further diminishes the quality of future waves. While a cross-sectional survey may be able to recruit additional sample to compensate for data collection difficulties, a longitudinal survey has fewer options for replenishing its representativeness.

The recent history of longitudinal survey data collection seems almost like a cat-and-mouse game in which technology helps survey researchers make impressive advances, but then additional innovations erect new barriers to successful data collection; again newer methods arise for surveyors, only to be counteracted with yet another generation of technologically based challenge.

Analytic Methods

Two main areas of analytic advances are of note when considering the impact of technology on longitudinal surveys. First, as the incidence of unit nonresponse increases in the face of data collection challenges, analysts have harnessed computing power and the sophistication of statistical software to create new and better methods of handling and even correcting for unit nonresponse in longitudinal data. Second, researchers have developed new analytic approaches such as sequential modeling, network analysis, time series analyses, and hazard modeling that have expanded the set of research questions addressed using longitudinal survey data. While the first longitudinal surveys generally collected repeated point-in-time data that would be cross-tabulated or used in simple multivariate regressions, longitudinal surveys today can collect data in a wide variety of structures that support different analytical approaches.

Linkages

One method of enhancing the value of longitudinal survey data is to link the survey data with other data, for example, administrative records such as tax files or college transcripts, environmental data such as pollution exposure or local crime rates, or other types of nonsurvey data such as biomarkers or cognitive tests. Linkage with longitudinal surveys is particularly valuable because a single linkage can enhance all years of survey data. In the NLSY97, linked college transcript data can be used with survey data from adolescence to model the determinants of college admission; with survey data contemporaneous to the college enrollment period to better understand college experience and predictors of college completion; or with survey data collected years after college graduation to examine the relationship of college major and grades to occupational choice and mid-career earnings levels. Researchers have linked survey data to nonsurvey data since at least the middle of the 20th century, but computational techniques such as fuzzy matching, computerization of many public program records, and high-powered analysis tools that can process large volumes of data have all increased the possibilities for linkages to survey data for analytic purposes.

Disclosure Risk

Maintaining respondent privacy is a particular challenge for longitudinal surveys, since disclosure threats to already available data can emerge over time (e.g., historical public records becoming available), and because activities and characteristics that are relatively common at one point in time can become rare or even unique as they are combined over time. The concept of deductive disclosure risk refers to information that can be combined to identify an individual, even without any personally identifying information about the individual such as name or date of birth. While there may be many mathematics students earning undergraduate degrees and many young adults working in journalism, the number of mathematics degree holders that become journalists may be much smaller, and that combination may become even more rare if an individual who studied mathematics in Chicago then becomes a journalist in New York. In determining what data can be released publicly, survey organizations must assess not only the risk that a current characteristic might disclose the identity of a respondent but also the risk that the prior sequence of observations about that respondent might identify him or her, but most challengingly, the risk that future information that would be analytically useful to release may combine with current or previously released data to result in deductive disclosure risk.

In early decades of the 21st century, the rise of the Internet, of easily accessible computing power, and of machine-learning techniques have all combined to greatly threaten the anonymity of individuals in research data. Fortunately, survey researchers have also been rapidly developing disclosure protection techniques and data access technologies that can counter these threats while retaining the analytic value of the data.

Further Readings

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