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Cognitive Research on Response Error in Survey Questions on Smoking

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This report describes three studies investigating the accuracy of subjects' self-report about cigarette smoking. The first study examined the way in which smokers answer questions about the number of cigarettes they smoke. The second study addressed the issue of social desirability effects by manipulating the context in which subjects were asked whether they smoked, and if so, how much. In the third study, participants from a 1981–82 study of people who completed a stop-smoking program were interviewed concerning their smoking histories.

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Preface

Many individuals contributed to the research described in this report. We wish to thank the National Center for Health Statistics' technical monitors for the project, Dr. Jared B. Jobe and Dr. James L. Esposito, for their suggestions, guidance, and support throughout the effort. We also wish to acknowledge the contribution of Dr. Elizabeth F. Loftus of the University of Washington, who consulted with us on the design of these studies. Study 1 owes much to the work of Dr. Saul Shiffman of the University of Pittsburgh, who first suggested using hand-held computers for logging smoking and shared his research protocols with us. We are also grateful to two other members of the University of Pittsburgh Smoking Research Group: James Sueker programmed the user interface for logging cigarettes onto the computer, and Jean Paty shared his procedures for training subjects and for handling data with us and served as technical consultant throughout the data collection. In testing subjects, Alison Dame assisted in studies 1 and 3, Anna Carroll assisted in studies 1 and 2, and George Clark assisted in study 3.

Symbols	
- - -	Data not available
. . .	Category not applicable
-	Quantity zero
0.0	Quantity more than zero but less than 0.05
Z	Quantity more than zero but less than 500 where numbers are rounded to thousands
*	Figure does not meet standard of reliability or precision
#	Figure suppressed to comply with confidentiality requirements

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Introduction

Since 1984, the National Center for Health Statistics (NCHS) has been fostering interdisciplinary efforts between cognitive psychology and survey research through its National Laboratory for Collaborative Research in Cognition and Survey Measurement. Studies conducted under this research program are exploring whether cognitive psychology principles and techniques can be applied to improve the validity of responses to survey questions. Moreover, interdisciplinary work can benefit cognitive psychology by increasing the empirical data base available to refine and evaluate theories of human memory, decisionmaking, and estimation.

In funding external research projects under this program, NCHS has sought to encourage the application of cognitive psychology to some of the most difficult and significant concerns facing those who develop and analyze health surveys. The project reported here addressed one such topic area—the validity of surveys regarding cigarette smoking.

Importance of surveys of smoking behavior

In the United States, smoking contributes to more than 300,000 premature deaths annually (1). Smoking is regarded as the largest preventable health problem facing the American public. Epidemiologic data show that exposure to tobacco smoke is linked to a heightened risk for a multitude of health conditions related to cardiovascular and pulmonary disease and to cancer (1). Because many of the epidemiologic models of smoking-illness relationships specify a dose-response effect, greater precision in collecting self-reports of smoke exposure and long-term smoking history is a key to refining current models and developing new ones. Researchers, thus, are not simply looking for a gross picture of the percent of smokers within the U.S. population but are seeking to assess the amount of smoking and different patterns of lifetime exposure to smoke and associated biological, environmental, and behavioral correlates. Research that could help unravel the behavioral correlates of smoking, successful smoking cessation, and relapse would have great import for the Nation's health.

Focus of the present study

Three types of smoking questions identified as commonly used in health surveys were selected as topics for this research project:

- Reports of smoking status (Do you smoke cigarettes?)
- Reports of smoking frequency (How many cigarettes do you smoke in a typical day? How many yesterday?)
- Reports of long-term smoking patterns.

Each of these smoking questions was addressed in an experiment in which varying methods of questioning were investigated and their effects on the validity of subject reports assessed.

Study 1—Estimating frequency of cigarette smoking—concerns subjects' ability to provide accurate reports of the number of cigarettes they smoked on specific, recent days.

Study 2—Social desirability and reports of smoking—examines the effects of different contexts and question wording on subjects' reports of smoking status (admission that they smoke) and on the typical daily cigarette consumption reported by those who say they smoke.

Study 3—Long-term recall of smoking activity—investigates subjects' ability to recall when they stopped and started smoking over an extended period, including events that occurred 8 years or more in the past.

Each of these studies is reported in a separate chapter following the review of issues in smoking research and cognitive aspects of survey methodology.

Review

Issues in smoking research

Most of the data used in epidemiologic studies of smoking consist of self-reports collected through face-to-face or telephone interviews or through self-administered questionnaires. For this reason serious concern arose from studies that appeared in the 1980's, showing that such reports are unreliable and that smoking appears to be underreported when self-reports are compared with biochemical markers of smoking.

Biochemical markers providing objective measures of exposure to tobacco smoke include assays of thiocyanate, carbon monoxide, nicotine, and cotinine. These tests vary in the extent to which they are sensitive and specific to nicotine, in their biological half-lives, in the ease with which the biological assay can be performed, and in the associated cost of the assay (2). Among the biochemical markers of smoking, cotinine (which can be measured in serum, saliva, or urine) has come to be regarded as the most promising marker for accuracy, reliability, and cost (3). Because saliva and serum cotinine are highly correlated and saliva collection is less invasive, the latter has become the preferred measure in field studies. Nevertheless, no biochemical marker should be uncritically accepted as perfect. All of the markers have difficulty distinguishing light smokers from those passively exposed to smoke, and there are many unanswered questions concerning how nicotine is metabolized (4).

Reports of smoking status

The strongest evidence of underreporting of smoking comes from studies on reports of smoking status (smoker versus nonsmoker) among adolescents or individuals in situations where there is strong pressure to stop smoking, for example, individuals under treatment for smoking-related health problems or those in a stop-smoking program. Sillet, Wilson, Malcolm, and Ball (5) worked with patients who survived a myocardial infarction and were in a prevention program that included either advice against smoking or an explicit stop-smoking program using nicotine chewing gum. Sillet et al. estimated that 22 percent of the subjects who said they did not smoke in one trial and 40 percent in another were actually smokers. (It is quite possible that the biochemical assays were affected by the nicotine in the chewing gum.) Wilcox, Hughes, and Roland (6) worked with patients in an infarction clinic. All of the smokers had been strongly warned to stop smoking. However, an estimated 17 percent of those who said they had stopped smoking were in fact smokers, according to their cotinine levels.

Jarvis et al. (3) studied smoking status reports among hospital outpatients, the majority of whom were suffering from smoking-related diseases. Subjects were asked at the clinic about their smoking and subsequently gave blood, urine, and saliva samples for biochemical assay. An estimated 19 percent of those who said they were nonsmokers had biochemical markers indicative of smoking. In contrast, among 159 hospital employees enrolled in smoking cessation programs, Abrams, Follick, Biener, et al. (7) found only one individual who reported not smoking but had a cotinine level indicative of smoking.

Other evidence of underreporting of smoking status comes from several studies in which responses during a telephone interview were compared with those in subsequent home interviews. Luepker, Pallonen, Murray, and Pirie (8) found that the population estimate for smokers among Minneapolis-St. Paul young adults (aged 17–21) was 27.3 percent based on home interviews compared with 24.2 percent based on telephone interviews. Smoking prevalence as defined by the level of cotinine in saliva samples taken during the home interview was even higher—28.6 percent.

It is possible that some cases interpreted as dissembling are actually passive smokers. Wall, Johnson, Jacob, and Benowitz (9) found detectable levels of cotinine in the saliva of one in four passive smokers. Jarvis, Russell, Feyerabend, et al. (10) found cotinine levels equivalent to smoking 80 cigarettes a year among nonsmoking schoolchildren with two smoking parents. The levels of cotinine detected, however, were below the designated cutoff for classifying subjects as smokers in the studies reporting that some individuals conceal their smoking. In summary, the literature suggests a modest (1–4 percent) underreporting of smoking status among a general population but significant underreporting (on the order of 15–20 percent) among those who are being heavily pressured to quit.

Smoking frequency estimates

Few studies have been able to assess the validity of reports of smoking frequency among respondents who identify themselves as smokers. In part, this lack of data reflects the unavailability of a solid standard against which

to judge the accuracy of self-reports. Although biochemical markers are good at discriminating smokers from nonsmokers, they do not yield estimates that are precise enough to accurately identify the number of cigarettes smoked in a specific period. Variables such as the kind of cigarette smoked, the way in which the cigarette is smoked (for example, depth of inhalation), and the way the individual metabolizes nicotine will lead to varying cotinine levels among individuals who have smoked the same number of cigarettes. Reported correlations between cotinine and smoking frequency have ranged from 0.24 to 0.43 (7,11–14). Although cotinine levels have not been used to estimate smoking frequencies, recent studies have investigated the ability of cotinine to distinguish among levels of smoking (for example, active smokers versus light smokers versus passive smokers versus unexposed nonsmokers). Cotinine appears to be more sensitive to differences in nicotine exposure at lower levels of exposure, but with heavier smokers (20–25 cigarettes a day), cotinine levels have been reported to hit a ceiling (12,13,15). Abrams, Follick, Biener, et al. (7) reported a correlation between cotinine level and self-reported smoking frequency of 0.47 among those who smoke fewer than 25 cigarettes a day compared with a nonsignificant -0.05 among those who smoke 25 cigarettes or more. (It is also possible that part of this difference stems from greater accuracy of self-reported smoking frequencies among the lighter smokers.)

Given this level of relationship, cotinine levels have not been used as a standard for identifying individuals who misreport their smoking frequency in the way that they have been used to mark "deceivers" with regard to smoking status (7). There are, however, several other sources of evidence that suggest reports of smoking frequency are flawed, although the data do not indicate whether they are biased or in what direction. In a study of Australian veterans interviewed on two occasions, O'Toole, Battistutta, Long, and Crouch (16) found poor intra-subject agreement across interviews concerning the reported number of cigarettes smoked. Others have found that reported frequencies show a decided digit bias, with respondents tending to report numbers ending in 0, especially in multiples of 20 (17,18).

The general literature on responses to sensitive questions also implies a need for caution in interpreting reported smoking frequencies. Summarizing a series of survey validity studies, Bradburn (19) reported that people report doing socially desirable acts, such as voting or contributing to charity, more often than they actually do them and underreport less desirable behaviors, such as alcohol consumption. Extrapolating from these studies, reports of smoking frequency would be expected to be underestimates of subjects' actual smoking levels.

Long-term smoking patterns

Like smoking frequency, long-term smoking patterns have proved difficult to validate. The O'Toole et al. study (16) also found poor agreement for reports given on two occasions of the age that smoking was initiated and the age it was stopped. Although validation data were not available in that study, the lack of reliability in the reports implies that validity was necessarily limited. In a study comparing reports of smoking over periods of 20 and 32 years, Krall, Valadian, Dwyer, and Gardner (20) found poor recall of cigarette dose, with underestimates of past smoking frequency (17 percent for 20-year recall and 37 percent for 32-year recall) more common than overestimates (9 and 6 percent, respectively).

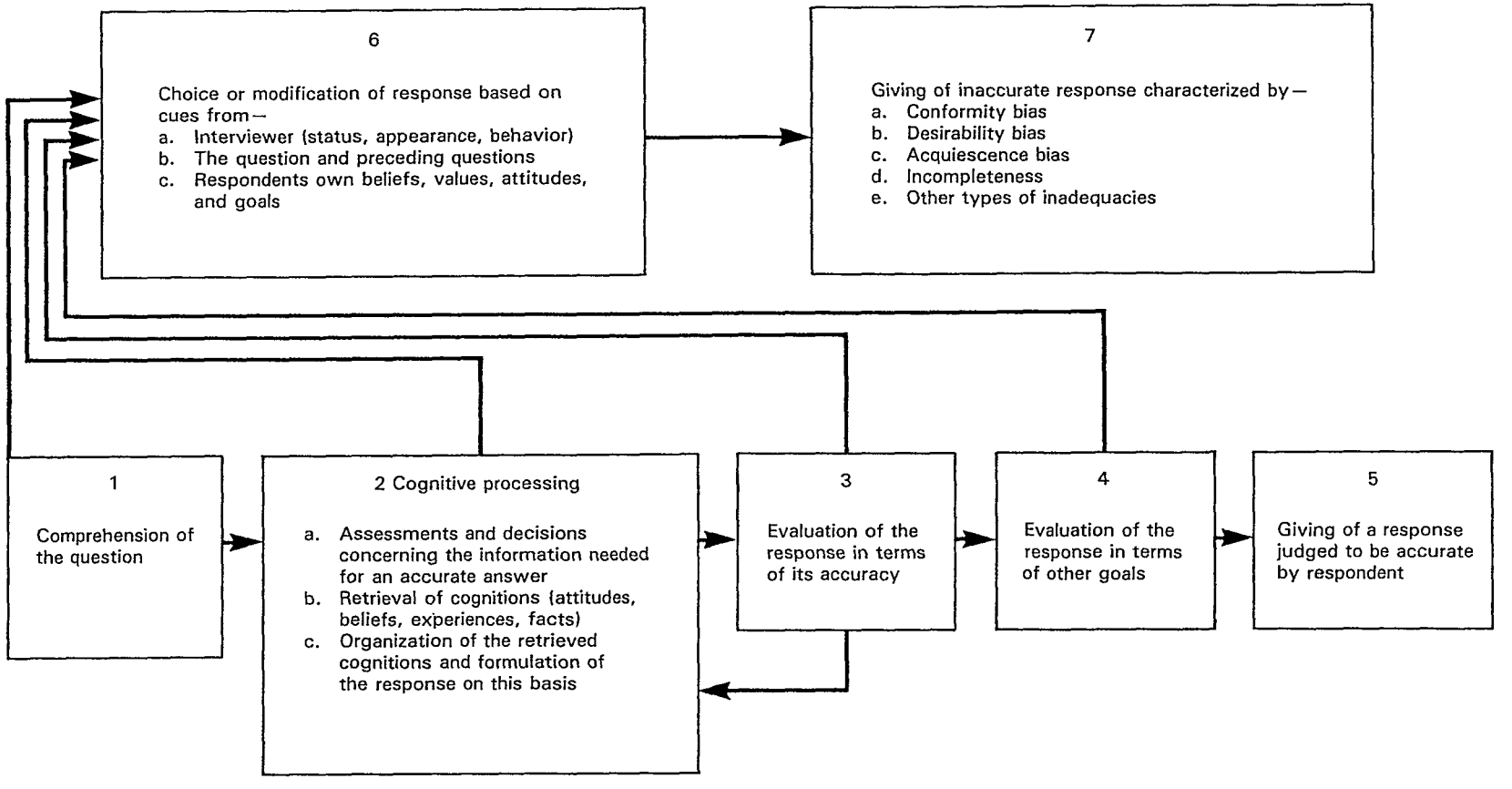
Given the fact that lifetime cigarette consumption is often marked by numerous fluctuations in the amount smoked, alterations in cigarette brand, and self-initiated changes in smoking habits, smokers are not expected to be able to provide accurate retrospective reports for extended periods. However, there are no good alternatives to self-report for long-term patterns. The use of biochemical tests to try to capture all of these changes over a long period is simply infeasible. Moreover, such tests cannot measure the relationships among life events that may well be the key to changes in smoking behavior. Self-reports have the potential for providing data on these variables over longer periods if the recall problem can be adequately addressed.

Cognitive issues in smoking surveys

Generating responses to survey items

The traditional model of the process of responding to survey items considers the survey question as a "stimulus," which leads the respondent to produce a readily available "response." As long as the question is asked in the same way, this naive model assumes that all respondents are responding to the same stimulus, and that the requested information is available and will be provided, except where there is some motivation to deceive or refuse cooperation. Even before the recent surge of interest in cognitive processes underlying responses to survey questions (21), it was quite apparent to survey researchers that this naive model was a misleading simplification. Cannell, Miller, and Oksenberg (22), for example, offered a model of question-answering that included comprehension of the question as well as the cognitive processes of decisions concerning needed information, retrieval, and organization (figure 1). Although their model lumped together some quite different cognitive processes (for example, assessments of information needed and retrieval processes), it was an important step forward in recognizing the complexity of the process of answering questions and the many possible sources of respondent error.

More recently, models have been seen with more detail developed to capture the processes involved in answering specific kinds of questions, as exemplified by the model of answering event frequency questions offered by Lessler, Salter, and Tourangeau (23). Recent writing on this topic points out the relevance of a sizable number of cognitive processes, previously studied in laboratory



SOURCE: Cannell, C. F., Miller, P. V., & Oksenberg, L. Research on interviewing techniques. In: S. Leinhardt, (Ed.), Sociological Methodology 1981. San Francisco: Jossey-Bass, 1981.

Figure 1. Model of the question-answer process

experiments, with relevance to the activity of answering survey questions (24).

Comprehension processes will affect the way in which the question is understood by the respondent. It is known from laboratory studies that comprehension can be far from straightforward, and that different respondents may interpret the same verbal statement in quite different ways. Respondents will use their prior knowledge and experience (which varies from respondent to respondent and may correlate with demographic group) to try to understand what is being asked. They will also use cues discerned from their assessment of the interviewer, the purpose of the interview, and the meaning of previous questions.

Memory retrieval processes are clearly important, as respondents attempt to find the information requested (as they understand it) in memory. It is known that the kind of cues available at the time of attempted recall and their similarity to the cues present when the information was originally encoded and stored in memory will affect the recall process (25). In addition, laboratory studies reveal that much of memory is a process of reconstruction, with the mind taking what can be retrieved from storage and "filling in the gaps" to produce a sensible picture. Because people are often unaware of this process of reconstruction, respondents are typically unable to discriminate information stored in memory from that which has been reconstructed at the time the questions were asked. Although the process of "gap filling" will usually produce responses that are not only more complete but also more accurate, there can also be cases when it leads to serious distortions (26).

Estimation processes are also involved in answering many survey questions. Even when the survey item involves reports of past events rather than projections of future events, the respondent will often be unable or unwilling to recall all events in the target category and instead will generate a frequency response from the information available. This process may involve conscious deliberation or may occur unconsciously.

Judgment processes are required by many survey questions, for example, in political polls when respondents are asked to indicate how acceptable a given course of action would be to them. It is now recognized that many opinion polls ask respondents for their views on issues and options they have never considered before. Nevertheless, most people will form some judgment at the time they are questioned in order to provide an answer.

Response formulation occurs after the respondent has recalled or generated the needed information or judgment. This refers to the processes involved in transforming the internally represented response into a response for presentation to the interviewer. Just as response error can occur within the process of comprehending the question, it can also result from problems of translation from what the respondent meant to say to what he actually does say (and how the interviewer interprets that response).

Various forms of *evaluation* occur throughout the question-answering process. Early in the process, the respondent evaluates the amount of effort that will be required to answer a question accurately, the importance of generating a precise answer, the potential risk to giving a true answer, and so forth. Later, after retrieving information from memory or forming an estimation or judgment and tentatively forming a response, the respondent will evaluate the potential response in terms of whether it meets the requirements of the interviewer, whether it fulfills his or her own goals for self-presentation, and so forth.

Although all of these processes are candidates for studies of cognitive processes in surveys, the work reported here focuses on the processes of memory retrieval, estimation (specifically of event frequencies), and evaluation (of a potential response's desirability).

Frequency estimation

When similar events occur repeatedly in an individual's life, people begin to build up "scripts" or "schemas" to capture the invariant features of similar episodes, such as going to a restaurant or visiting a doctor's office (27,28). Researchers in autobiographical memory have elaborated this idea and proposed that individual episodes that share many characteristics can, over time, become fused into a script or schema that then becomes part of the person's knowledge (29). Neisser (30) describes memory traces for specific episodes as molecular memories nested within more molar memories for generic events. As time passes, the contents of the molar memory (the features that are invariant across events) become much more accessible than the distinguishing features of individual events. Similarly, Reiser, Black, and Kalamarides (31) describe personal memory as consisting of a schema for a certain type of event with individual events associated with it. An event of the latter sort is marked for characteristics that distinguish it from the generic or prototype event in the semantic knowledge structure.

These ideas have implications for survey questions asking individuals to recall all of the events of a certain type that occurred within a reference period. On the basis of the cognitive research, respondents are not expected to have trouble producing the script or schema for the class of events but to have difficulty recalling and describing individual incidents. This prediction was in fact confirmed in a study of recall of medical visits by Means, Nigam, Zarrow, et al. (32).

This result suggests that if respondents are given questions about the frequency with which a certain class of event occurred within the reference period (for example, "How many times did you see a doctor or other medical care provider during the past year?"), recalling all of the individual incidents would be difficult, and they will prefer answering on the basis of general information. Sometimes the latter strategy can be quite useful ("Well, I know I see

the allergist once a month, so that must be 12 times."). Often, however, respondents will not have information that is very useful in generating estimates.

There is a small but growing literature on how people answer questions about the frequency of personal events, and it suggests that memory of individual events will be used only when the number of events involved is quite small (33,34). With categories of events that occur more frequently (and this would certainly include the act of smoking a cigarette for most smokers), people seem to use either general information about their habits or a more "direct" estimation strategy, perhaps relying upon some implicit, automatic evaluation of the strength of the schema or molar memory for that type of event.

How people form frequency estimates for smoking on recent days is the focus for the first study described in the next chapter. The second study considers social-desirability effects in reports of smoking status and smoking frequency. The third and final study investigates recall of long-term smoking patterns and evaluates an experimental procedure for aiding retrieval of past incidents of smoking cessation and relapse.

Study 1: Estimating frequency of cigarette smoking

It is common practice in standardized surveys to ask people to report how frequently they do something—use a particular product, exercise, or read a book. The implicit assumption underlying the development of such survey items is that people can retrieve the relevant incidents from episodic memory and tally them to arrive at an accurate response. Given this assumption, survey methodologists have tended to focus their concern on sources of response error associated with episodic recall, that is, retrieval failures and telescoping effects (placing events in the wrong time frame).

Recently, this implicit assumption regarding the processes involved in answering frequency questions has been challenged, particularly for behaviors that are high in frequency (33). A set of alternative strategies for answering frequency questions—subject to biases quite different from the omission and telescoping errors found in episodic recall—has been identified.

Blair and Burton (33) explored the issue of alternative frequency estimation strategies in a recent series of studies. They administered survey questions about frequency of behaviors such as dining in a restaurant or using an automatic teller machine. Immediately after answering the frequency question, the respondent was questioned about the method used to arrive at the response. Episodic recall was the most frequently reported strategy when there were three incidents or fewer in the event category, but use of this strategy declined rapidly as event frequency rose. For those who ate in a restaurant 10 times or more, for example, no one reported basing his or her frequency estimate on episodic recall. Instead, responses were based either on what Blair and Burton called "direct" estimates or on procedures for decomposing the reference period and computing rates. For a very frequent, commonplace behavior (such as writing checks) nearly two-thirds of their respondents reported using direct estimates under normal interviewing procedures. Using a similar methodology, Means and Loftus (34) found that respondents depend primarily on recalling each visit individually only when there were fewer than three, when asked how many medical visits of a specific type (for example, visits for allergies) they had during the last year.

The psychological literature suggests that the alternative approach of making direct "gut reaction" estimates is subject to biases quite different from the omission and telescoping errors found in episodic recall. Tversky and Kahneman (35) suggest that a commonly used heuristic for producing these estimates is *availability* judgments. Easy-to-retrieve events are assumed to have a high rate of occurrence. Because factors other than frequency affect retrievability, this heuristic can lead to bias. For example, in one Tversky and Kahneman study, respondents were asked to consider a letter (K, L, N, R, or V) and asked whether the letter is more likely to appear in the first or third position in English words. Although these letters are in fact more likely to appear in the third position, it is easier to retrieve words starting with a given letter than words in which the letter appears in the third position. Each letter was judged by the majority of respondents to be more frequent in the first position of words than in the third position, and the bias was quite strong: The mean estimate for the ratio of the two frequencies was 2:1. Given the relationship between event salience and retrievability and the low salience of individual smoking episodes, the Tversky and Kahneman work would suggest that using an availability strategy would tend to lead to underestimates of smoking rates.

On the other hand, findings reported by Bruce and Read (36) suggest that however biased direct estimates based on availability may be, they are better than estimates based on attempted episodic recall for high-frequency events. In that study (conducted with F. Craik), respondents saw lists of words from different semantic categories (for example, animals). After viewing a list, respondents were asked first to give an initial frequency estimate (presumably based on availability) for each category (for example, "How many animals were on the list?"). This first frequency estimate was followed by cued recall, that is, the experimenter provided category labels and instructed the respondent to recall as many instances as possible of that category from the word list. This cued recall was followed by a second frequency estimate. Second estimates were typically *less* accurate than the initial estimates. Bruce and Read interpret the results to indicate that although respondents had failed to recall all instances, they used their partial recall as a guide in making the second estimate. The literature does not indicate whether the same effect would be found for memory of a behavior (as opposed to briefly viewed verbal material).

Another approach to estimating frequency reported by respondents interviewed by Blair and Burton (33) and in a similar study reported by Bradburn, Rips, and Shevell

(37) entails *decomposing* the reference period, computing a frequency for one or more parts of it, and then multiplying or adding part frequencies to arrive at an estimate for the whole. Although respondents have reported using this strategy in several studies, evidence concerning the relative accuracy of frequency estimates derived in this way is lacking.

Yet another form of decomposition strategy was investigated by Menon and Sudman (38). In that study, the reference period was decomposed in terms of domains of activity, with respondents trying to recall the number of incidents of a certain type connected with each domain (for example, going out to dinner with a business associate, with a date, and so forth). This form of decomposition was compared with a strategy based on recall of a typical rate, with adjustment made to consider any unusual circumstances during the reference period. For a regularly occurring personal event such as washing one's hair, estimates based on rate-of-occurrence knowledge were most commonly used when respondents were given a choice of strategies and were more accurate than answers based on decomposition when strategies were imposed. In contrast, for an irregular behavior such as snacking, decomposing the questions into subdomains (for example, "I snack when I study, at the movies," and so forth) led to more accurate answers than estimates based on knowledge about usual rates and rate changes.

Because it represents behavior that tends to be habitual, repetitious, and almost unconscious, smoking is a very difficult activity to assess by means of a frequency question. In this study, we explored and manipulated the types of strategies individuals used in attempting to answer frequency questions about cigarette smoking behavior. In this way, we were able to assess the relative accuracy of these different strategies.

Design

Issues and hypotheses

In this study, we investigated whether manipulating the strategy that respondents use to develop answers to questions about smoking frequency would affect the accuracy of those estimates. From a theoretical standpoint, we wanted to understand the limits of people's ability to judge the frequency of a commonly occurring event and the estimation strategies that proved most effective. We did not begin this research with a prediction as to which strategy would lead to the most accurate estimates. We did hypothesize, however, that attempts at episodic recall might be reasonably effective when the number of events to be recalled (smoking rate) was relatively low (that is, when each incident of smoking retained some salience), but would be ineffective when the number of events was large (when the act of smoking has become habitual). Additive decomposition, on the other hand, is a strategy that seems well suited for estimating events of a wide range of frequencies.

From a practical standpoint, researchers are constantly seeking better measures of smoking frequency. Several studies report problems with underreporting of smoking (2,18). It is also clear that respondents demonstrate a digit bias, typically reporting a daily smoking rate ending in zero. Concern over the accuracy of self-report data about smoking has led researchers to resort to the more cumbersome and expensive practice of obtaining biochemical measures of constituents of cigarette smoking in many studies. In addition to the expense and greater intrusiveness of these measures, it is problematic that the biochemical measures themselves are not calibrated well enough to provide highly accurate estimates of an individual's daily smoking rate. The measures are far more effective at discriminating smokers from nonsmokers than they are at differentiating among different degrees of smoking activity.

In this study, we tested an alternative means of obtaining measures of smoking activity: Respondents logged cigarettes onto a hand-held computer and we used this log to assess the accuracy of self-reports of smoking level, giving different instructions for making that estimate. To provide a baseline performance representing respondents in typical health surveys, one group of respondents gave smoking frequency estimates without any instructions as to the method they should use. For this group—the free-strategy condition—the style and pacing of the interview preceding the smoking frequency question were made as much as possible like that of a large-scale survey such as the National Health Interview Survey (NHIS). Comparing this group's estimates of their smoking with computer records established an estimate of the level of accuracy now obtained in national surveys (assuming there were no deliberate attempts to underreport). This allowed us to gauge the size of the reporting problem in current surveys and to assess the accuracy of the three imposed-estimation strategies—episodic, additive decomposition, and availability. Given the length and pacing of the typical health survey, our hypothesis was that most respondents, when given a choice of strategies, would use something resembling an availability judgment as a basis for answering the smoking frequency question.

Experimental design

To permit assessment of recall accuracy, respondents recorded each cigarette they smoked on a hand-held computer for a period of 6 days. Afterwards, they were given unexpected questions about the number of cigarettes they smoked on specific days during that assessment period. Using a four-group, between-respondents design, we allowed one group to answer the frequency question, using any method they liked, while the others were constrained to employ a particular estimation strategy. These frequency estimation strategies include:

- Additive decomposition—the typical weekday is divided into different types of activities such as "commuting," "in the office," and "after dinner." The subject is asked to report the number of cigarettes

typically consumed in each of these portions of the day. After all separate estimates are made, they are summed to arrive at a total day's estimate.

- Availability—the subject is instructed to answer the smoking frequency question quickly with a "gut reaction" without trying to think of specific instances of smoking.
- Episodic recall—the subject is instructed to take a selected weekday and to work through the day recalling all instances of smoking. The subject is then asked to use the recalled instances to arrive at a daily total.

A saliva sample was taken from each respondent for biochemical analysis for cotinine, a nicotine indicator.

Method

Respondents

A convenience sample of 128 respondents was recruited through advertisements in local newspapers and on bulletin boards. Individuals who responded to the advertisement were questioned about their age, smoking frequency, and any current attempts to change their smoking behavior. Those who met the study participation criteria (between the ages of 18 and 65 years who smoked at least 5 cigarettes daily and were not trying to quit) were offered $45 for participating.[1] They were told that we were interested in the relationships among smoking behaviors, nicotine dose, and saliva cotinine. We explained the requirements for participation—to carry a small computer and log in every cigarette smoked over a period of 6 days. We also informed them that we were not asking them to alter their normal smoking habits during the assessment period and that their records would be confidential. The recruiting procedures and sample response rates are described in detail in appendix I.

Of the 128 respondents tested, 2 were eliminated from the data set for failure to comply consistently with instructions for logging their cigarettes onto the computer. The final sample included 43 males and 83 females, ranging in age from 18 to 63 years, with a mean age of 37.60 years.

Procedures

Respondents completed a brief initial interview at SRI and logged each cigarette smoked into a hand-held computer over a 6-day period.[2] They then returned to SRI for a second interview, at which time they were asked about the number of cigarettes smoked on specific days and provided a saliva sample for biochemical analysis.

During the first interview, which was always held on a Friday, the interviewer asked the respondent to show his or her cigarettes so the brand could be recorded. Subjects were also asked a number of questions about their smoking style (for example, "How much of each cigarette do you smoke?"). These questions were designed to focus their attention on the concept of nicotine dosage and to deflect their attention away from the issue of the number of cigarettes smoked.

After answering these questions about smoking behaviors, respondents were shown the hand-held computer (a PSION Organiser II, Model CM, measuring 3/4 inch by 3 inches by 5 1/2 inches) and were instructed on its use. The procedure for logging in cigarettes was kept as simple as possible. Respondents were required to press one button to turn the computer on and another to log in a cigarette just before they smoked it. Pushing this button activated a time and date stamp within the computer. The respondent did not see a display of the time or any tally for cigarette consumption. Respondents were also required to respond to occasional "beeps" from the computer to verify that they were carrying it.

In the event the respondent logged in a cigarette and was interrupted before smoking it, or smoked a cigarette and forgot to log it in at the time, a 3- by 5-inch card was issued with the computer for entering such errors in logging the number of cigarettes onto the computer.

Respondents practiced using the computer during the initial interview. They were also given a set of written instructions and a telephone number to call if they had any questions or problems. They signed a form, pledging to carry the computer with them and to log in all cigarettes smoked, starting upon leaving the interview that was held on a Friday until they returned for their second interview 6 days later. Respondents were told that the $45-participation fee was dependent on a faithful recording of the number of cigarettes smoked. In addition, they were informed that they would receive a bonus of $5 if they were good about responding to computer prompts. Appendix II contains a complete description of the training provided for using the computers along with the experimenter protocol for the first interview.

After logging their smoking for 6 days, respondents returned to SRI on the next Thursday for their final interview. They returned the computer and were asked to tell the interviewer how many cigarettes they smoked on the preceding day, using the procedures appropriate for their assigned treatment group. Before being asked to estimate the number of cigarettes they smoked, respondents in the three imposed-strategy conditions were told that we wanted them to use a particular method for estimating their smoking frequency. The method was described and examples of its application were given. The respondent practiced applying the method to two other behavior categories (for example, frequency of getting into

[1]The first 24 respondents participating in the study were offered $25, with a potential bonus of $5 for good compliance. After several respondents dropped out of the study because they found the smoking procedure too onerous, given the level of remuneration, we increased the fee by $20.

[2]Respondents were instructed to log all their cigarettes from the time they left the first interview until they returned for their second interview 6 days later. However, only data for full days (starting the day after the initial interview) were used in the analyses.

one's car on a typical day) before using it to estimate the number of cigarettes smoked on the previous day.

Respondents in the free-strategy condition received neither instructions concerning any method for answering the frequency question nor practice items. Instead, they were asked some filler demographic questions taken from NHIS before being given the smoking frequency question. Estimation strategies were not mentioned until after this question was answered. During this part of the free-strategy condition interview, the interviewer maintained a questioning pace comparable to that used by NHIS interviewers. Interviewers gave respondents as much time as they needed to answer, but they read the questions rapidly, thus implying that the interview should be completed expeditiously.

After the first smoking frequency question was answered, respondents in all conditions were asked to describe how they arrived at their answer. They were then shown a checklist of possible frequency estimation strategies—including additive decomposition, availability, and exhaustive episodic recall—and were asked to choose the strategy that best matched what they did. These strategy-response options were:

- Think of each individual event for the entire day and add up the total number.
- Divide the day up into parts (such as during work and after work); rely on knowledge about how often I usually smoke during each part; and then add up the total number.
- Give the first number that comes to mind, a gut reaction or guess.
- Rely on knowledge about my usual daily total for smoking.
- Make an inference from a fact I remember (for example, opening a new pack).
- A combination of the above. (Specify which ones and how they were combined.)
- None of the above. (Describe how you did arrive at a number.)

After the respondents provided their frequency estimates for cigarette smoking and reported the strategy they used, they were given a confidence estimate for their frequency response. They indicated, on a 5-point scale, how confident they were that their frequency estimate was accurate. Respondents were then asked to use the same strategy to provide smoking frequency estimates for the preceding Monday and Saturday.

In the next portion of the interview, a saliva sample was taken for later analysis of cotinine content. This was followed by the debriefing, in which the interviewer asked respondents whether there were any occasions when they smoked a cigarette but did not log it into the computer or record it on the error card. The interviewer also asked about any difficulties the respondent had in using the computer. Finally, respondents were asked whether they had expected to be required to recall the number of cigarettes smoked on specific days. The experimenter protocols for the four strategy conditions are contained in appendix III.

Results

Smoking levels

For each full day of logging cigarettes onto the hand-held computer (that is, Saturday, Sunday, Monday, Tuesday, and Wednesday), the number of cigarettes logged was recorded (as corrected by notations on the error card or specific omissions reported during the debriefing interview).[3] The mean of these five totals was taken as an indicator of the respondent's overall smoking level. During the 5 full days when their smoking was logged, the mean smoking level across all subjects was 20.25 cigarettes per day, and the median was 19.40 cigarettes per day. The lightest smoker averaged 2.25 cigarettes per day, and the heaviest smoker averaged 54 cigarettes per day during the assessment period. This mean varied little by experimental condition, ranging from a low of 19.91 in the availability condition to a high of 21.07 in the episodic condition.

The number of cigarettes smoked appeared fairly stable over the assessment period. The mean for Saturday smoking was 20.54 compared with 20.21 for Monday and 19.73 for Wednesday. For individual respondents, the correlation between the number of cigarettes smoked on Monday and those smoked on Wednesday was quite high ($r = 0.82$), whereas correlations with Saturday smoking were somewhat lower (0.77 for Saturday with Monday and 0.75 for Saturday with Wednesday) and consistent with self-report data that weekend smoking patterns are different from those on weekdays.

Estimation strategy condition

For each respondent, we computed the size of the deviation between the number of cigarettes recalled for each target day and the recorded number of cigarettes for that day (the computer record as amended by any notations on the error card or needed adjustments cited in the debriefing). Few significant differences between estimation strategy conditions were found.

Absolute error—Table A shows the mean absolute difference between the number of cigarettes reported during the interview and the number on the behavioral record for each of the 3 target days by condition. The mean difference between reported and logged smoking frequency increases with retention interval. The average absolute deviation is 4.10 cigarettes for the previous day's smoking (Wednesday), 5.02 for 3 days prior (Monday),

[3]The number of corrections on the error card was fairly small, averaging 0.50 cigarettes per respondent per day. Similarly, during the debriefing, respondents reported that they failed to record an average of less than 0.40 cigarettes over the entire assessment period.

Table A. Mean absolute difference between reported and logged smoking frequency, by strategy condition and recall interval

[Number of observations appears in parentheses]

Strategy condition	Recall interval: Yesterday (Wednesday)	3 days prior (Monday)	5 days prior (Saturday)
Total	4.10 (118)	5.02 (121)	5.80 (118)
Free	4.38 (29)	5.50 (30)	7.00 (28)
Availability	4.13 (31)	6.13 (31)	6.63 (30)
Additive decomposition	4.18 (28)	3.90 (29)	4.76 (29)
Episodic	3.73 (30)	4.48 (31)	4.87 (31)

and 5.80 for 5 days prior (Saturday). Taking the free-strategy condition as an estimate of the accuracy to be expected from frequency reports obtained in national surveys, we found absolute deviations of 4.38 for the previous day's smoking, 5.50 for 3 days prior, and 7.00 for 5 days prior.

Because the difficulty of the reporting task varies, depending upon the number of cigarettes a person smokes, we created a proportional measure of report accuracy—the absolute value of the deviation of the report divided by the subject's daily average. This measure of report accuracy is shown for each condition and retention interval in table B. The pattern of means suggests that accuracy declines as retention interval increases and that imposed strategies, particularly the episodic approach, tend to produce more accurate reports.

The largest discrepancy between interview report and recorded Wednesday smoking was found for the free-strategy group (0.26 cigarettes) and the smallest for the episodic group (0.18), but none of the differences between imposed strategies and the free-strategy condition was statistically significant. In reporting Monday smoking, the free-strategy and availability groups had larger deviations (0.32 and 0.33, respectively) than did the additive decomposition or episodic groups (0.21 and 0.24, respectively). Similarly, recall for Saturday's smoking was off by an average of 0.37 in the free-strategy condition compared with a mean deviation of 0.26 for the episodic group.

Table B. Mean absolute deviation as a proportion of smoking frequency, by condition and recall interval

[Number of observations appears in parentheses]

Strategy condition	Recall interval: Yesterday (Wednesday)	3 days prior (Monday)	5 days prior (Saturday)
Free	0.26 (30)	0.32 (30)	0.37 (28)
Availability	0.20 (31)	0.33 (31)	0.33 (30)
Additive decomposition	0.20 (31)	0.21 (30)	0.34 (30)
Episodic	0.18 (30)	0.24 (31)	0.26 (31)

Table C. Mean absolute difference between reported and logged smoking frequency by subject confidence level and recall interval

[Number of observations appears in parentheses]

Confidence level	Recall interval: Yesterday	3 days prior	5 days prior
1 = off by more than 10	10.00 (2)	14.00 (3)	16.33 (3)
2 = off by no more than 10	6.11 (19)	6.05 (21)	5.50 (22)
3 = off by 4 or 5	4.33 (46)	6.41 (37)	6.58 (43)
4 = off by 2 or 3	3.08 (40)	3.04 (47)	4.73 (41)
5 = off by no more than 1	2.00 (10)	4.33 (12)	3.75 (8)

Despite the appearance of the means, none of the differences was statistically significant.

Confidence levels

After providing their estimate of how many cigarettes they smoked on a given day, respondents were asked to rate their confidence in the accuracy of their estimate on a 5-point scale:

- 1 = off by more than 10 cigarettes
- 2 = off by no more than 10 cigarettes
- 3 = off by 4 or 5 cigarettes
- 4 = off by 2 or 3 cigarettes
- 5 = off by no more than 1 cigarette

Table C shows the relationship between these confidence estimates and accuracy of frequency reports. The data suggest that those with higher confidence in their estimates are in fact more accurate, $F(4,116)=3.94$, $p<0.01$ for Wednesday, $F(4,116)=5.39$, $p<0.01$ for Monday, and $F(4,116)=3.94$, $p<0.01$ for Saturday, but the relationship is not so strong to suggest that confidence estimates could be used to generate corrections or weights for frequency estimates. The correlation between confidence level and the absolute difference between reported and recorded smoking was –0.33 for Wednesday smoking, –0.30 for Monday, and –0.21 for Saturday smoking.

Table D shows the confidence data by treatment condition. The confidence scores are very similar across the four strategy conditions, suggesting that respondents' sense of their estimation accuracy was not affected by the method by which they had derived the estimate. Contrary to intuition, the day for which respondents were providing confidence estimates also had little effect. Respondents tended to evaluate their degree of error as either 2 to 3 or 4 to 5 cigarettes, regardless of whether they were providing an estimate for the previous day or 5 days ago. (Results might, of course, have been different if the day for which they provided the estimates had been a between-respondents rather than a within-respondents variable.)

Table D. Mean confidence level by strategy condition and recall interval

[Number of observations appears in parentheses]

Strategy condition	Recall interval: Yesterday (Wednesday)	3 days prior (Monday)	5 days prior (Saturday)
Free	3.10 (31)	3.47 (30)	3.37 (30)
Availability	3.26 (31)	3.19 (31)	3.29 (31)
Additive decomposition	3.29 (31)	3.54 (28)	3.11 (28)
Episodic	3.53 (32)	3.31 (32)	3.25 (32)

Confidence level key:
1 = off by more than 10 cigarettes
2 = off by no more than 10 cigarettes
3 = off by 4 or 5 cigarettes
4 = off by 2 or 3 cigarettes
5 = off by no more than 1 cigarette

Smoking level

Based on their mean daily smoking frequency across the 5 full days for which they logged cigarettes, respondents were divided into two smoking levels. Lighter smokers were defined as those with a mean daily cigarette consumption below the median of 19.40 cigarettes. Heavier smokers were defined as those with a smoking level above the median. An analysis of variance was run on each of the estimation accuracy variables (Wednesday, Monday, and Saturday deviation scores), with smoking level and condition as independent variables. For all 3 target days, a significant effect of smoking level was obtained, $F(1,120) = 5.57$ for Monday, $F(1,121) = 7.45$ for Wednesday, and $F(1,117) = 12.84$ for Saturday. Table E shows the mean absolute deviation scores for the two smoking level groups for each of the target days. As expected, lighter smokers' estimates were off by fewer cigarettes than were heavier smokers' estimates. For reports of the previous day's smoking, light smokers erred by a mean of 2.95 cigarettes compared with 5.26 for heavy smokers. For Saturday smoking the differences were 4.14 and 7.27, respectively. Neither the main effect for strategy condition nor the interaction between condition and smoking level attained significance for any of the 3 target days.

Table E. Mean absolute difference between reported and logged smoking frequency by smoking level and recall interval

[Number of observations appears in parentheses]

Smoking level	Recall interval: Yesterday	3 days prior	5 days prior
Light smokers: Less than 19.4 cigarettes per day	2.95 (60)	3.73 (59)	4.14 (57)
Heavy smokers: More than 19.4 cigarettes per day	5.26[1] (62)	6.19[1] (63)	7.27[1] (62)

[1]Differs from light smokers at $p < 0.01$.

Cotinine

Saliva samples were submitted to the University of Minnesota, Division of Epidemiology, for cotinine assay. Levels ranged from 12 nicotine grams per milliliter (ng/mL) to 768 ng/mL, with a mean of 297.5 ng/mL and a standard deviation of 141.1 ng/mL.

Correlations were computed between respondents' cotinine levels and a number of the measures of smoking frequency. Correlations are very similar, whether cotinine is correlated with reported or logged smoking. Correlations with measures of the previous day's smoking were 0.31 for cigarettes logged onto the computer (as corrected by the error card) and 0.30 for self-reported smoking. The correlation between cotinine level and average daily number of cigarettes recorded during the 5-day assessment period was 0.29. Because cotinine has a half-life of 17 hours, a correlation was also computed between cotinine level and the number of cigarettes recorded in the 17 hours preceding the interview. This correlation (0.44) compares favorably with reported correlations between cotinine and self-reported smoking in the literature, which range from 0.24 to 0.43 (7,11–14). Figure 2 shows the cotinine level plotted against the mean smoking level during the assessment period.

Although cotinine is related to smoking frequency, the relationship does not appear strong enough to make cotinine a good index of an individual smoker's frequency of cigarette consumption. The data in figure 2 suggest that a good relationship exists between cotinine and smoking level for light smokers (fewer than 17 cigarettes in the previous 17 hours) and also for heavier smokers (more than 24 cigarettes in the last 17 hours), but little relationship exists among those with in-between rates of smoking (17–24 cigarettes in the 17 hours preceding the saliva test). This pattern was confirmed in a trend analysis that identified a significant cubic component in the cotinine data.[4]

We compared the cotinine levels for respondents classified as lighter and heavier smokers on the basis of their logged smoking over the 5 days during which cigarettes were recorded. An average level of 325 ng/mL was obtained for smokers with smoking rates above the median compared with 266 for those smoking below the median rate, $t(118) = -2.32$, $p < 0.05$. When respondents are classified as above or below the median on both logged smoking and cotinine level, the two classifications match

[4]Inspection of the scatter plot in figure 2 suggested the possibility that the significant cubic fit could have resulted from the influence of one observation—a cotinine value of 768 ng/mL. Review of this value in relation to other values for cotinine in this sample indicated that, although it was a large value, it was not an outlier, as measured by the criterion of Tukey (39). Nevertheless, we repeated the analysis reported above after excluding this observation. Results of this second trend analysis confirmed the earlier conclusion: The addition of the cubic component resulted in a significant improvement in the fit to the data.

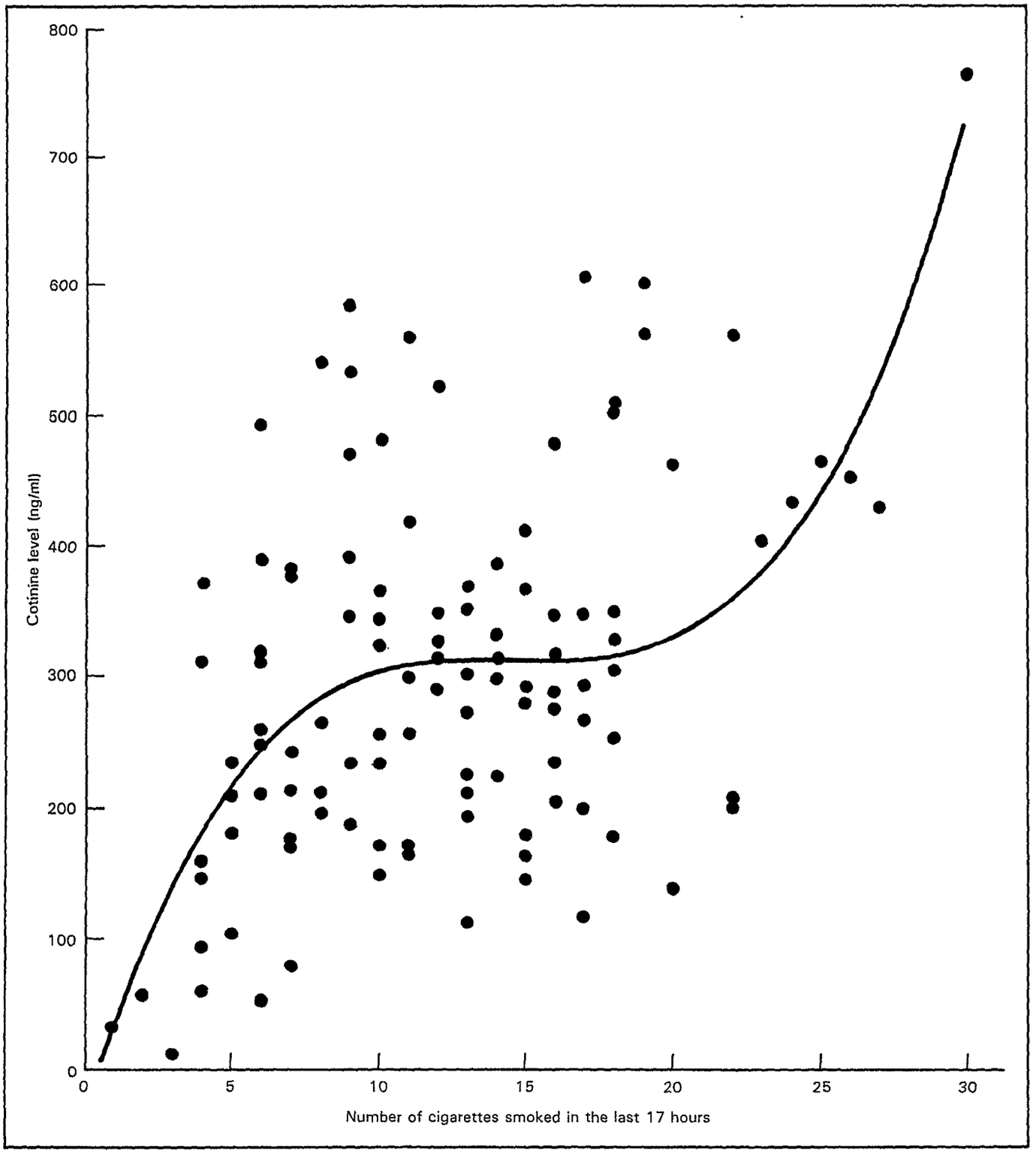


Figure 2. Cotinine and record of amount smoked during the 17 hours prior to saliva sample

for 60 percent of the 120 respondents for whom both measures were available, $\chi^2 = 4.81$, $p < 0.05$.[5]

Strategies used in free condition

One of our interests in conducting this study was to ascertain the strategies that unconstrained respondents use to answer questions about smoking frequency. Each respondent was asked to describe the strategy used to estimate the number of cigarettes smoked the previous day and then to select the best description of it from the strategy response options previously listed. Table F shows the distribution of responses for free-strategy respondents.

These respondents (41 percent) were most likely to report using a combination of strategies. By far, the most popular combination of strategies involved "making an inference from a fact I remembered" and "using knowledge about my usual daily total." The first of these was also the most frequently reported single strategy. Inferences tended to be of the sort "I was sick and I always smoke very little when I'm ill" or "I went drinking, so I probably smoked more than usual." Only two respondents (7 percent) reported answering the question with an episodic strategy, suggesting that in normal survey interviews respondents answer smoking frequency questions primarily through semantic memory and inferential processes rather than by recalling individual events. There are two different types of additive decomposition strategies. Both strategies involve breaking the reference period into segments, but one then entails using knowledge about typical frequency within a segment, whereas the other requires trying to recall all incidents within each segment (using episodic memory). Respondents were trained on the first of these in our additive decomposition condition, but some respondents in the free-strategy group reported using the latter approach.

[5]Cotinine results were not available for five respondents. Four saliva samples were inadequate for analysis, and the interviewer failed to take a saliva sample from one respondent.

Table F. Response distribution of estimation strategies reported by free-strategy respondents

Strategy	*Frequency*	*Percent*
Think of each individual event	2	7
Divide day up into parts and think of each event within each part	0	0
Divide day up into parts and use knowledge about usual smoking for each part	3	10
First number that came to mind	2	7
Using knowledge about my usual daily total	3	10
Making an inference from a fact I remembered	7	24
Combination of strategies	[a]12	41

[a]Frequency of specific combination strategies:

2+4:1	1,5,6:1
2+6:1	2,4,5:1
4+5:1	3,4,5,6:1
5+6:6	

Compliance measures

Respondents reported very high compliance with the experimental procedures for logging cigarettes. The mean number of cigarettes respondents said they smoked without entering them in the computer or on the error card was just 0.36 over the entire assessment period. Although error cards appeared to be useful adjuncts, respondents appeared to have no trouble entering most of their cigarettes accurately on the computer. On the average, respondents made a mean of 2.4 entries onto their error cards over the 5 days the data were analyzed.

Another measure of respondent compliance was their rate of responding to the computer prompts. On the average, they responded to 73 percent of their prompts. Even in cases of missed prompts, most respondents reported that they used the computer consistently when logging cigarettes but had trouble hearing the prompt signals when the computer was in a case or handbag, when they were in a noisy environment, or when they walked into another room. Only two respondents were judged, on the basis of missed prompts and erratic recording of cigarettes, as having failed to comply with experimental procedures. (These respondents are not included in any of the analyses of reporting accuracy.)

In addition, several respondents were excluded from specific analyses for noncompliance or deviation from standard procedures. These decisions were based on the electronic diary records, notes on the error cards, or statements by respondents during the procedural debriefing section of the second interview. Respondents were excluded from a specific day's analyses for leaving the electronic diary where they did not have continuous access, for being too busy, or just forgetting to record cigarettes for an extended period on a certain day. On the first day (Saturday), four respondents had such erratic schedules that they did not begin to comply with the procedure consistently until the second day. These respondents were eliminated from the analyses of the first day but were included in analyses of report accuracy for Monday and Wednesday. Two respondents stated that they got tired of entering cigarettes and stopped entering every cigarette on the last day. In total, eight respondents were excluded from 1 day and two were excluded from 2 days for noncompliance with the data collection procedure. Comparisons of reported usage of the electronic diary with the computer record and inspection of smoking patterns across days suggested that respondents whose compliance was somewhat erratic were quite candid in reporting their omissions during the debriefing.

It was more difficult for many respondents to comply with the instructions for estimation strategy. Instructions to episodically recall every instance of smoking a cigarette were particularly hard to follow, especially for more remote target days and for heavy smokers. A review of the interview protocols suggested that of respondents in the episodic-strategy group, 19 (59 percent) really used episodic recall, 12 (38 percent) used episodic recall for some

but not all smoking instances during the day, and despite repeated instructions from the interviewer, 1 (3 percent) did not use episodic recall at all.

Compliance with the other instructions for estimation strategy was much higher. None of the additive decomposition respondents was judged as not complying with the strategy instructions in reporting the previous day's or Monday's smoking, and six (18 percent) had some trouble executing the strategy for Saturday (a day with less structure for many people). None of the availability respondents was judged as failing to give a response based on availability (a gut reaction).

Reactivity

Most respondents (79 percent) reported they had not changed the number of cigarettes they were smoking while in the study. Of those who reported changes, 15 said their smoking increased somewhat and 12 said it decreased. Among respondents who reported a change in daily smoking, the mean reported change was 3.11 cigarettes a day.

When asked whether they had expected to be questioned about how many cigarettes they had smoked on a particular day during the time they were logging cigarettes onto the computer, 93 percent of the respondents reported they had not expected recall questions. Three respondents reported they tried to keep track of how many cigarettes they were smoking, two kept track mentally, and one made notes on the error card.

Discussion

In this study, the self-reports of respondents in the free-strategy condition and their rapid response rate suggest that they were not using effortful episodic memory strategies to answer questions about how many cigarettes they had smoked on specific days. On the other hand, their self-reports indicated that they were not simply giving "gut reaction" frequency estimates based on availability, as seen in studies conducted by Tversky and Kahneman (35). Rather, they appeared to be using information about their general smoking habits (for example, "I usually smoke a bit less than a pack a day"), often in combination with an easily recalled fact about a specific incident ("I was sick that day"). These findings are similar to those reported by Menon and Sudman (38). Unlike the artificial laboratory tasks in which availability heuristics have been demonstrated (for example, "How many words begin with the letter R?"), our frequency estimation task involved personal habits about which respondents are likely to have information stored in memory.

For questions about typical smoking levels, this reliance on general self-knowledge would be quite appropriate. For questions about smoking on specific days, however, we had expected a more detailed, effortful analysis of the day (that is, either episodic recall or an additive decomposition procedure) to lead to more accurate responses. Although the group means suggest an advantage for episodic and additive decomposition strategies, at least for longer retention intervals, none of the imposed-strategy conditions was statistically superior to the free-strategy condition. At the same time, our results failed to confirm the poorer performance for episodic recall that would be expected on the basis of the Bruce and Read (36) study in which respondents gave poorer frequency estimates for words on a list after trying to recall the words.

A second of our imposed strategies—additive decomposition—appeared easier than the episodic strategy for respondents to execute (although still more time consuming than the strategies respondents selected when unconstrained) and produced significant increments in estimation accuracy when used by lighter smokers (those smoking less than 19.4 cigarettes on an average day). This strategy has promise for studies in which researchers are concerned with accurate self-reports of smoking frequency for individuals. When population estimates are the main concern, no advantage accrues to the more elaborate questioning technique in terms of the resulting group estimate.

Although a perfect measure of smoking frequency is probably unattainable, we have confidence that the corrected computer logs, as used in this study, offer the best index available to date. Respondents reported that they were able to consistently comply with the logging requirements, and the corrected log data related sensibly to other measures of smoking frequency. In particular, the correlation between cigarettes logged over the previous 17 hours and measured saliva cotinine was higher than that typically found between cotinine and self-reports of smoking frequency. In an earlier study using similar logging procedures with hand-held computers, Shiffman (40) found an even higher correlation between cotinine level and logged smoking during the last 17 hours (0.55). The cigarette logging procedures used here thus provide a good standard against which to judge the accuracy of respondent memory for smoking and a practical methodology for studies of smoking behavior.

The final issue is whether recording their cigarettes on the computer made subjects more aware of each cigarette they smoked, with subsequent benefits for their ability to accurately recall smoking levels. In the absence of data on the degree of accuracy in smoking frequency reports of people who have not maintained any record of their smoking, we cannot rule out this possibility. However, several aspects of the data suggest that any such effect is not large in magnitude. First, to the extent that logging cigarettes makes instances of smoking more memorable, we would expect the effect to be stronger in the initial days of study participation rather than in the later days. (Subject reports suggest that logging cigarettes became very automatic over the course of the 5 days of study participation.) We can see from the relative accuracy of reports over different time lags (table A), however, that there is not an initial effect of the cigarette logging procedure that

is strong enough to counteract the effect of time (report accuracy being better for 1-day recall than for 3-day recall, which is better than that for 5-day recall).

Second, we can compare the report accuracy of subjects who recorded their smoking on computers to subjects in our pilot study who deposited all of their cigarette stubs in canisters. The pilot subjects' reports for the previous day's smoking were in error by an average of 3.44 cigarettes compared with 4.10 for the subjects using computers in the present study. Thus, although any kind of record maintenance or study participation may make subjects more conscious of smoking, the computer-logging procedure does not appear to improve report accuracy any more than do other methods for maintaining behavioral records.

Study 2: Social desirability and reports of smoking

In view of findings in the literature on reports of socially undesirable behaviors (41), we would expect underreporting of smoking to become increasingly frequent as smoking becomes socially less acceptable. Recent restrictions on smoking in the workplace and on domestic flights and a California ballot proposition to levy a very large cigarette tax to make smokers "pay for their smoking-induced requirement for health care" are signs of the social trend toward adverse opinions of smoking. Given these trends, we can expect social desirability effects and the consequent underreporting of smoking to increase.

As discussed in the review section of this report, there are two types of underreporting of smoking. First, there are underreports of smoking status—the case in which a person who smokes asserts that he or she is a nonsmoker. Second, there is underreporting of smoking frequency—the case in which a smoker admits to smoking but underreports the number of cigarettes consumed. Biochemical verification has been used to detect the first type of underreporting but has not yet been calibrated to a degree where it has demonstrated utility for detecting and correcting the second type of underreporting.

Bradburn, Sudman, and Associates (41) assert that responses to sensitive questions are generated in two stages:

> First, the respondents decide whether or not to report that they have engaged in the type of behavior being asked about. This decision is influenced by the facts of the situation . . . and about their own feelings about whether they want to tell the interviewer about it. If the decision is negative—either because they have not in fact done anything or do not remember doing it, or because they do not want to talk about it—the series of questions is terminated. If the decision is positive, the form of the question does play a very important role in influencing how much behavior is reported. (p. 168)

Figure 3 provides an illustration of this model of the response-generation process as well as the various sources of response error at different stages within it. Respondents may fail to report a negatively valenced behavior that they have in fact engaged in, either because they do not remember committing the act or because they do not want to reveal this fact to the interviewer. The latter phenomenon, which we term a *social-acceptability effect*, is a function of the perceived risk of revealing the behavior. In some instances, this may involve perceived risk of actual negative consequences (for example, fear that information given to a census taker will be turned over to the IRS or immigration services). In most instances, however, the risk involves a feared loss of prestige or acceptability in the eyes of the interviewer. According to the model of Bradburn and Sudman, this kind of effect would lead to underreports of smoking status.

For respondents who admit to having engaged in negative behavior, a second kind of *social-desirability effect* may exert itself as the individual formulates an estimate of the frequency with which the act has been committed. At this stage, the respondent may be influenced by the wording of the question and the *response norm* that the wording implies.

Study 2 examined the effects of two approaches to manipulating social desirability. The first manipulation was an attempt to load the wording of the smoking questions such that smoking seems like a common and understandable act. This "response-norm" condition is an example of a technique commonly used in survey research (42). We predicted that this manipulation would have no effect on the decision to admit being a smoker, but that among admitted smokers, it would affect the smoking frequencies reported.

The second technique sought to put the smoking questions in a context that would lessen the respondent's felt need to present something positive or to avoid presenting negative information to the interviewer. In this "social-acceptability" condition, the respondent was first given the opportunity to tell the interviewer about his or her positive health practices before being asked about smoking. This manipulation was inspired by a study by Crespi and Swinehart (43) in which overreporting of a socially positive behavior (figure 3) for a 2-month interval was reduced if respondents were first asked about the behavior over a 6-month interval (presumably increasing the probability that they would have just told the interviewer something positive about themselves).

Design

Issues and hypotheses

Adopting the Bradburn and Sudman (41) two-stage model of response generation, we predicted that our

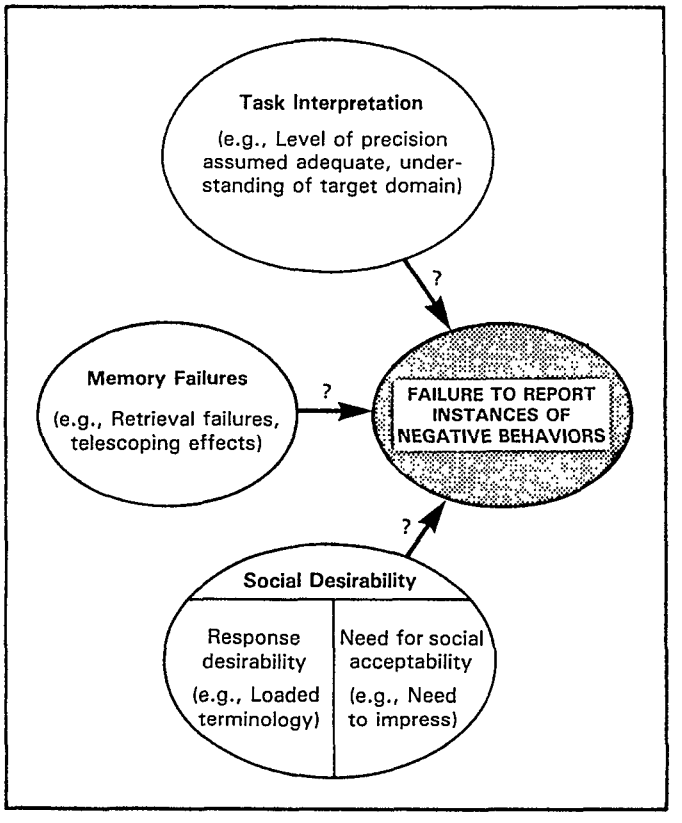


Figure 3. Potential causes for underreporting of behaviors

social-acceptability manipulation would affect reports of smoking status because respondents who have established themselves in a positive light should, if they do in fact smoke, feel less pressure to present themselves as nonsmokers. Once smokers have identified themselves as such to the interviewer, the frequency of smoking they report should be influenced by manipulations of question wording such as that used in our response-desirability condition.

Experimental design

Respondents were asked about their smoking status and frequency within one of three different interview conditions. In the first condition (response norm), the question about smoking status was preceded by a preamble implying that smoking is just one of many behaviors people engage in to reduce stress. This preamble was designed to provide an "excuse" for smoking and to present it as well within the social norm.

In the second condition (social acceptability), we attempted to manipulate the respondent's sense of social acceptability by providing an opportunity for telling the interviewer about positive health habits before being asked about smoking. The third (neutral) condition was designed to be representative of a standard smoking survey. The only questions preceding those on smoking concerned demographic information.

Thus there were three conditions in a simple between-respondents design with random assignment of respondents to interview groups.

Method

Respondents

Respondents were recruited from a variety of locations in the San Francisco Bay mid-Peninsula area. Criteria used in selecting locations were the proportion of smokers among individuals there, and the likelihood that people would have 15 minutes to spend completing our interview. Locations included restaurants, bowling alleys, public transportation waiting areas, shopping malls, and a racetrack. A total of 168 respondents participated, including 100 men and 68 women, ranging in age from 15 to 73 years, with a mean age of 40.9 years. Insofar as possible, administration of the three treatment conditions was balanced at each site visit.

Procedures

Respondents were individually interviewed at the types of locations described. The study was described as an investigation funded by NCHS as part of its mission to maintain information on people's health-related habits. Respondents were offered $10 for their participation.[1]

In the *neutral* condition, a set of initial demographic questions was followed immediately by asking the respondent whether he or she smoked. Those who said they were smokers were asked how many cigarettes they smoked on a typical day.

In the *response-norm* condition, a brief set of opening demographic questions was followed by the preamble, "When we interview people about their health habits, we find that many people's habits are shaped by stress. When they encounter tension on the job or at home, they respond by taking a drink, smoking a cigarette, or eating something fattening. Do you find that there are times when stress triggers such behaviors for you?" They were then asked directly whether they smoke.

In the *social-acceptability* condition, the demographic items were followed by giving respondents a lengthy list of health habits and asking them to pick two or three things that they do as much or more than most people. Followup questions were asked for whichever items the respondent picked. After talking about their good health practices, these respondents were then asked whether they smoke and, if so, how much.

The remainder of the interview for all respondents included questions about the prevalence of smokers in their family, among their friends, and at work; and for smokers, about what they do in a public setting with no posted rules about smoking. At the conclusion of the

[1]Initially, respondents were not offered a participation fee. After finding that a high proportion of those approached declined to participate, we first began offering State lottery tickets worth $1 and subsequently offered a $10-participation fee. Overall, 82 respondents participated for lottery tickets, 1 respondent declined payment, and 85 participated for $10.

Table G. Number and percent of reported smoking status and mean frequency among self-reported smokers, by interview condition

Interview condition	Smoking status: Nonsmoker, Number	Nonsmoker, Percent	Smoker, Number	Smoker, Percent	Mean frequency among self-reported smokers
Neutral	35	65	19	35	15.37
Response norm	34	61	22	39	13.82
Social acceptability	35	61	22	39	17.82

NOTE: One subject refused to answer the smoking status question.

interview, all respondents were asked to provide a saliva sample for cotinine testing. They were told that we wanted to compare cotinine levels for those who smoke with the levels for those who do not smoke.

Experimental protocols for this study appear as appendix IV.

Results

This experiment failed to find significant effects for the experimental interview conditions.

Smoking status

Among the 168 respondents interviewed, 63 (38 percent) said that they were smokers. This percent varied little by interview condition (table G). Compared with the neutral-interview group, in which 35 percent of the respondents said they were smokers, the two manipulations of response desirability had only small effects, with 39 percent of those in both the response-norm and social-acceptability groups saying they were smokers. None of these differences was statistically significant.

Smoking frequency

Among the 63 respondents who said they were smokers, the mean reported frequency for smoking on the previous day was 15.68 cigarettes. This number also did not vary significantly by condition. The mean reported frequency was 15.37 in the neutral condition, 13.82 in the response-norm condition, and 17.82 in the social-acceptability condition (table G). Thus the Bradburn and Sudman (41) model, which would predict a higher reported frequency in the response-norm group in which question wording was manipulated, did not receive support.

Saliva cotinine

Among the 168 respondents, 18 (11 percent) refused to give a saliva sample for cotinine analysis. Although there are many plausible reasons for refusal, one possibility is that those who were dissembling their smoking status (falsely claiming to be nonsmokers) might be more inclined than others to refuse to provide the sample. For this reason, we compared the refusal rate across conditions and found very small differences. The refusal rate was 9.26 percent in the neutral condition, 12.50 percent in the response-norm condition, and 10.53 in the social-acceptability condition. The groups did not differ significantly from each other.

The distribution of cotinine values for those who said they were smokers and for those who said they were nonsmokers is shown in figure 4. An inspection of the distribution suggests that a cutoff value of 40 ng/mL will yield a classification with the fewest biochemically based categorizations disagreeing with self-reports. Given this cutoff, three individuals who said they were nonsmokers showed cotinine values expected of smokers. Among these, one was in the neutral-interview condition and two were in the social-acceptability condition.

Smokers versus nonsmokers

Interview questions concerning the smoking habits of the respondents' families, friends, and coworkers were analyzed to determine whether smokers and nonsmokers experience different environments with respect to the prevalence and acceptability of cigarette smoking.

As shown in table H, this is indeed the case. Smokers report a greater proportion of smokers among the people they live with ($\chi^2 = 19.24$, $p < 0.01$), work with ($\chi^2 = 7.52$, $p \leq 0.06$), and see as friends ($\chi^2 = 18.22$, $p < 0.01$).

Discussion

Although it is fairly well accepted that cigarette smoking has become an activity with strong social connotations, the manipulations of the context within which the smoking status and frequency questions were asked in this study had no significant effects. We might interpret this finding as an indication that the manipulations were simply not strong enough, supposing that more extensive differences in wording or interviewer behaviors would have elicited more variability across conditions. Another possible explanation for the null result, however, would implicate the particular sample that was used.

To obtain a high proportion of smokers, we intentionally solicited respondents in locations where a large proportion of people smoke. In so doing, we may have inadvertently selected environments in which the usual social pressures against smoking are minimal or nonexistent. In this case there would be little underreporting linked to social-desirability effects for either of the experimental conditions to mitigate. The difference between

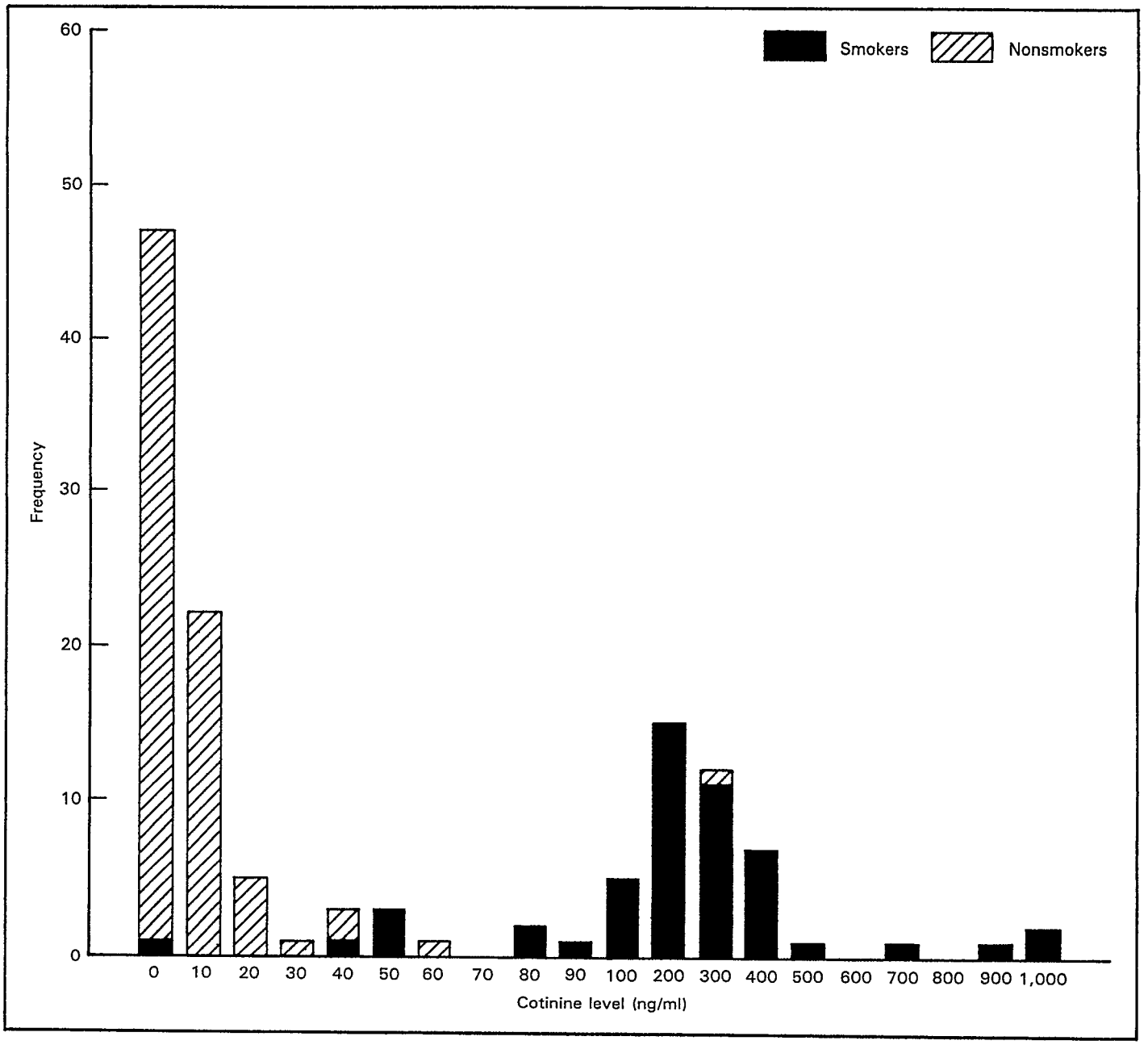


Figure 4. Cotinine level for smokers and nonsmokers

smokers and nonsmokers in the reported proportion of other smokers among the people they interact with suggests that although society in general is becoming more negative about smoking, there is a wide range in the perceived social acceptability of this habit, with smokers tending to congregate together or at least perceiving a higher percent of smokers among those around them. The manipulations used in this study could be better tested if included in a large survey that would provide adequate numbers of smokers for testing the social-desirability hypotheses without resorting to strategies for oversampling smokers.

Table H. Number and percent of reported smoking status, by social environment

Social environment	Smokers		Nonsmokers	
	Number	Percent	Number	Percent
Number of other smokers in household				
0 smokers	31	49	82	79
1 smokers	25	40	17	16
2 smokers	7	11	3	3
3 smokers	0	0	1	1
4 smokers	0	0	1	1
Proportion of coworkers who smoke				
None	7	14	8	12
Few	23	45	46	68
Half	12	24	6	9
Most	9	18	8	12
All	0	0	0	0
Proportion of friends who smoke				
None	5	8	20	19
Few	26	41	59	57
Half	12	19	15	14
Most	18	29	7	7
All	2	3	3	3

Study 3: Long-term recall of smoking activity

Accurate reporting of smoking behavior over a period of time is important for understanding the varying patterns of smoking engaged in by one individual historically, differences in smoking patterns across individuals, the effect of smoking cessation efforts on smoking patterns, and the resultant effect of these patterns on illnesses such as lung cancer and heart disease (44). Smoking research performed by SRI and others (2,45,46) indicates that lifetime tobacco use is often characterized by numerous fluctuations in the amount smoked, alterations in brand of cigarettes, and other changes in smoking habits. Moreover, the past 2 decades have seen increasing frequency of serious attempts to quit smoking, roughly half of which are sustained for a year or more (47).

Much or all of the data used in epidemiologic investigations of smoking prevalence have consisted of self-reports gathered through face-to-face or telephone interviews or through self-administered questionnaires. The use of biochemical tests to try to measure all of the changes in individual smoking patterns that occur over an extended period of time is simply infeasible. Moreover, biochemical tests cannot capture the relationships among life events that may well be the key to understanding changes in smoking behavior. Given the reliance of smoking research on self-report, the accuracy of information recalled and provided is, and will continue to be, a major concern.

In the interests of testing dose-response hypotheses concerning lifetime smoking, surveys often ask respondents to indicate when they first started smoking, when, if ever, they finally stopped smoking, and what intervening periods of abstinence occurred. The NHIS, for example, asks smokers to report all serious attempts to stop smoking during the past year, including the dates and duration of each. The National Heart, Lung, and Blood Institute (NHLBI) Survey of Past Smoking Behavior asked respondents to report all extended periods of smoking cessation, by month, over a 10-year period. Such questions make severe demands on people's ability to recall dates for past events. Survey research incorporating validation of subject reports has found that even events as serious as hospitalizations are frequently underreported after as little as 1 year has passed; for example, 16 percent of hospitalizations 41–50 weeks ago and 42 percent of hospitalizations 51–53 weeks ago were not reported in a study by Cannell, Miller, and Oksenberg (22). Thus the accuracy of self-reports of periods of smoking and smoking cessation over extended time periods must be suspect.

Given that surveys are going to include such difficult memory tasks, the typical survey interview does not appear to be structured in a way that is most conducive to recall. It is well established that a person's ability to retrieve an event from long-term memory is heavily dependent on the cues available at the time of attempted recall: The greater the similarity between cues present when the person tries to recall an event and the cues present when the event was encoded, the more likely the subject is to be successful in retrieving the event from long-term memory (25). Necessarily, survey interviews are generally administered at a time and place quite unlike those surrounding the target events. Additional impediments to retrieval of past events are raised by the standard survey's stricture against "irrelevant" discussion of the topic of the survey item. This prohibition discourages the respondent from reconstructing the context in which the event occurred—an activity that is important for generating useful retrieval cues.

In addition, the order in which surveys pose questions about a topic is often less than optimal for stimulating event retrieval. In a study of memory for use of health facilities during the past year, Means, Nigam, Zarrow, et al. (32) found that the reason motivating a visit was the best remembered aspect of it. Subject protocols suggested that the preferred method of recalling events was in terms of a narrative structure, with an identifiable problem, actions, and a resolution. Whereas the problem or reason for an event appears to be a good recall cue; the time when it occurred is a poor one.

In a study of longer-term autobiographical memory, Wagenaar (48) found that information about when an event occurred was the poorest cue for retrieving other information about it. Over a period of 6 years, Wagenaar recorded two personal events each day in terms of four cues—*who, what, when*, and *where*. Later he administered recall tests to himself to investigate the effectiveness of the various cue types. Generally he found that *when* was the least effective of the four as an initial recall cue. The potency of the other cues seemed to be a function of their uniqueness within the corpus of events to be remembered. The cue *what* was best, followed by *where* and *who*. Wagenaar interprets his data in terms of a file cabinet metaphor, with the cue *when* acting somewhat differently

from other types of event information. As a recall search cue ("file header"), *when* is very general, essentially a season of a year. (Thus, given a date and instructed to think of the target event, a person would think of all personal events within 3 months of the provided date.) Once a specific event is accessed, however, Wagenaar suggests that much more specific date information is available (1-week rather than 3-month precision). This finding suggests that dating of personal events will be better if subjects first access the "file" for the particular event, and that questions other than *when* will increase the likelihood of accessing that file.

This memory research raises questions about the efficacy of the order in which event topics are addressed in many survey interviews. In the smoking supplement for the NHIS, for example, the interviewer initiates the topic by asking about frequency and dating of periods of smoking and smoking abstinence.

- How many times within the last year have you made a serious attempt to stop smoking cigarettes?
- When did you last make a serious attempt to quit smoking?
- When you tried to quit, how long did you stay off cigarettes?
- Of all the times you have tried to quit smoking, what was the longest period you stayed off cigarettes?
- When did you make the serious attempt to quit smoking?

Respondents were asked how and why they changed their smoking behavior only after answering these questions. A very different question order would be recommended based on the research literature on autobiographical memory.

A second feature of the typical survey interview that appears less than optimal from a cognitive psychology viewpoint is that the subject is repeatedly asked to shift focus. In the smoking history section of the NHIS shown in this report, for example, the respondent is asked first to think about all attempts to stop smoking, then about the most recent attempt to stop smoking, and then about the longest cessation period. The survey's use of shifting reference periods can be expected to disrupt natural retrieval strategies, if we are correct in our interpretation that an event story or narrative form, in which the subject develops a coherent narrative of a single event, is preferred for autobiographical recall, much as a story structure facilitates recall of prose material (49).

Table J summarizes the differences between the conditions that laboratory research suggests are most conducive to recall of past events and those that apply in most standard survey interviews.

The study to be reported here explores an alternative approach to obtaining personal history information. The study is designed to have applications for the design of interviews dealing with personal history over an extensive time frame. Although the specific application used in this study concerns smoking history, the same techniques could be used in surveys concerning long-term residential patterns, employment history, or any other category of significant life event.

Respondents in this study were all individuals who were involved in a formal program to stop smoking sometime in 1981 or 1982. After stopping as part of that program and remaining abstinent for 3 months, they joined an SRI study of factors contributing to smoking relapse (for convenience, we will refer to this as "the 1982 SRI study"). Some participants subsequently resumed smoking, whereas others remained abstinent. Our interview questions concern their smoking patterns just before participating in the stop-smoking program and previous and subsequent attempts to stop smoking.

Respondents were assigned randomly to either a standard or an experimental interview group. In developing the experimental interviews, we sequenced interview questions in a way that would be compatible with memory retrieval processes—first asking questions about the reasons *why* the respondent did something, followed by *how* he or she did it, the *result*, and, finally, *when* the event occurred. In this way the respondent is allowed to describe the essentials of an episode before being asked to place it in a time frame.

In addition, in our experimental condition we sought to employ a more natural, conversational approach to interacting with the respondent without sacrificing objectivity. For structured-response items, the interviewer first elicited open-ended responses to the questions and then asked the respondent to look at the list of standard responses and select those that were relevant. The interviewer acknowledged information that the respondent had already provided and used that information to form individualized probes. For example, a respondent who said he could not remember when an attempt to quit occurred might be probed, "Well, you said you are pretty sure you smoked at least up until the spring of 1979 when you were still working as a gardener, and you are pretty sure you

Table J. Differences between conversations and survey interviews

Conversations	*Survey interviews*
Participants identify a topic of mutual interest	Survey designers identify topics in advance
Topics evolve dynamically but follow rules of continuity	Topics may switch suddenly, with no logical continuity
Person can reject or reframe the question	Respondent must answer question as it is written in advance
Participant's talk is adapted to information the other participant has provided	Interviewer uses standard wording so that respondent's prior responses have no effect
Procedures are used to obtain clarification when ambiguity is encountered	Requests for clarification are responded to with repetition of the same question

Table K. Contrasts between experimental and standard interview conditions

Feature	*Experimental interview*	*Standard interview*
Question order:	*Why* tried to stop smoking, *how* tried to stop smoking *why* restarted, *when* stopped and started	*How many* times tried to stop, *when* was most recent stop, duration of longest stop, *how* tried to stop smoking, *why* ever tried to stop, *why* ever restarted
Continuity:	Each episode described completely before respondent is questioned about other episodes	Focus of questions shifts as on NHIS
Standardization:	Balance sought between conversational axioms and standardization; questions about reasons and methods asked first in open-ended format followed by provision of standard response options	Questions completely standardized; subjects given standard response set for all items
Relevance:	Subjects encouraged to talk about any details that might help them remember the event	Subjects discouraged from rambling

participated in the SRI project in February 1982. That leaves a period of 3 years: What about when you were singing in the choir, were you smoking then?" In this way we encouraged respondents to talk about the details of their past that have connections to changes in their smoking behavior and could serve as retrieval cues to help them remember the events in their smoking history.

The study design compared this experimental interview approach with a standard survey interview, in which questions were sequenced into a way similar to the order used in the NHIS smoking supplement, and the interviewer adhered strictly to the interview protocol. In this standard condition, respondents were not asked about topics with open-ended questions before the standard response options were given. Digressions were discouraged. If a respondent said that he or she could not remember something such as the date of an attempt to stop smoking, he or she was simply urged, "Well, try to give me your best estimate." Table K summarizes the differences between the experimental and standard interview conditions.

This study is unusual because we are able to compare these two conditions in terms of the accuracy of the information obtained from respondents. This is possible because the respondents were all participants in the 1982 SRI study of smoking behavior and relapse (45,50) funded by the NHLBI. As part of that study, extensive smoking histories were obtained from all participants. They completed a written questionnaire asking about all periods of smoking cessation and attempts to quit during the previous 10 years. These participants were then followed up for a 12-month period, during which they were regularly asked about their smoking status and twice had saliva samples taken and analyzed for tobacco by-products. The records from the earlier study provide a standard to which the respondents' retrospective reports in our interviews could be compared.

Method

Respondents

A total of 76 individuals, all of whom had participated in the 1982 SRI study of smoking relapse, served as respondents. Of these, 20 were interviewed between 1988 and 1989 during a pilot phase of our research, and 56 were interviewed between 1989 and 1990 during the main data collection. Much, but not all, of the interview protocol remained the same between the two study phases, permitting pooling of data for some items. Respondents were randomly assigned to interview groups. Respondent locating and recruiting procedures are described in appendix V.

Procedures

All respondents were interviewed individually in their home, on their job, or another setting convenient to them. A total of four researchers served as interviewers; each conducted approximately equal numbers of experimental and control interviews.

In the experimental-interview condition, the interviewer began by asking the respondent about the attempt to quit immediately before joining the 1982 SRI smoking relapse study. These respondents were first asked about why they wanted to stop smoking at that time in their life. They were then asked questions about how much they had been smoking before joining the stop-smoking program, the number of family members and friends who smoked at that time, and the extent to which these people made it easier or harder to stop smoking. As part of this program, only after addressing all of these questions about this attempt to stop smoking were they asked to try to recall the month and year they stopped. These questions were followed by less detailed inquiries about why and how they had tried to stop smoking on any other occasions between 1977 and 1983. For each period of smoking cessation, they were first asked why they had tried to stop, followed by questions about methods used, and then dates. Finally, they were asked about changes in smoking status after participating in the 1982 SRI study.

In the standard-interview condition, respondents were first asked to estimate the month and year when they had stopped smoking prior to participating in the SRI smoking relapse study. They were then questioned about the details surrounding their participation in the stop-smoking program. After answering these questions, they were asked to consider all their other smoking cessations of a week or more between 1977 and 1983. They were first

asked how many cessations had occurred and then the month and year when each period of abstinence started and stopped. Next, they were asked to report all the methods they had ever used to try to quit smoking during this period and all of the reasons why they had ever resumed smoking after trying to stop.

The form of the questions used with the standard-interview group (asking about methods and reasons for all of their attempts to quit at once) was identical to that used on the questionnaire respondents completed in 1982. In contrast, the experimental group was asked to consider the motives and methods for each event individually. In addition, the experimental respondents were first asked to describe their reasons or methods in their own words and were only subsequently given the standardized response categories that had been used on the 1982 questionnaire. (Responses were aggregated across 1977–82 attempts to quit for comparison with their 1982 responses.) Thus any variance related to similarity of method should favor the standard-interview group. In both conditions, the interview concluded with questions about the respondent's current smoking status and the amount smoked or date of final quit, whichever was relevant. Experimenter protocols for the two conditions are provided in appendix VI.

Results

Long-term recall for smoking behaviors

Given the extended period of time between the events to be remembered and the date of our interviews (an average of 8 years), the first issue of interest is the overall accuracy of reports of different types of information. These data provide some guidelines that can assist researchers in estimating the feasibility of obtaining valid responses to different types of questions that might be included in a retrospective smoking history interview.

Dates of smoking cessation—Memory accuracy for the month and date in which the respondent stopped smoking before joining the SRI study was estimated for the 56 respondents in the main part of the study. (In the pilot phase, respondents were told the year in which this stop-smoking attempt occurred.) For each respondent, the remembered month and year when he or she stopped smoking before joining SRI's study were compared with the date on record.[1]

Overall, respondents were able to date this attempt to stop smoking (which had occurred some 6 to 9 years prior to the interview) within 7.47 months of its actual occurrence. Dating errors usually involved respondents remembering the event as occurring more recently than it actually did ("forward telescoping"), with the average date remembered being 4.91 months too recent.

After participating in the program to stop smoking in 1981 or 1982, a majority of the respondents remained abstinent, according to both records from the followup conducted for approximately 1 year and their own account in 1989 or 1990. There were 37 respondents (49 percent), however, who resumed smoking; although a majority of these have since quit. The smoking history provided by each respondent in our interview was compared with the recorded dates and followup data collected for the earlier study, roughly 6 and 12 months after quitting in 1981 or 1982. In this way we were able to assess the respondents' memory for their smoking behavior in the year following their 1981 or 1982 smoking cessation. Among the 56 respondents in the main study, 80 percent of the reports given in the 1989–90 interviews were consistent with the 1982 study records for the 6-month followup; 88 percent were consistent for the 12-month followup.

Amount smoked—The questionnaire completed as part of the 1982 SRI smoking relapse study included a self-reported item on the amount smoked prior to participating in the stop-smoking program. The item format and the mean level of agreement between 1982 and 1989–90 reports are shown in table L; 44 percent of the respondents gave an identical response on both occasions, with

[1]For two respondents who reported they could not remember a date at all, a value equal to the total sample mean plus one standard deviation was imputed.

Table L. Number and percent of smoking levels reported in 1982 compared with levels reported in 1989–90

[Percents appear in parentheses]

1982 reported level	1989–90 reported level: 1	2	3	4	5	6
1 = Less than 1/2 pack per day	0 (0.00)	3 (4.00)	4 (5.33)	1 (1.33)	0 (0.00)	0 (0.00)
2 = 1/2–1 pack per day	1 (1.33)	3 (4.00)	10 (13.33)	0 (0.00)	1 (1.33)	0 (0.00)
3 = 1–1/2 pack per day	0 (0.00)	8 (10.67)	17 (22.67)	3 (4.00)	0 (0.00)	0 (0.00)
4 = 1–1/2–2 packs per day	0 (0.00)	0 (0.00)	2 (2.67)	9 (12.00)	2 (2.67)	1 (1.33)
5 = 2–2–1/2 packs per day	0 (0.00)	0 (0.00)	0 (0.00)	3 (4.00)	3 (4.00)	2 (2.67)
6 = More than 2–1/2 packs per day	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (1.33)	1 (1.33)

NOTE: The 1982 questionnaire for one subject could not be located.

Table M. Level of agreement and memory for features of cigarettes smoked in 1982

Cigarette feature	*Percent agreement*	*Chance level of agreement*	*Correct level of agreement*[a]
Brand smoked	0.46	...	...
Length (options: regular, king, 100 mm, or 120 mm)	0.41	0.25	0.21
Mentholated (options: yes, no)	0.84	0.50	0.68
"Lights" (options: yes, no)	0.75	0.50	0.49

[a]Correction for chance agreement on items with limited options. Corrected agreement = (percent agreement-chance percent agreement) or (1-chance percent agreement). The first divided by the second.

NOTE: The 1982 questionnaire for one subject could not be located.

another 47 percent reporting a category adjacent to the one they had picked in 1982. Among respondents whose 1982 and 1989 reports disagreed, the 1989 reports of 1982 smoking levels were more likely to exceed those reported in 1982 (36 percent of reports above the diagonal) than to be lower (20 percent of reports below the diagonal).

Cigarette brand and characteristics—During our interviews, we asked respondents about the brand of cigarette they were smoking prior to stopping and joining the earlier SRI study, the length of the cigarettes, whether they were mentholated, and whether they were "lights." The extent to which reports of this information agreed with reports provided in 1982 is displayed in table M.

Memory for type of cigarette smoked 8 years ago appears poor. Less than half the respondents could remember the brand they had smoked, and when corrected for guessing, memory for cigarette length was accurate among less than a quarter of the sample. One factor that may have contributed to the relatively low agreement between 1989 and 1982 reports is that some of the stop-smoking programs in which respondents participated directed them to change their cigarette brand as part of the effort to break the smoking habit. The cigarettes described on the 1982 questionnaire may have been the last brand smoked during the smoking cessation program rather than the individual's customary brand before starting the program.

Social environment for smoking—A number of questions on the 1982 questionnaire were aimed at assessing the social pressures to smoke or not to smoke. Some of these items were objective (for example, the number of smokers living in the home and the proportion of coworkers who smoked), whereas others were quite subjective (rating the extent to which friends helped or hindered the attempt to stop smoking). Table N shows the level of agreement between the 1982 and 1989–90 reports of these variables. Not surprisingly, memory was better for objective aspects of the social environment surrounding the stop-smoking attempt, where 69 percent of the reports matched, than for the subjective environment, where 44 percent of the reports matched ($t(49) = 14.93, p < 0.01$).

Reasons for quitting and restarting—Other items on the 1982 questionnaire asked subjects why they had wanted to quit smoking and why they had restarted after previous attempts to quit. These questions and the relationship

Table N. Relationship between the 1982 and 1989–90 reports of assessing objective and subjective aspects of the social environment for smoking

Item	*Objective social environment*[a]	*Subjective social environment*[b]
Number possible[c]	4.35	2.55
Number of matches	3.01	1.11
Percent matches	0.69	0.44

[a]Includes whether respondent lived alone, number of adults in household, number of smokers in household, proportion of friends who smoked, and proportion of coworkers who smoked.
[b]Includes ratings of degree of support received from household members, friends, and coworkers, each on a 4-point scale.
[c]Number possible varies, depending upon whether the respondent lived alone and was employed at the time the questionnaire was completed.

NOTE: The 1982 questionnaire for one subject could not be located.

Table O. Consistency between 1982 questionnaire and 1989–90 interview items on reasons for quitting and restarting smoking

Item	*Reasons for quitting*[a]	*Reasons for restarting*[b]
Number possible[c]	7.36	4.01
Number of matches	4.63	1.72
Percent matches	0.64	0.44
Number of false alarms	1.06	0.97
Corrected percent matches[d]	0.46	0.13

[a]Includes whether respondent lived alone, number of adults in household, number of smokers in household, proportion of friends who smoked, and proportion of coworkers who smoked.
[b]Includes ratings of degree of support received from household members, friends, and coworkers, each on a 4-point scale.
[c]Number possible varies, depending on number of options marked on 1982 questionnaire.
[d](Matches - False Alarms)/Possible.

NOTE: The 1982 questionnaire for one subject could not be located.

between the 1982 and 1989–90 reports are shown in table O. Although 64 percent of the reasons for quitting reported in 1982 were also reported in 1989–90, consistency looks much less impressive once we correct these scores for the respondents' inclination to agree with all the response options (as indicated by the number reported in 1989–90 that had not been marked in 1982). The resulting corrected match rate of 46 percent is still considerably better than that found on the similarly formatted question on reasons for resuming smoking after earlier (pre-1982 questionnaire) attempts to stop. Here, the corrected match rate is only 13 percent.

Methods used—All respondents knew that they had joined a formal stop-smoking program before participating in the SRI study, although only 57 percent of them could remember the organization offering the program. Respondents were also asked about methods used in earlier attempts to quit. Table P shows the question format

Table P. Consistency between 1982 questionnaire and 1989–90 interview reports of methods used in attempts to stop smoking

Item	*Methods used*[a]
Number possible[b]	1.85
Number of matches	0.77
Percent matches	0.47
Number of false alarms	0.25
Corrected percent matches[c]	0.29

[a]Options comprise drugstore remedy, health association program, commercial program, individual counseling and/or private therapy, group therapy, hypnosis, and quit on own.
[b]Number possible varies, depending on number of options marked on 1982 questionnaire.
[c](Matches - False Alarms)/Possible.

Table Q. Consistency between interview smoking history and 1982–83 followup data

[Standard errors appear in parentheses]

Interview condition	First followup		Second followup	
	Number	Percent agree	Number	Percent agree
Experimental interview . . .	33	0.94 (0.04)	34	0.97 (0.03)
Standard interview	24	0.75 (0.09)	28	0.75 (0.08)

NOTE: Followup data were not available for some subjects.

(taken from the 1982 questionnaire) and recall performance. False positives (reporting options in 1989–90 that were not selected in 1982) were much less common on this item (about one respondent in four reported an additional method). The corrected recall rate of 29 percent was better than that for reasons for relapsing but not as good as that for reasons for quitting in 1982.

Interview conditions

Dates of smoking cessation—The experimental interview technique was designed to help respondents generate a context for remembering incidents in their smoking histories. A key prediction was that respondents would be better able to place an event in time if they first had the opportunity to recall the reason for wanting to stop smoking and the context in which the event occurred rather than being asked first about when the event had happened.

This hypothesis was confirmed: There were large differences between the two interview groups in the precision with which this event was dated. Respondents in the experimental-interview condition erred by an average of just 4.99 months (absolute deviation) compared with an average of 10.74 for those in the standard-interview condition, $t(40) = 2.01$, $p < 0.05$. Thus the experimental technique appeared highly effective in helping respondents to place this event in time, cutting the dating error by more than half.

In terms of net error, respondents in both conditions produced date estimates that were, on the average, too recent. The tendency appeared more pronounced among standard interview respondents, whose group estimate was 6.37 months too recent, than among experimental respondents, whose group estimate was 2.98 months too recent, but the difference was not statistically significant.

Table Q compares the two interview conditions in terms of the consistency of reports with the recorded followup data. Experimental-interview respondents gave more accurate histories for the period after the stop-smoking program. Their reported smoking status at the time of the two followup visits matched the followup data in 94 percent of cases for the first followup compared with 75 percent for standard-interview respondents, $z = 1.95$, $p < 0.10$. Similarly, the smoking status reported in the interview for the time of the second followup matched that on record for 97 percent of experimental-interview respondents compared with 75 percent of those in the standard-interview condition, $z = 2.53$, $p < 0.05$.

Amount smoked—Tables R and S show the degree of consistency between 1982 and 1989–90 reports of the amount smoked prior to the smoking cessation in 1981–82. Experimental respondents chose the same response option on both occasions 37 percent of the time compared with 51 percent for standard-interview respondents. This difference was not statistically significant.

Cigarette brand and characteristics—The two groups were also similar in terms of the consistency of their 1982 and 1989–90 reports of the cigarette brand they used to smoke. These data are shown in table T. Although the experimental group's mean appears higher for reports of cigarette length, and the standard-interview respondents show a higher mean for reports of whether the cigarettes were mentholated, neither difference was statistically significant.

Social environment for smoking—For the objective items about social environment, responses of the experimental-interview group matched those on their 1982–83 questionnaire 71 percent of the time, whereas those of the standard-condition respondents matched 66 percent of the time (a nonsignificant difference). For the subjective items, the experimental-interview group's responses matched 40 percent of the time compared with

Table R. Number and percent of smoking levels reported in 1982 compared with 1989–90 among experimental interview respondents

[Percents appear in parentheses]

1982 reported level	1989–90 reported level					
	1	2	3	4	5	6
1 = Less than 1/2 pack per day	0 (0.00)	1 (2.63)	3 (7.89)	1 (2.63)	0 (0.00)	0 (0.00)
2 = 1/2–1 pack per day	1 (2.63)	1 (2.63)	5 (13.16)	0 (0.00)	1 (2.63)	0 (0.00)
3 = 1–1–1/2 packs per day	0 (0.00)	5 (13.16)	10 (22.32)	2 (5.26)	0 (0.00)	0 (0.00)
4 = 1–1/2–2 packs per day	0 (0.00)	0 (0.00)	0 (0.00)	2 (5.26)	2 (5.26)	1 (2.63)
5 = 2–2–1/2 packs per day	0 (0.00)	0 (0.00)	0 (0.00)	2 (5.26)	0 (0.00)	0 (0.00)
6 = More than 2–1/2 packs per day	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.63)

NOTE: The 1982 questionnaire for one subject could not be located.

Table S. Number and percent of smoking levels reported in 1982 compared with 1989–90 among standard interview respondents

[Percents appear in parentheses]

1982 reported level	1989–90 reported level: 1	2	3	4	5	6
1 = Less than 1/2 pack per day	0 (0.00)	2 (5.41)	1 (2.70)	0 (0.00)	0 (0.00)	0 (0.00)
2 = 1/2–1 pack per day	1 (0.00)	2 (5.41)	5 (13.33)	0 (0.00)	0 (0.00)	0 (0.00)
3 = 1–1–1/2 pack per day	0 (0.00)	3 (8.11)	7 (18.92)	1 (2.70)	0 (0.00)	0 (0.00)
4 = 1–1/2–2 packs per day	0 (0.00)	2 (5.41)	7 (18.92)	0 (0.00)	0 (0.00)	0 (0.00)
5 = 2–2–1/2 packs per day	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.70)	3 (8.11)	2 (5.41)
More than 2–1/2 packs per day	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.70)	0 (0.00)

NOTE: The 1982 questionnaire for one subject could not be located.

Table T. Consistency between 1982 questionnaire and 1989–90 interview reports of cigarette features, by interview condition

Cigarette feature	Experimental interview: Percent agreement	Chance level of agreement	Corrected level of agreement[a]	Standard interview: Percent agreement	Chance level of agreement	Corrected level of agreement
Brand	0.46	...	...	0.47	...	...
Length	0.61	0.25	0.48	0.49	0.25	0.32
Mentholated	0.79	0.50	0.58	0.89	0.50	0.78
"Lights"	0.74	0.50	0.48	0.76	0.50	0.52

[a]Correction for chance agreement on items with limited options. Corrected agreement = (% A – Chance % A)/(1 – Chance % A).

48 percent among the standard-interview respondents (again, nonsignificant). These results are shown in table U.

Although the trend toward greater consistency in the responses to subjective items among the standard-interview group was not statistically significant, it suggests the possibility that standard-interview respondents may have had an advantage in terms of the similarity of the strategies used to answer the question on the two occasions. Either a standard interview or a written questionnaire is likely to elicit a rough estimate, "gut reaction," when a complex question such as "How supportive were your friends when you tried to stop smoking?" is posed. The slower paced, more detailed discussion elicited in the experimental interview was designed to lead respondents to actually recall specific people and how they responded to the attempt to stop smoking. To the extent that respondents did so and actually tried to mentally average the degree of support over various friends or family members, they may have tended to arrive at a different answer than the estimate provided in 1982 after more superficial consideration of the item on the questionnaire (51).

Table U. Consistency in description of objective and subjective aspects of social environment, by interview condition

[Standard errors appear in parentheses]

Social environment	Experimental interview n=38	Standard interview n=37[a]
Objective social environment[b]		
Number possible[c]	4.32 (0.15)	4.38 (0.13)
Number of matches	3.11 (0.20)	2.92 (0.17)
Percent matches	0.71 (0.04)	0.66 (0.03)
Subjective social environment[d]		
Number possible	2.55 (0.10)	2.54 (0.09)
Number of matches	0.97 (0.15)	1.19 (0.14)
Percent matches	0.40 (0.06)	0.48 (0.05)

[a]Does not include one subject whose 1982 questionnaire could not be located.
[b]Includes whether respondent lived alone, number of adults in household, number of smokers in household, proportion of friends who smoked, and proportion of coworkers who smoked.
[c]Number possible varies depending upon whether the individual lived alone and was employed at the time the questionnaire was completed.
[d]Includes ratings of degree of support received from household members, friends, and coworkers, each on a 4-point scale.

Reasons for quitting and restarting—In comparing the congruence of the 1982 and 1989–90 responses to these questions, it should be remembered that those in the experimental interview responded to a large set of options shown in table O after describing the reasons in their own words for wanting to quit smoking (or for restarting). Respondents in the standard interview merely responded to the set of options.

Figure 5 shows some examples of the reasons experimental-interview respondents provided in response to the open-ended question about why they wanted to quit and the options selected by the same respondents. Respondents in this condition clearly selected some options that were quite different from anything they had talked about in response to the open-ended query. Nevertheless, the data shown in table W suggest that preceding the

Open-ended response	Structured-Response Items											
	Experienced health problem	Wanted more active life	Concerned about lung cancer	Advised by physician	Needed to change lifestyle	Convinced by friends	Experiencing some tension	Concerned about heart disease	Wanted to set good example	Thought smoking was a dirty habit	To show will power	For someone important to me
S#7: *Mother had recently died of cancer . . . I was smoking a lot and not enjoying it.*	✓		✓		✓				✓	✓		
S#12: *We had recently moved from Oregon and were planning for children . . . We wanted to be nonsmokers . . .*		✓	✓		✓		✓		✓		✓	
S#23: *I wanted to get healthier . . . A guy I was dating didn't smoke. Also a friend was in this stop-smoking program . . .*		✓	✓		✓	✓		✓	✓	✓	✓	
S#29: *Dad died and mother was concerned about people who smoke in general . . . It was really devotion to my mother . . .*		✓	✓				✓			✓		✓
S#35: *I had recently quit drugs and alcohol so I thought I should quit smoking too.*	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
S#48: *The real motivator was my wife. She really wanted to quit and I just sort of went along.*						✓			✓	✓	✓	✓
S#51: *I was anticipating a divorce and wanted to take control of my life . . .*	✓	✓	✓							✓	✓	

Figure 5. Comparison of responses to open-ended and structured-response items on reasons for stopping smoking

Table W. Consistency between 1982 questionnaire and 1989–90 interview items on reasons for quitting smoking in 1981–82 and reasons for prior relapses, by condition

[Standard errors appear in parentheses]

Interview items	*Experimental interview n=38*	*Standard interview n=37*[a]
Reasons for quitting smoking		
Number possible[b]	7.66	7.05
	(0.34)	(0.33)
Hits	4.71	4.54
	(0.28)	(0.33)
False alarms	0.92	1.20
	(0.18)	(0.22)
Percent hits	0.64	0.64
	(0.04)	(0.03)
(Hits–false alarms)/possible	0.48	0.44
	(0.04)	(0.05)
Reasons for prior relapses		
Number possible[b]	4.26	3.76
	(0.30)	(0.37)
Hits	1.32	2.14
	(0.23)	(0.27)
False alarms	0.64	1.30
	(0.17)	(0.24)
Percent hits	0.28	0.61
	(0.05)	(0.06)
(Hits–false alarms)/possible	0.06	0.20
	(0.10)	(0.08)

[a]Does not include one subject whose 1982 questionnaire could not be located.
[b]Number possible varies, depending upon number of items marked on 1982 survey.

standard question with the open-ended item may have made respondents more conservative in selecting options: Experimental respondents were less likely than respondents in the standard-interview condition to select options that they had not marked on the 1982 questionnaire (mean of 0.92 versus 1.20 per respondent). When the proportion of matches between the interview and the 1982 questionnaire responses was corrected for these intrusions, the experimental-interview group had a score of 48 percent compared with 44 percent for those in the standard-interview condition, a difference that was not statistically significant.

Methods used—Table Y shows the consistency between 1982 and 1989 questionnaire and interview items on methods used to try to stop smoking by interview condition. As shown in the table, the corrected recall score for the experimental group was 34 percent compared with 24 percent for the standard-interview group, a difference that was not statistically significant.

Table Y. Consistency between 1982 questionnaire and 1989–90 interview items on methods used to try to stop smoking, by condition

[Standard errors appear in parentheses]

Method	*Experimental interview n=38*	*Standard interview n=37*[a]
Methods used before 1982 quit		
Number possible[b]	1.79	1.92
	(0.19)	(0.18)
Hits	0.79	0.75
	(0.10)	(0.13)
False alarms	0.25	0.26
	(0.08)	(0.11)
Percent hits	0.53	0.40
	(0.07)	(0.07)
(Hits–false alarms)/possible	0.34	0.24
	(0.11)	(0.13)

[a]Does not include one subject whose 1982 questionnaire could not be located.
[b]Number possible varies depending upon number of items marked on 1982 survey.

Success of the smoking cessation

As previously described, the strongest effect of the experimental-interview condition was found for the respondent's ability to place his or her smoking cessation in time. Another important factor in determining the accuracy with which the respondent could date the event was whether this attempt to quit smoking was ultimately successful (that is, the respondent never smoked again). It is quite reasonable to assume that the date of the final cessation of smoking is more likely to be discussed or otherwise mentally rehearsed than the date of an attempt to quit smoking that was not sustained. This is clearly the case: The mean absolute deviation between the remembered date and the actual date for the attempt to quit smoking was 3.76 months if it was the "final" attempt and 11.75 months if it was not. A general linear model test, with both condition and finality of the quit as factors, found a significant effect for the interaction between these two variables, $F(1,52)=5.87$, $p<0.05$ (as well as significant main effects, $F(1,52)=5.19$, $p<0.05$ for condition and $F(1,52)=10.16$, $p<0.01$ for finality of the quit). Respondents in the experimental-interview group were good at dating the event regardless of whether it was the final attempt to quit (3.95-month and 5.90-month deviations for final and nonfinal attempts, respectively). In contrast, respondents in the standard-interview condition were quite good at dating final attempts to quit (mean deviation of 3.58 months) but very poor at dating the smoking cessation if it was not ultimately successful (mean deviation of 17.91 months). Table Z displays these data, which are illustrated in figure 6.

Table AA compares the respondents who quit for good in 1981–82 with those who subsequently resumed smoking in terms of corrected percent matches for reasons for quitting in 1982, reasons for previous relapses, and methods used prior to the 1981–82 smoking cessation program. The finality of the quit in 1981–82 was not related to consistency of responses for any of these variables.

Table Z. Deviations between recalled and actual date of stopping smoking

Interview condition	*N*	*Mean absolute deviation (in months)*	*Standard error*
Total sample	56	7.47	1.50
Experimental interview	28	4.99	1.29
Never smoked again	13	3.95	2.02
Smoked again	15	5.90	1.68
Standard interview	28	10.74	2.56
Never smoked again	14	3.58	1.17
Smoked again	14	17.91	3.98

NOTE: A value equal to the total sample mean plus one standard deviation was imputed for two subjects who reported that they had no idea when the event occurred.

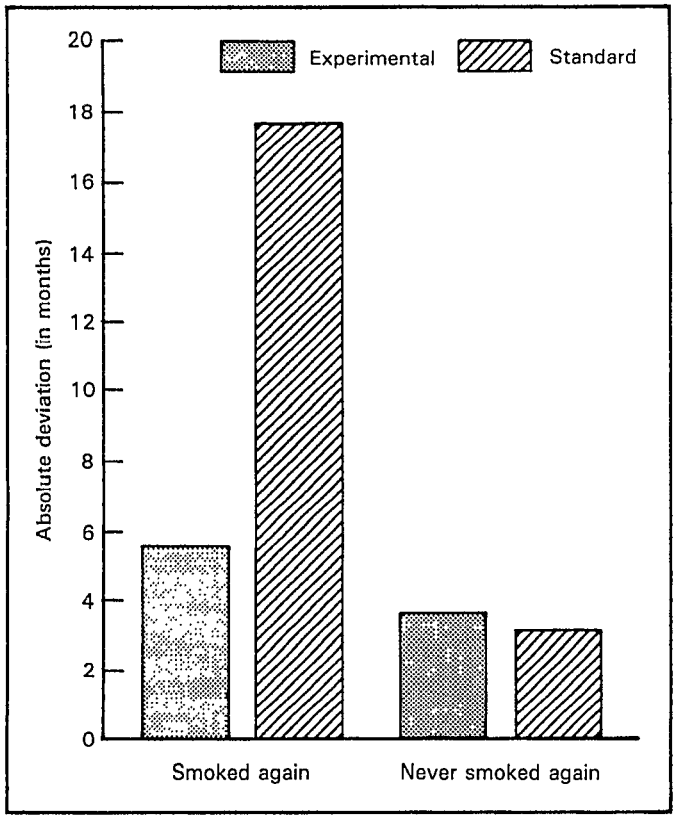


Figure 6. Deviation between recalled and actual date of stopping smoking

Table AA. Consistency between 1982 questionnaire and 1989–90 interview reports of reasons for quitting smoking, reasons for relapses, and methods tried, by quit status

[Number of subjects appears in parentheses]

Corrected percent matches	*Final quit in 1981–82*	*Resumed smoking after 1981–82 quit*
Reasons for quitting	0.42 (38)	0.51 (33)
Reasons for restarting after previous quits	0.15 (37)	0.10 (33)
Methods tried in previous quits	0.26 (38)	0.32 (31)

NOTE: The 1982 questionnaire for one subject could not be located.

Current smoking status

Several studies of retrospective reporting suggest that individuals whose behavior patterns change are less accurate in reports of past behaviors than are those who have continued the same kind of activity (52–54). For this reason, we had expected individuals who are current smokers to have better memory for information related to their smoking in 1982. Testing this hypothesis was severely hampered by the fact that only 14 of the respondents in our sample were still smokers at the time of the 1989–90 interview. Nevertheless, we compared these respondents with the remaining respondents who either never resumed smoking after 1982 or resumed but subsequently quit. Table BB displays these data.

Table BB. Consistency between 1982 questionnaire and 1989–90 interview reports of reasons for quitting smoking, reasons for relapses, and methods tried, by current smoking status

[Number of subjects appears in parentheses]

Behavior pattern	*Current nonsmokers*	*Current smokers*
Reasons for quitting	0.46 (58)	0.48 (13)
Reasons for restarting after previous quits	0.14 (58)	0.08 (12)
Methods tried in previous quits	0.24 (57)	0.53 (12)

NOTE: The 1982 questionnaire for one subject could not be located.

Current smokers and nonsmokers appear similar in terms of consistency between 1982 questionnaire and 1989 interview responses. The largest difference between means was for reports of methods used to try to stop smoking: Individuals who currently smoke reported the same methods they had cited in 1982 in 53 percent of the cases compared with 24 percent for those who are now nonsmokers. This seems reasonable because these individuals may still be evaluating methods for quitting, and hence their earlier methods are relevant to future decisions. Nevertheless, despite the sizable difference in means, the effect of smoking status was not statistically significant with this small sample of current smokers.

Discussion

The experimental-interview technique used in this study appeared effective in helping respondents recall an accurate smoking history for the period surrounding a smoking cessation that occurred 7 to 9 years earlier. Both memory for the date when the smoking cessation occurred and the report of smoking status a year afterward were more accurate among experimental-interview respondents.

At the same time, the data also indicate that another factor that needs to be considered is the salience of the information to be remembered. For respondents whose attempt to quit smoking in 1982 or 1983 was successful (who never resumed smoking), memory for the date of this event was highly accurate regardless of the interviewing technique. The date for such an event is likely to become one of the "landmarks" in autobiographical memory—one of the relatively few events for which an exact date is stored—and thus a potential aid in reconstructing dates for other personal events. The advantage of the experimental interviewing technique was found for less salient events—attempts to quit that were not ultimately successful. Because the events queried in standardized interviews are not necessarily of high salience for the respondents, this finding is important. At the same time, it should be acknowledged that the memory for smoking behaviors, going back as many as 9 years, displayed by our respondents was almost certainly enhanced by the fact that they had the unusual event of participating in the 1982–83 SRI

smoking relapse study as a cue for recalling other events in their smoking histories.

Although the aspects of their smoking histories that could be validated by project records were more accurate for experimental respondents, there was no comparable advantage for consistency between responses to more subjective survey items administered on the two occasions 7 to 9 years apart. When interview responses were compared with responses on a questionnaire completed in 1982, none of the differences between experimental groups was statistically significant. Likewise, those who quit for good in 1981–82 were no more or less consistent in their responses than those who later resumed smoking. In part this may reflect the relatively small size of our sample, but it also appears to reflect the instability of the type of response requested by the questionnaire (for example, responses to 12 feasible justifications for trying to stop smoking).

Overall, the data suggest that, to the extent that the survey designer seeks to get accurate retrospective reports of specific medium-salience events, the techniques explored here have promise, especially when there is a requirement for placing the events in time. At this stage in our research, however, our data do not permit us to pinpoint the locus of our experimental interview's positive effect. It could be the change in question order to one more compatible with autobiographical memory. Alternatively, the change in the nature of the interaction to one in which personal details are elicited, and the respondent is encouraged to relate the target event to other things going on in his or her life at that time, may be the critical factor (34). These two aspects of the intervention need to be separately tested and evaluated as potential tools for national surveys.

Before such techniques are considered for implementation on a wider scale, we would want to identify the contribution of these individual factors to increases in validity as well as their costs in terms of increased time to complete the interview. Although a change in the question order could be implemented in national surveys without greatly increasing interview time, the more interactive-interview technique and the request for respondents to recall major life incidents that might serve as cues for recalling the target information would be likely to have major implications for time requirements and interviewer training.

In our study, experimental interviews averaged three times as long as control interviews (33 versus 11 minutes in a sample of 10 respondent pairs matched on the remembered number of attempts to quit). This was probably an extreme case because we compared respondents questioned about each incident separately (the experimental group) with those who responded once for a whole class of incidents (standard group). Comparing the two approaches for survey items concerned with specific events, rather than classes of events, would presumably show smaller differences in the time required to conduct the two types of interviews. Alternatively, there may be more efficient ways of providing a meaningful context for respondents' attempts at recall, perhaps by providing a piece of general or personal information that can serve as a date marker and a retrieval cue (55).

Interviewer selection and training in our study were more extensive than in many large-scale surveys but not as costly as one might suppose. The training was conducted in three four-spaced sessions of several hours each over a period of 3 weeks, and included modeling and coaching in the experimental techniques, using videotaped practice interviews. The majority of interviews were conducted by research assistants with bachelor's degrees and interview experience, but with no formal advanced training in social science or research methodology. Certainly a much broader research base is needed to support decisions concerning whether the additional training and implementation time for cognitive interviewing techniques are warranted for various applications. Given such information, individual survey designers can weigh increased costs against the value they place on the estimated increment in the validity of individual responses. To the extent that the latter is a serious concern, we believe that alternative interview methods designed to facilitate respondents' recall and to clarify communication are worth investigating.

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Appendix I Recruiting and screening

Sample selection

Recruiting of potential respondents

Respondents were recruited between February and August 1990, from the surrounding communities of SRI International, which included Menlo Park, Palo Alto, Redwood City, Mountain View, Belmont, and Sunnyvale, California. Posters soliciting smokers were posted in businesses (for example, business offices, retail establishments, bars, restaurants, car dealerships), libraries, bus stops, and train stations within a 1-mile radius of SRI. Classified advertisements were published in the daily newspapers of these cities, as well as in four weekly papers covering readership from San Jose to South San Francisco. The advertisement read, "Smokers Wanted, earn $45 for one week's participation in an SRI International study on smoking patterns. Call (415) 859–3456." In addition, some respondents were referred by word-of-mouth from previous participants.

Interested participants called and listened to a brief recording on an answering machine, with a description of initial screening criteria (items 2–5 listed below) and a brief description of the procedure they would be asked to follow to help investigate smoking patterns. Respondents were never told that the study was investigating memory. If candidates were still interested after listening to the recording, they were instructed to leave their name and phone number so someone could call them and set up an appointment or answer additional questions. Once a message was received, candidates were phoned within a week to screen for participation and to set up an interview appointment. Before an interview could be scheduled, the following items were screened over the phone with the candidate (the acceptable response is indicated in parentheses):

1. Have you already participated in this study? (No)
2. Do you only smoke cigarettes (for example, not a pipe or other tobacco)? (Yes)
3. Are you between the ages of 18 and 65? (Yes)
4. Do you smoke an average of at least five cigarettes a day? (Yes)
5. Are you trying to quit smoking? (No)
6. Are you on any medications that might affect your memory? (No)
7. Do you have a permanent residence? (Yes)
8. Are you able to understand English well enough to learn how to use the hand-held computer? (Yes)
9. Would you be able to carry a small, hand-held computer with you 24 hours a day for 6 days? (Yes)
10. Would you be able to participate in a one-half hour interview at SRI International, in Menlo Park on a Friday between 8 a.m. and 6 p.m.? (Yes)
11. Would you be able to participate in a 30-minute to 1-hour long followup interview at SRI International, in Menlo Park on the following Thursday between 8 a.m and 6 p.m.? (Yes)

Many of these criteria were checked simply through the course of informal conversation rather than in a structured interview format. In some cases, however, respondents were probed further because of something unusual mentioned in the conversation. Because of the relatively complex procedure for collecting the data and the cost of the electronic diary, potential respondents whose responses suggested a tendency towards unreliability were thanked for their interest but denied participation.

Respondents were called each Thursday to confirm their appointment and time for the next day, to make sure that they knew SRI's location, and to tell them whom to contact once they arrived.

Response rates

Figure I summarizes the response, screening, and participation rates. Of the 246 candidates who left a message indicating interest in the study, after speaking with them on the phone, 70 (28 percent) were screened out for ineligibility based on the screening criteria. Reasons for screening out respondents spanned the entire range of items (1–11).

Of the 176 candidates (72 percent) who passed the initial screening and were scheduled for an interview, 40 (23 percent) canceled or did not show up. Eight (4 percent) were dropped because they were unable to complete the entire procedure (that is, two were unable to understand the electronic diary procedure, one lost the electronic diary, two experienced technical difficulties and declined to participate another week, two declined to participate after completing the initial interview, and one returned several days late for the second interview). The remaining 128 candidates (73 percent) completed all phases of participation.

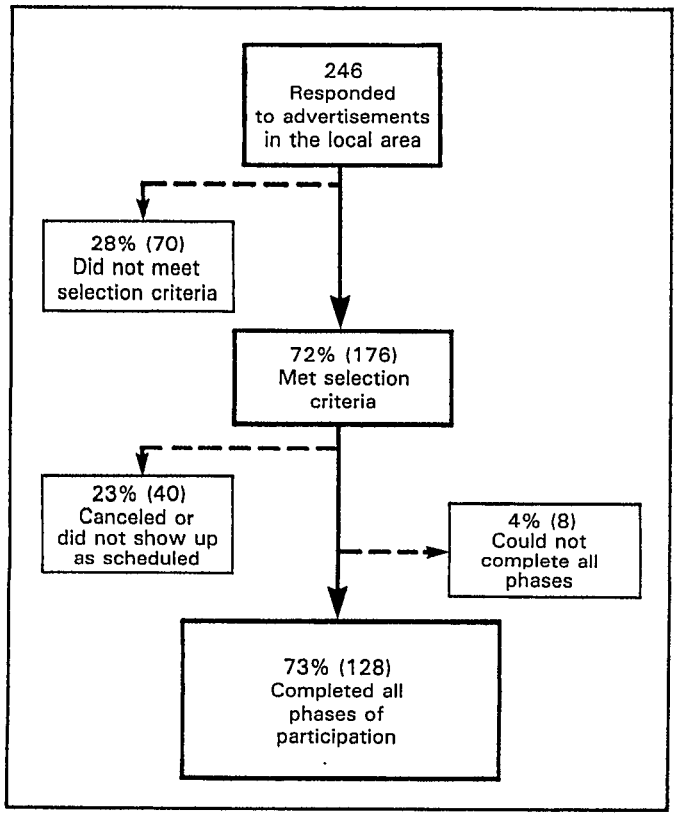

Figure I. Recruitment and sampling of smokers from the mid-Peninsula and South Bay regions of the San Francisco Bay Area

Appendix II
Study 1: Initial interview protocol

Overview

There were three essential goals of the initial interview—completion of the interview record form, explanation of how to use the electronic diary (ED), and encouragement to comply with the data collection procedure.

Interview record form

After a brief overview of the purpose of the study, respondents were asked a series of questions about the type of cigarettes they smoke and how they usually smoke them. This 5-minute protocol was used primarily to divert the respondent's attention away from the issue of frequency of cigarettes smoked. The items included in this section of the interview are listed on the interview record form at the end of this appendix.

Summary of electronic diary training

The interviewer set up the ED for training mode (in which entries are not stored) so that all instructions could be hands-on for the respondent. Respondents were told that they would need to respond to the ED on two types of occasions—just before smoking each cigarette and when the ED prompts them by "beeping," which could be up to five times a day. At the end of the training section of the interview, respondents were required to demonstrate their ability to record a cigarette, respond to prompts, suspend prompts, and set the wake-up alarm.

Data collection compliance encouragement

Finally, throughout the training, respondents were given several incentives to comply with the procedure. Missed prompts would be recorded, too many suspends were discouraged, and the sleep function was only to be used when actually sleeping. Respondents received an instruction card and an error card that fit into the carrying case for the ED, as well as a number to call if problems arose. They signed a pledge form promising to take good care of the ED and to record all of their cigarettes and were told that they could also receive a $5-bonus for exemplary compliance. Once the ED was taken out of training mode and set up for regular data collection, the cover was positioned so that only the top six keys were visible, and using a screw on the back of the unit, the computer was sealed shut.

The interviewer's protocol of the initial interview for all conditions and the interview record form follow on the remaining pages in this appendix.

INTERVIEWER'S PROTOCOL
INITIAL INTERVIEW:
ALL CONDITIONS

We're trying to learn more about the variables that affect the nicotine dosage a person receives from each cigarette smoked. Today, I'm going to ask you questions about the type of cigarettes that you smoke and how you usually smoke them. Then I'm going to explain our procedures for monitoring your smoking and show you how to use an electronic diary to record the time of day for every cigarette you smoke.

First, though, I need to give you this form that describes your rights and the things that you'll be asked to do during the study. Please read it over carefully, ask any questions that you have, then sign the form, indicating your consent to participate.

[*After completing consent form.*] OK, this copy is for you to keep.

Now we can get started. First, I need a description of the brand of cigarettes you smoke most frequently. Can you show me a pack? I'm going to record all the information here so that we can obtain tar and nicotine levels for your cigarette type.

[*Go through Interview Record Form items.*]

OK. Good. Now, I need to explain the procedures we're going to use to get an accurate assessment of your smoking. From the time you leave this interview until you come back next Thursday, you'll record each cigarette you smoke on this device. When you indicate that you are about to smoke a cigarette, this Electronic Diary (ED) will automatically store the time of day. This way, we'll know exactly how long you go between cigarettes.

ELECTRONIC DIARY (ED) TRAINING

The Electronic Diary (ED) [*Show ED to subject*] will record when you smoke. In addition, the ED will beep you throughout the day to make sure that you're carrying it with you. So, it's essential that you carry the ED at all times. We're not asking you to change your everyday smoking or activity patterns, just to carry the ED and record each cigarette you do smoke.

You'll need to respond to the ED on two types of occasions:

(1) when you smoke

(2) when the ED "beeps" you

In addition, you'll need to know how to put the ED to sleep and set the alarm when you go to bed at night. I'm going to show you how to do each of these things and also give you a sheet of directions to take with you.

[*Turn ED on and start training program. Training prompt will go off in 1 minute.*]

Key Pad Orientation

[*Show key pad to subject*]

ON - used to initiate any interaction

MODE - used to record responses or make choices

LEFT/RIGHT - used to see choices

So ON is how you start an interaction and MODE is what you use to enter your response onto the ED.

Responding to a Prompt

Up to 5 times a day the ED will prompt you by sounding a beep randomly. When the prompt sounds the ED display looks like this [*Wait for ED to begin prompting. Let subject hear both alarms.*] The ED will beep for a period of 2 minutes. If for some reason you do not hear the first beep, the ED changes its "beep" to a siren-like sound after 1 minute. If you do not respond to the second alarm, it will turn off and record that you have missed the prompt. We will keep track of how many prompts you miss, so you want to keep the number of missed prompts to a minimum.

To respond to a beep, simply press the ON during the alarm.

We want you to avoid missing prompts. To help do this you can:

(1) Place the ED on a hard surface (like a desk or a table) as much as possible since this increases the volume of the alarm.

(2) Keep the ED as close to you as possible so that the alarm will be audible at all times.

Recording a Cigarette

Just before smoking, press the ON key [*Have subject turn ED on.*]. The screen will look like this [*point to screen display of ED.*] The left and right arrows are used to move back and forth between different menu choices [*show on computer*]. Since the menu will show CIGARETTE after you press ON, all you have to do is press MODE to select the cigarette option. The M in the upper right-hand corner is a reminder to press MODE to register your choice. Press MODE and see what the ED displays:

Entry Complete

Recording...

This message indicates that your entry has been recorded and the ED is turning off. You should see this message at the end of every interaction you start with the ED. If you don't see it, you haven't finished.

Review basic steps - ON (initiation)
- make choice
- hit MODE

It's essential that you record ALL of your cigarettes just before you smoke. If you forget and start smoking, please record the cigarette as soon as you remember. If you remember within 5 minutes of actually smoking it, use the ED as I've just shown you. If more than 5 minutes has gone by, use this Error Card. The card has a place for the date and the time of day which you fill in and then just note "smoked cigarette." We have you use this instead of the ED because if you entered a forgotten cigarette an hour later, the ED record would show the wrong time.

Suspend

We recognize that it may sometimes be severely inconvenient to be "beeped" -- in situations like ceremonies or very important business meetings. So we've made it possible for you to suspend all prompts for up to 2 hours.

Putting the ED into Suspend mode stops the prompts but allows you to record cigarettes. So, if you're in a situation where you absolutely can't be beeped, set the ED on Suspend mode. Please, use this <u>only</u> when being prompted would be very disruptive.

To use the Suspend function [*Have subject use ED*]:

(1) Press ON to get Entry menu.

(2) Use the Right arrow key twice to select "Suspend."

(3) Press MODE to enter this Choice.

(4) The ED now displays "Time to Suspend." You have a choice of eight intervals ranging from 15 minutes to 2 hours. Using the LEFT/RIGHT arrow keys, select the desired Suspend interval. Press MODE to enter choice. The ED will remind you to "Record each Cigarette."

(5) Press MODE once and the ED reminds you to "Record each Cigarette."

(6) Press MODE a second time and the ED is in the Suspend mode.

At the end of the Suspend interval, the ED will sound the alarm in the same manner as a prompt. This signals the end of the Suspend mode and is a regular prompt. After responding to this prompt, the ED returns to normal functioning.

It's essential that you record your cigarettes even when you've suspended all prompts. The procedure for this is identical to recording a cigarette normally. [*Review cigarette entry.*]

Please use the suspend function as little as possible. When you do use Suspend, you want to make sure that you set it for long enough that the end-of-Suspend alarm doesn't go off in the middle of the very event you didn't want interrupted. When you use Suspend, it's a good idea to set it for more time than you think you'll need. Then, it's possible to get out of the Suspend mode when your circumstances change and prompting would no longer be a problem. We ask that you do interrupt the Suspend interval if you can respond to prompts before it's over.

To do this: [*Have subject use ED.*]

(1) Press ON. The ED will display the Choice menu.

(2) Use the Right arrow key to get to the "Resume" choice.

(3) Press MODE to enter this selection. The ED now displays the heading "Resuming normal operation."

(4) Press MODE and the ED is back to normal.

Sleep Timer

When you're ready to go to bed at night, you must put the ED "to sleep" also. Do this ONLY when you're going to sleep. You can set an alarm to wake you up in the morning, just like a clock radio.

[*Go through steps on Instruction Card, having subject follow with ED. Have subject set alarm for 2 minutes from current time on ED. Do not forget to mention:*]

- ED uses 24-hour time
- use left/right keys to switch from hours to min.
- use up/down keys to change time
- ED will not let you set a wake-up time of less than 30 minutes or more than 12 hours from the current time.

In the morning the ED will sound an alarm for a period of 2 minutes. Press the ON key and the ED will display a good morning message that looks like this. [*Wait for ED to being sounding the alarm.*]

If you do not want to get up immediately when the alarm sounds, you can sleep a little longer by using the ED's "Snooze" option. [*Have subject follow the steps on the Instruction Card.*] When the ED sounds the alarm, just press ON to get the Wake Up menu and then use the right arrow key to get to the Snooze option on the menu. The ED then displays "Minutes to Delay" and gives you a choice of 5, 10, 15, or 20 minutes to snooze. Use the LEFT/RIGHT arrow keys to select the snooze interval you want and press MODE to enter your selection.

When the snooze interval is over, you get the same beep as with the wake-up alarm and after pressing ON, you will see the regular Wake Up menu.

If you miss the alarm the first time, it will continue to "beep" you every 15 minutes until you respond to it. At any time during this period you can press ON, then MODE, and the ED will be ready to go.

Breaking Sleep Mode

If you wake up in the middle of the night to smoke, you need to wake up the ED so that you can record the cigarette. [*Have subject put ED to sleep according to a morning wake-up time.*] To wake the ED up early, press ON, then MODE. The ED is now awake. Record your cigarette as usual. Do not forget to put the ED back to sleep before you return to bed.

Oops! Function

If you press ON to record a cigarette or initiate a suspend and then change your mind, you can get out of the interaction by pressing the right arrow key until you see the OOPS! display. Press MODE and the ED will turn off without recording anything. The OOPS! function only works if you use it before pressing MODE. You cannot change an entry once you have hit MODE.

If you do make a mistake and enter wrong information on the ED or forget to enter a cigarette, you have a backup in the 3 X 5 card. Keep this card with you all the time. We hope that you will not make any mistakes in using the ED, but if you do, write the date and time on this card and indicate whatever happened. For example, you might have recorded a cigarette but then been interrupted and ended up not smoking it. Just write the time and date and note "Recorded cigarette but didn't smoke it." Or you might have awakened early and forgotten to wake up the ED. If this happens, write "Actual wake up time at ...." and then indicate the date and time to the best of your knowledge. It is important that you use this card to make any necessary corrections to the ED record. Be sure and record the date and time as well as the correction because we will be computing things such as time between cigarettes.

Summary

Although we have covered a fair amount, there are really just two basic things you need to know:

(1) - how to enter a cigarette and

(2) - how to respond to a prompt.

The two other ED functions we covered are:

- sleep timer
- suspend.

Now I'd like for you to show me that you know how to do each of these things. First, show me how you would record a cigarette...[*Check off skills on Interview Record Form.*]

Pledge

Do you have any questions about this? I'm going to ask you to sign this pledge saying that you will record each cigarette you smoke from the time you leave this office until you return for your interview next Thursday and that you will take good care of the ED.

As you can see, I'm sealing up the unit. Please only use the six exposed buttons on the top row. We are asking that you please do not open up the case. It would be very easy to accidentally wipe out our research data. Also, please do not:

--- lend the ED to others

--- let others use your ED

--- leave the ED anywhere.

Your second interview is scheduled for XXXXXXX. Is that still OK for you? You'll come back here and bring the ED with you. Your appointment time is written on the back of your Error Card. Please call us if you need to reschedule. Also on the back of your Error Card is a phone number and the name of someone you may call if any you have any questions or problems before returning next Thursday. Please call us immediately should any problems or questions arise.

At your second interview, we'll get the physiological measure of the nicotine dosage you experienced over the past few days.

After we've had a chance to check the data recorded on the electronic diary, we'll send you a check in compensation for your participation. You'll receive $45 for participating in all phases of the study and using the ED conscientiously every day. We're also giving a $5 bonus to subjects who are in the top 25% in terms of responding to all the beeps and minimizing the number of suspends. In addition, we'll prepare a record of your smoking for you so that you'll be able to see how long you go between cigarettes and the times of day when you smoke the most. Once the entire study is finished and the data are analyzed, we'll send you a record of your results and the study's findings.

INTERVIEW RECORD FORM

*Subject ID*_____

1. Cigarette Brand _____

   Length is _____ Regular/ King Size
   _____ 100 mm
   _____ 120 mm

   Softpack? _____ Yes
   _____ No

   Mentholated? _____ Yes
   _____ No

   "Lights"? _____ Yes
   _____ No

   Filtered? _____ Yes
   _____ No

2. How much of each cigarette usually smoke?
   _____ Less than 1/4
   _____ Between 1/4 and 1/2
   _____ Over 1/2
   _____ Most all of it

3. How often leave on ashtray?
   _____ Less than 1/4 time
   _____ Between 1/4 and 1/2
   _____ 1/2 or more of time
   _____ Almost every time

4. How much time between cigarettes? _____

5. How deeply inhale?
   _____ Just puff, don't really inhale at all
   _____ Inhale into the chest, but not too deeply
   _____ Inhale into the chest deeply

6. Are there restrictions on smoking at your place of work?
   _____ Yes Describe them _____
   _____ No

7. How often do you buy cigarettes?

_____ times per Day Week Month
[*circle one*]

8. Do you usually buy them by the carton or by the pack? [*circle one*]

Carton Pack

9. Do you use any tobacco other than cigarettes? _____ Yes

_____ No [Go to Q10]

Substance	Use	Inhale?	Weekly Frequency
Cigars/cigarillos	_____	___ Yes ___ No	_____ cigars
Pipe	_____	___ Yes ___ No	_____ bowls
Chewing tobacco	_____	NA	_____ can(s)
Nicorette gum	_____	NA	_____ sticks

10. Are you frequently exposed to passive smoking?

____ Yes Describe _____

____ No

11. Saturday/Sunday smoking compared to weekdays

_____ More on Saturday/Sunday
_____ Less on Saturday/Sunday
_____ About the same

12. Body Frame _____ Small
_____ Medium
_____ Large

13. Height _____ Weight _____ 100-125 lbs.
_____ 126-150
_____ 151-175
_____ 176-200
_____ 201-225
_____ 226-250
_____ 251-275
_____ 276-300
_____ Over 300

14. Second interview date/time _____

CHECK-OFF FOR ED USE SKILLS

1. Record a cigarette _____
2. Respond to a prompt _____
3. Set sleep timer _____
4. Set Suspend _____

Appendix III Study 1: Second interview protocols, by condition

INTERVIEW RECORD FORM

2-2-90

Condition: Study 1 **Free Strategy** Date:

Time:

S#: Interviewer:

I'm going to start by asking you some general questions about your background, just so that we'll be able to describe our participants.

[*Establish pacing typical of national surveys with these initial items.*]

Your current age:

Occupation:

Highest year of education completed:

Were you born in U.S.? What state?

Age at which you started smoking?

Are you married?

[*If yes*] Does your spouse smoke?

SMOKING FREQUENCY

Q1. How many cigarettes did you smoke yesterday? _____

Do you think that's the correct number or would you change it?

ADJUSTED TOTAL _____

STRATEGY REPORT

Q2. Now I'd like to ask you to think about <u>how</u> you answered the question about how many cigarettes you smoked. Can you describe what you were thinking from the time I asked the question until you gave your final answer of X cigarettes?

_____

_____

_____

Q3. [*Show strategy card.*] Here is a list of different methods people use to answer questions about how many cigarettes they smoke. Which of these is closest to what you did?

_____ 1 = Think of each individual event for the entire day and add up the total number.

_____ 2 = Divide the day up into parts (such as during work and after work); recall each individual event within each part; and then add up the total.

_____ 3 = Divide the day up into parts (such as during work and after work); rely on knowledge about how often I usually smoke during each part; and then add up the numbers to get a total.

_____ 4 = Give the first number that comes to mind, a gut reaction or guess.

_____ 5 = Rely on knowledge about my usual daily total for smoking.

_____ 6 = Make an inference from a fact I remembered (e.g., opening a new pack).

_____ 7 = A combination of the above. (Specify which ones and how they were combined.)

_____

_____ 8 = None of the above. (Describe how you did arrive at a number.)

CONFIDENCE ESTIMATE

Q4. How confident are you that the number of cigarettes you gave is correct?

_____ 1 = I think I could be off by more than 10 cigarettes.
_____ 2 = I think the number is off by 5-10 cigarettes.
_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.
_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.
_____ 5 = I think the number is off by no more than 1 cigarette.

MONDAY SMOKING

Now, I'd like you to try to remember your smoking on a different day. How many cigarettes did you smoke on Monday?

Q5. Number Cigarettes = _____

Do you think that's the correct number for Monday or would you change it?

ADJUSTED TOTAL _____

Q5a. How confident are you that the number of cigarettes you gave is correct?

_____ 1 = I think I could be off by more than 10 cigarettes.
_____ 2 = I think the number is off by 5-10 cigarettes.
_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.
_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.
_____ 5 = I think the number is off by no more than 1 cigarette.

SATURDAY SMOKING

Now, I'd like you to try to remember your smoking once more. How many cigarettes did you smoke on Saturday?

Q6. Number Cigarettes = _____

Do you think that's the correct number for Saturday or would you change it?

ADJUSTED TOTAL _____

Q6a. How confident are you that the number of cigarettes you gave is correct?

_____ 1 = I think I could be off by more than 10 cigarettes.
_____ 2 = I think the number is off by 5-10 cigarettes.
_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.
_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.
_____ 5 = I think the number is off by no more than 1 cigarette.

COLLECTION OF SALIVA

Turn off tape recorder. Have subject hold cotton in mouth for 5 minutes. Invite him/her to read own material or lab material. Offer drink of water afterward.

[*Turn tape recorder on.*] OK. Now I'd like to ask you a few questions about your experiences recording your cigarettes on the ED.

Q7. Was it difficult to remember to record your cigarettes?

_____ Yes
_____ No [*Go to Q9*]

Q8. What made it difficult?

_____

Q9. Were there some occasions when you had a cigarette and did not record it on the ED or the Error Card?

_____ Yes
_____ No [*Go to Q11*]

Q10. Please describe each one and tell me what day it happened.

_____
_____

Total not recorded per week _____ Total not recorded on target days:
_____ Wed _____ Mon _____ Sat

Q11. Do you think that you changed the number of cigarettes you were smoking because you were in this study?

_____ Yes
_____ No [Go to Q13]

Q12. How so?

_____ Cut down by _____ cigarettes a day
_____ Increased smoking by _____ cigarettes a day
_____ Other _____

Q13. While you were recording your cigarettes on the ED, did you think that you might be asked to remember how many cigarettes you smoked on a particular day?

_____ Yes
_____ No

[*Inform subject that after data are uploaded from the hand-held computer and checked for completeness, you'll send a check for participation and a printout of his/her smoking record. Remind subject that you'll also be sending a description of results after the whole study is completed.*]

Do you have any comments or questions for us?

Are there any changes in procedure you would suggest to make recording cigarettes easier or more efficient?

INTERVIEW RECORD FORM

2-2-90

Condition: Study 1 **Availability** Date:

S#: 21- Time:

Age: Interviewer:

STRATEGY PRACTICE

[*Turn on tape recorder.*] I'm going to ask you to try to answer some questions about how often you did certain things yesterday and I want you to try to give me as accurate an answer as you can. I also want you to arrive at your answer in a particular way.

When I ask you how often you did something...say getting into a car on a certain day...I want you to just give me your gut reaction, the first number that comes to you without trying to think of all the instances.

How many times did you get into a car yesterday?

Now, how many times did you make a phone call to someone?

Got into a Car _____ Made a Phone Call _____

SMOKING FREQUENCY

Now, I'd like you to try out this method once more. This time, tell me your gut reaction, how many cigarettes did you smoke yesterday?

Q1. Number Cigarettes = _____

Do you think that's the correct number for yesterday or would you change it?

ADJUSTED TOTAL _____

STRATEGY REPORT

Q2. Now I'd like to ask you to think about <u>how</u> you answered the question about how many cigarettes you smoked. Can you describe what you were thinking from the time I asked the question until you gave the final answer of X cigarettes?

_____

_____

Q3. [*Show strategy card.*] Here is a list of different methods people use to answer questions about how many cigarettes they smoke. Which of these is closest to what you did?

_____ 1 = Think of each individual event for the entire day and add up the total number.

_____ 2 = Divide the day up into parts (such as during work and after work); recall each individual event within each part; and then add up the total.

_____ 3 = Divide the day up into parts (such as during work and after work); rely on knowledge about how often I usually smoke during each part; and then add up the numbers to get a total.

_____ 4 = Give the first number that comes to mind, a gut reaction or guess.

_____ 5 = Rely on knowledge about my usual daily total for smoking

_____ 6 = Make an inference from a fact I remembered (e.g., opening a new pack).

_____ 7 = A combination of the above. (Specify which ones and how they were combined.)

_____

_____ 8 = None of the above. (Describe how you did arrive at a number.)

CONFIDENCE ESTIMATE

Q4. How confident are you that this number is correct? [*Show card.*]

_____ 1 = I think I could be off by more than 10 cigarettes.
_____ 2 = I think the number is off by 5-10 cigarettes.
_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.
_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.
_____ 5 = I think the number is off by no more than 1 cigarette.

MONDAY SMOKING

Now, I'd like you to try to remember your smoking again, using the same method, this time for Monday. Again, tell me your gut reaction, how many cigarettes did you smoke on Monday?

Q5. Number Cigarettes = _____

Do you think that's the correct number for Monday or would you change it?

ADJUSTED TOTAL _____

Q5a. How confident are you that this number is correct? [*Show card.*]

_____ 1 = I think I could be off by more than 10 cigarettes.
_____ 2 = I think the number is off by 5-10 cigarettes.
_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.
_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.
_____ 5 = I think the number is off by no more than 1 cigarette.

SATURDAY SMOKING

Now, I'd like you to try to remember your smoking one more time. Again, tell me your gut reaction, how many cigarettes did you smoke on Saturday?

Q6. Number Cigarettes = _____

Do you think that's the correct number for Saturday or would you change it?

ADJUSTED TOTAL _____

Q6a. How confident are you that this number is correct? [*Show card.*]

_____ 1 = I think I could be off by more than 10 cigarettes.
_____ 2 = I think the number is off by 5-10 cigarettes
_____ 3 = I think the number is off by no more than 4 or 5 cigarettes
_____ 4 = I think the number is off by no more than 2 or 3 cigarettes
_____ 5 = I think the number is off by no more than 1 cigarette.

COLLECTION OF SALIVA

Turn off tape recorder. Have subject hold cotton in mouth for 5 minutes. Invite him/her to read own material or lab material. Offer drink of water afterward.

[*Turn tape recorder on.*] OK. Now I'd like to ask you a few questions about your experiences recording your cigarettes on the ED.

Q7. Was it difficult to remember to record your cigarettes on the ED?

_____ Yes
_____ No [*Go to Q9*]

Q8. What made it difficult?

_____

Q9. Were there some occasions when you had a cigarette and did not record it on the computer or the ED?

_____ Yes
_____ No [*Go to Q11*]

Q10. Please describe each one and tell me what day it happened.

_____

_____

Total not recorded per week _____ Total not recorded on target days
Wednesday _____ Monday _____ Saturday _____

Q11. Do you think that you changed the number of cigarettes you were smoking because you were in this study?

_____ Yes
_____ No [Go to Q13]

Q12. How so?

_____ Cut down by _____ cigarettes a day

_____ Increased smoking by _____ cigarettes a day

_____ Other _____

Q13. While you were recording your cigarettes on the ED, did you think that you might be asked to remember how many cigarettes you smoked on a particular day?

_____ Yes

_____ No

[*Inform subject that after data are uploaded from the hand-held computer and checked for completeness, you'll send a check and a printout of his/her smoking record. Remind subject that you'll also be sending a description of results after the whole study is completed.*]

Do you have any comments or questions for us?

Are there any changes in procedure you would suggest to make recording cigarettes easier or more efficient?

2/2/90

INTERVIEW RECORD FORM

Condition: Study 1 **Additive Decomposition** Date:

S#: 21- Time:

Age: Interviewer:

STRATEGY PRACTICE

Turn on tape recorder.] I'm going to ask you to try to answer some questions about how often you did certain things yesterday and I want you to try to give me as accurate an answer as you can. I also want you to arrive at your answer in a particular way.

When I ask you how often you did something...say getting into a car on a specific day...I want you to first think about your typical day and divide your day up into parts. Then I'd like you to think about how often you usually do whatever it is we're talking about during each of those portions of your typical day. Finally, you should add up all the pieces to get a total for the day.

First, we have to figure out how to divide up your typical weekday.

OK, let's use these divisions to figure out how many times you got into a car yesterday. Typically, how often do you get into a car ...[*Using divisions subject selected*]. So that would be X times. Is that a good estimate for yesterday or would you change it? [*Allow subject to adjust estimate if desired.*]

Now I want you to figure out how many times you make a phone call to someone in a typical day, using the same method. So that makes Y times that you place a call to someone. Is that a good estimate for yesterday or would you change it?

	Day Divisions	Got into a Car	Made a Call
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____
8.	_____	_____	_____
	TOTAL	_____	_____

SMOKING FREQUENCY

Now I'd like you to use this method once more. This time, let's talk about how many cigarettes you smoke in a typical day. How many cigarettes do you typically smoke...[*Use first division, etc.*]

Day Divisions

1. _____ _____

2. _____ _____

3. _____ _____

4. _____ _____

5. _____ _____

6. _____ _____

7. _____ _____

8. _____ _____

9. _____ _____

10. _____ _____

Q1. TOTAL (Sum of 1-10) _____

OK, so that equals X cigarettes on a typical day. Do you think that's the right number for yesterday or would you change it?

ADJUSTED TOTAL _____

STRATEGY REPORT

Q2. Now I'd like to ask you to think about how you answered the smoking question about how many cigarettes you smoked. Can you describe what you were thinking from the time I asked the question until you gave your final answer of X cigarettes?

_____

_____

Q3. [*Show strategy card.*] Here is a list of different methods people use to answer questions about how many cigarettes they smoke. Which of these is closest to what you did?

_____ 1 = Think of each individual event for the entire day and add up the total number.

_____ 2 = Divide the day up into parts (such as during work and after work); recall each individual event within each part; and then add up the total.

_____ 3 = Divide the day up into parts (such as during work and after work); rely on knowledge about how often I usually smoke during each part; and then add up the numbers to get a total.

_____ 4 = Give the first number that comes to mind, a gut reaction or guess.

_____ 5 = Rely on knowledge about my usual daily total for smoking

_____ 6 = Make an inference from a fact I remembered (e.g., opening a new pack).

_____ 7 = A combination of the above. (Specify which ones and how they were combined.)

_____

_____ 8 = None of the above. (Describe how you did arrive at a number.)

CONFIDENCE ESTIMATE

Q4. How confident are you that the number of cigarettes you gave is correct? [*Show card.*]

_____ 1 = I think I could be off by more than 10 cigarettes.
_____ 2 = I think the number is off by 5-10 cigarettes.
_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.
_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.
_____ 5 = I think the number is off by no more than 1 cigarette.

MONDAY SMOKING

Now, I'd like you to try to remember your smoking on a different day, again using the same method, this time for Monday. Was Monday a typical day for you? [*If yes*] Well, on a typical day you said that you [*recap subtotals*] for a total of X cigarettes. Do you think that's the correct number for Monday? [*If Monday atypical, get new divisions and go through additive decomp procedure as for Wed.*]

Q5. ADJUSTED MON TOTAL = _____

Q5a. How confident are you that the number of cigarettes you gave is correct? [*Show card.*]

_____ 1 = I think I could be off by more than 10 cigarettes.
_____ 2 = I think the number is off by 5-10 cigarettes.
_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.
_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.
_____ 5 = I think the number is off by no more than 1 cigarette.

SATURDAY SMOKING

Now, I'd like you to try to remember your smoking once more. Again, think about how much you smoke in each part of your day, but this time I want to know about Saturday, so you may need to divide your day differently. [*Get new divisions and go though additive decomp*]

Q6. Number Cigarettes = _____

Do you think that's the correct number for Saturday or would you change it?

ADJUSTED SAT TOTAL _____

Q6a. How confident are you that the number of cigarettes you gave is correct? [*Show card.*]

_____ 1 = I think I could be off by more than 10 cigarettes.
_____ 2 = I think the number is off by 5-10 cigarettes.
_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.
_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.
_____ 5 = I think the number is off by no more than 1 cigarette.

COLLECTION OF SALIVA

Turn off tape recorder. Have subject hold cotton in mouth for 5 minutes. Invite him/her to read own material or lab material. Offer drink of water afterward.

[*Turn tape recorder on.*] OK. Now I'd like to ask you a few questions about your experiences recording your cigarettes on the ED.

Q7. Was it difficult to remember to record your cigarettes?

_____ Yes
_____ No [*Go to Q9*]

Q8. What made it difficult?

_____

Q9. Were there some occasions when you had a cigarette and did not record it on the ED or on the Error Card?

_____ Yes
_____ No [*Go to Q11*]

Q10. Please describe each one and tell me what day it happened.

_____

_____

Total not saved per week _____ Total not saved on each target day _____ (Wed) _____ (Mon) _____ (Sat)

Q11. Do you think that you changed the number of cigarettes you were smoking because you were in this study?

_____ Yes

_____ No [*Go to Q13*]

Q12. How so?

_____ Cut down by _____ cigarettes a day

_____ Increased smoking by _____ cigarettes a day

_____ Other _____

Q13. While you were recording your cigarettes on the ED, did you think that you might be asked to remember how many cigarettes you smoked on a particular day?

_____ Yes

_____ No

[*Inform subject that after data are uploaded from the hand-held computer and checked for completeness, you'll send a check and a printout of his/her smoking pattern. Remind subject that you'll also be sending a description of results when the whole study is completed.*]

Do you have any comments or questions for us?

Are there any changes in procedure you would suggest to make recording cigarettes easier or more efficient?

INTERVIEW RECORD FORM

2-2-90

Condition: Study 1 **Episodic** Date:

S#: 21- Time:

Age: Interviewer:

STRATEGY PRACTICE

[*Turn on tape recorder.*] I'm going to ask you to try to answer some questions about how often you did certain things yesterday and I want you to try to give me as accurate an answer as you can. I also want you to arrive at your answer in a particular way.

When I ask you how often you did something...say getting into a car...I want you to think through the day from beginning to end and try to remember each instance...every time you got into a car on that day. After you've recalled all the instances, we can add them up to figure out how many there were. OK. Are you ready to try it?

Think about the times you got into a car on Saturday. Tell me about each time you can remember. [*Pause for S recall.*] So that was X times in all.

Now, let's try the method again. This time, think about the times you made a phone call to someone yesterday. Tell me about each one starting at the beginning of the day. [*Pause*] So that makes Y times in all.

Incidents	Got into a Car	Made a Call
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____
7.	_____	_____
8.	_____	_____
9.	_____	_____
10.	_____	_____
TOTAL	_____	_____

SMOKING FREQUENCY

Now I'd like you to try out this method once more. This time, I want you to figure out how many cigarettes you smoked yesterday. Again, go through the day from the beginning and tell me about each cigarette you smoked.

Instance

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Q1. So that makes.... TOTAL _____

Would you say that X is the right number for how many cigarettes you smoked yesterday or would you change it?

ADJUSTED TOTAL _____

STRATEGY REPORT

Q2. Now I'd like to ask you to think about how you answered the question about how many cigarettes you smoked. Can you describe what you were thinking from the time I asked the question until you gave your final answer of X cigarettes?

_____

_____

Q3. [*Show strategy card.*] Here is a list of different methods people use to answer questions about how many cigarettes they smoke. Which of these is closest to what you did?

_____ 1 = Think of each individual event for the entire day and add up the total number.

_____ 2 = Divide the day up into parts (such as during work and after work); recall each individual event within each part; and then add up the total.

_____ 3 = Divide the day up into parts (such as during work and after work); rely on knowledge about how often I usually smoke during each part; and then add up the numbers to get a total.

_____ 4 = Give the first number that comes to mind, a gut reaction or guess.

_____ 5 = Rely on knowledge about my usual daily total for smoking.

_____ 6 = Make an inference from a fact I remembered (e.g., opening a new pack).

_____ 7 = A combination of the above. (Specify which ones and how they were combined.)

_____

_____ 8 = None of the above. (Describe how you did arrive at a number.)

CONFIDENCE ESTIMATE

Q4. How confident are you that the number of cigarettes you gave is correct?

_____ 1 = I think I could be off by more than 10 cigarettes.

_____ 2 = I think the number is off by 5-10 cigarettes.

_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.

_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.

_____ 5 = I think the number is off by no more than 1 cigarette.

MONDAY SMOKING

Now, I'd like you to try to remember your smoking again, using the same method, this time for Monday. Can you remember Monday? Something particular that happened that day? Again, I want you to go through the day from beginning to end, remembering each time you smoked.

Instance

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Q5. So that makes.... MON TOTAL _____

Do you think that's the correct number for Monday or would you change it?

ADJUSTED MON TOTAL _____

Q5a. How confident are you that the number of cigarettes you gave is correct?

_____ 1 = I think I could be off by more than 10 cigarettes.

_____ 2 = I think the number is off by 5-10 cigarettes.

_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.

_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.

_____ 5 = I think the number is off by no more than 1 cigarette.

SATURDAY SMOKING

Now, I'd like you to try to remember your smoking one more time. Again, I want you to go through the day from beginning to end, remembering each time you smoked. How many cigarettes did you smoke on Saturday?

Instance

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Q6. So that makes.... SAT TOTAL _____

Do you think that's the correct number for Saturday or would you change it?

ADJUSTED SAT TOTAL _____

Q6a. How confident are you that the number of cigarettes you gave is correct?

_____ 1 = I think I could be off by more than 10 cigarettes.
_____ 2 = I think the number is off by 5-10 cigarettes.
_____ 3 = I think the number is off by no more than 4 or 5 cigarettes.
_____ 4 = I think the number is off by no more than 2 or 3 cigarettes.
_____ 5 = I think the number is off by no more than 1 cigarette.

COLLECTION OF SALIVA

Turn off tape recorder. Have subject hold cotton in mouth for 5 minutes. Invite him/her to read own material or lab material. Offer drink of water afterward.

[*Turn tape recorder on.*] OK. Now I'd like to ask you a few questions about your experiences recording your cigarettes on the ED.

Q7. Was it difficult to remember to record your cigarettes on the ED?

_____ Yes
_____ No [*Go to Q9*]

Q8. What made it difficult?

_____

Q9. Were there some occasions when you had a cigarette and did not record it on the ED or on the Error Card?

_____ Yes
_____ No [*Go to Q11*]

Q10. Please describe each one and tell me what day it happened.

_____
_____

Total not recorded per week _____ Total not recorded on target days
_____ Wednesday _____ Monday _____ Saturday

Q11. Do you think that you changed the number of cigarettes you were smoking because you were in this study?

_____ Yes
_____ No [Go to Q13]

Q12. How so?

_____ Cut down by _____ cigarettes a day

_____ Increased smoking by _____ cigarettes a day

_____ Other _____

Q13. While you were recording your cigarettes on the ED, did you think that you might be asked to remember how many cigarettes you smoked on a particular day?

_____ Yes

_____ No

[*Inform subject that after data are uploaded from the hand-held computer and checked for completeness, you'll send a check and a printout of his/her smoking record. Remind subject that you'll also be sending a description of results after the whole study is completed.*]

Do you have any comments or questions for us?

Are there any changes in procedure you would suggest to make recording cigarettes easier or more efficient?

Appendix IV
Study 2: Interview protocols, by condition

INTERVIEW RECORD FORM

Condition: Study 2 **Neutral** Date:

S#: Interviewer:

Sex: Site:

Age:

Marital Status:

Highest Year of Education:

Born in U.S.?

Father born in U.S.?

Mother born in U.S.?

SMOKING FREQUENCY

1. Do you smoke?

Yes

No

[*If yes*] The NCHS is seeking detailed knowledge of how many cigarettes people smoke. I'm going to ask you about the number of cigarettes you smoked yesterday. I'd like you to think about it and give me as exact an answer as you can.

2. [*For smokers*] How many cigarettes did you smoke yesterday?

_____

HEALTH ACTIVITIES

I'm going to show you a list of some practices that contribute to good health. I'd like you to look at the list and tell me which of these things you usually do as much or more than most people.

3. Activities

_____ Eat fresh fruit and vegetables

_____ Take vitamin & mineral supplements

_____ Drink plenty of water

_____ Get exercise

_____ Not drink in excess or not at all

_____ Avoid fatty foods

_____ Keep a regular schedule of going to bed & getting up

_____ Have a period of relaxation at least 1 X per day

_____ Avoid staying out in the sun a long time without sunscreen or lotion

_____ Include whole grains & fibre in your diet

4. Currently, are you living alone?

   _____ Yes [*Go to Q7*]
   _____ No

5. How many people age 18 or older are living with you? _____

6. Of these people, how many smoke? _____

7. How many of your friends smoke?

   _____ None of them

   _____ A few of them

   _____ About 1/2 of them

   _____ Most of them

   _____ All or nearly all of them

8. Are you employed or going to school?

   _____ Yes

   _____ No [*Go to Q11*]

9. In your present job (or at your school), are there restrictions on smoking?

   _____ No, smoking is allowed anywhere and at any time

   _____ Yes [Mark all that apply, below.]

   _____ Smoking is allowed only at certain times

   _____ Smoking is allowed only in certain places

   _____ Smoking is not allowed at all

10. In your present job (or at your school), how many of your co-workers (or fellow students) smoke?

_____ None of them

_____ A few of them

_____ About 1/2 of them

_____ Most of them

_____ All or nearly all of them

11. [*For smokers*] What do you usually do when you are in a public place that has no rules about smoking?

_____ Light up a cigarette if I want to

_____ Look around to see if others are smoking and then light up if I want to

_____ Ask others if they would mind if I smoke

_____ Just not smoke

_____ Something else [describe] _____

12. As part of our study, we are examining the saliva of people who smoke and people who don't smoke to compare it for cotinine, a nicotine byproduct. Would you be willing to give us a sample? This card explains what's involved. [*Show card explaining procedures*]

Sample Requested _____

Sample Supplied _____

Sample Refused _____

INTERVIEW RECORD FORM

Condition: Study 2 **Stress**

Date:

S#:

Interviewer:

Sex:

Site:

Age:

Marital Status:

Highest Year of Education:

Born in U.S.?

Father born in U.S.?

Mother born in U.S.?

SMOKING FREQUENCY

When we interview people about their health habits, we find that many people's habits are shaped by stress. When they encounter tension on the job or at home, they respond by taking a drinking, smoking a cigarette, or eating something fattening.

Do you find that there are times when stress triggers such behaviors for you?

Yes
No

1. Do you ever smoke cigarettes because of stress?

Yes

No

[*If no*] Do you ever smoke cigarettes at all?

Yes
No

[*If yes*] The NCHS is seeking detailed knowledge of how many cigarettes people smoke. I'm going to ask you about the number of cigarettes you smoked yesterday. I'd like you to think about it and give me as exact an answer as you can.

2. [*For smokers*]How many cigarettes did you smoke yesterday?

_____

HEALTH ACTIVITIES

I'm going to show you a list of some practices that contribute to good health. [*Show response card*] I'd like you to look at the list and tell me which of these things you usually do as much or more than most people.

3. Activities

_____ Eat fresh fruit & vegetables

_____ Take vitamin & mineral supplements

_____ Drink plenty of water

_____ Get exercise

_____ Not drink in excess or not at all

_____ Avoid fatty foods

_____ Keep a regular schedule of going to bed and getting up

_____ Have a period of relaxation at least 1X per day

_____ Avoid staying out in the sun a long time without sunscreen or lotion

_____ Include whole grains & fibre in your diet

4. Currently, are you living alone?

_____ Yes [*Go to Q7*]

_____ No

5. How many people age 18 or older are living with you? _____

6. Of these people, how many smoke? _____

7. How many of your friends smoke?

_____ None of them

_____ A few of them

_____ About 1/2 of them

_____ Most of them

_____ All or nearly all of them

8. Are you employed or going to school?

_____ Yes

_____ No [*Go to Q12*]

9. In your present job (or at your school), are there restrictions on smoking?

_____ No, smoking is allowed anywhere and at any time

_____ Yes [Mark all that apply, below.]

_____ Smoking is allowed only at certain times

_____ Smoking is allowed only in certain places

_____ Smoking is not allowed at all

10. In your present job (or at your school), how many of your co-workers (or fellow students) smoke?

_____ None of them

_____ A few of them

_____ About 1/2 of them

_____ Most of them

_____ All or nearly all of them

11. [*For smokers*] What do you usually do when you are in a public place that has no rules about smoking?

_____ Light up a cigarette if I wanted to

_____ Look around to see if others were smoking and then light up if I wanted to

_____ Ask others if they would mind if I smoked

_____ Just not smoke

_____ Something else [describe] _____

12. As part of our study, we are examining the saliva of people who smoke and people who don't smoke to compare it for cotinine, a nicotine byproduct. Would you be willing to give us a sample? This card explains what's involved. [*Show card explaining procedures*]

Sample Requested _____

Sample Supplied _____

Sample Refused _____

INTERVIEW RECORD FORM

Condition: Study 2 Health

Date:

S#:

Interviewer:

Sex:

Site:

Age:

Marital Status:

Highest Year of Education:

Born in U.S.?

Father born in U.S.?

Mother born in U.S.?

HEALTH ACTIVITIES

I'm going to show you a list of some practices that contribute to good health. [*Show interview card*] I'd like you to look at the list and tell me which of these things you usually do as much or more than most people.

1. Activities

		Benefit?	How?
_____	Eat fresh fruit & vegetables	___	_____
_____	Take vitamin & mineral supplements	___	_____
_____	Drink plenty of water	___	_____
_____	Get exercise	___	_____
_____	Not drink in excess of not at all	___	_____
_____	Avoid fatty foods	___	_____
_____	Keep a regular schedule of going to bed & getting up	___	_____
_____	Have period of relaxation at least 1 X per day	___	_____
_____	Avoid staying out in the sun a long time without sunscreen or lotion	___	_____
_____	Include whole grains & fibre in your diet	___	_____

SMOKING FREQUENCY

2. Do you smoke?

Yes
No

[*If yes*] The NCHS is seeking detailed knowledge of how many cigarettes people smoke. I'm going to ask you about the number of cigarettes you smoked yesterday. I'd like you to think about it and give me as exact an answer as you can.

3. How many cigarettes did you smoke yesterday?

SMOKING ENVIRONMENT

4. Currently, are you living alone?

_____ Yes [*Go to Q7*]
_____ No

5. How many people age 18 or older are living with you? _____

6. Of these people, how many smoke? _____

7. How many of your friends smoke?

_____ None of them

_____ A few of them

_____ About 1/2 of them

_____ Most of them

_____ All or nearly all of them

8. Are you employed or going to school?

_____ Yes
_____ No [*Go to Q11*]

9. In your present job (or at your school), are there restrictions on smoking?

_____ No, smoking is allowed anywhere and at any time

_____ Yes [Mark all that apply, below.]

_____ Smoking is allowed only at certain times
_____ Smoking is allowed only in certain places
_____ Smoking is not allowed at all

10. In your present job (or at your school), how many of your co-workers (or fellow students) smoke?

_____ None of them

_____ A few of them

_____ About 1/2 of them

_____ Most of them

_____ All or nearly all of them

11. [*For smokers*] What do you usually do when you are in a public place that has no rules about smoking and you want to smoke?

_____ Light up a cigarette if I wanted to

_____ Look around to see if others were smoking and then light up if I wanted to

_____ Ask others if they would mind if I smoked

_____ Just not smoke

_____ Something else [describe] _____

12. As part of our study, we are examining the saliva of people who smoke and people who don't smoke to compare it for cotinine, a nicotine byproduct. Would you be willing to give us a sample? This card explains what's involved. [*Show card explaining procedures*]

Sample Requested _____

Sample Supplied _____

Sample Refused _____

Appendix V
Study 3: Subject locating and recruitment procedures

Recruitment of subjects

Initially, a list of possible respondents was made from the 1982 SRI Smoking Study of approximately 2,000 respondent-record files. Since the current study would attempt to ask respondents to remember past events from 8 to 14 years prior, eligibility was based upon respondents having indicated at least one or more *significant* attempts to quit smoking during the 5 years prior to participating in the 1982 study. ("Significant" was at first defined as at least one 6-month period of smoking cessation. Later, to recruit a sufficient number of respondents, "significant" was redefined to be any cessation attempt no longer than 5 years prior.) Of the previous participants, 131 were determined eligible to participate in the new study.

Respondents were recruited from August 1989 to October 1990. Because the last known address and phone numbers of the former study were an average of 8 years old, there was some difficulty in reaching potential participants.

The first step in locating potential respondents was to try reaching them by phone at home or at work. About two-thirds of the 76 respondents were reached at an old phone number, with an average of about 4 attempts per respondent. Although all phone numbers on file were tried, directory assistance was used to confirm the number, or to list a possible alternate number if the one on file was found to be incorrect or disconnected. About one-third of those located for interview were found either through directory assistance under their name or possible relatives' names, or from information obtained from former coworkers at an old place of employment. Approximately 10 to 12 phone calls per respondent were needed to finally reach this group.

If a potential respondent was unreachable by phone, an attempt was made to contact the person by mail. However, this method proved to be unsuccessful. Aside from the initial phone attempt and the letter, an attempt was made to locate respondents through the local voters' registrar from three counties. One respondent was located as a result of this effort.

When the respondent was reached, the research assistant introduced herself and briefly explained that he or she was being contacted because of his or her participation in a previous study done at SRI a number of years ago. The assistant would not mention the year of the previous study but explained that the current study was related but not a followup. However, recruitment of respondents for the pilot study did mention their year of participation in the 1982 SRI Smoking Study. Respondents were asked to participate in a one-time interview to discuss their smoking behavior prior to their participation in the previous study. They were told that the interview could be scheduled at a time and place convenient for them and that it would take no more than 45 minutes. The SRI's research assistant explained interest in seeing how much people can remember about their smoking over a long period and what cues trigger recall. The respondents were instructed not to look at any records or to do any checking on their past smoking history prior to the interview.

Results of recruitment

Of the 131 possible respondents, 3 were deceased, 3 had moved out of the area, and 2 refused to participate. (It is worth noting that the two refusals came from current smokers.) Another 45 respondents were determined lost because they could not be reached by phone, mail, or the voters' registrar. One respondent was in poor health and unable to participate, and one was willing to participate but was never scheduled. During the pilot study in 1988–89, 20 respondents were interviewed, and 56 respondents were scheduled during the main period of data collection in 1989–90.

Appendix VI
Study 3: Interview protocols, by condition

INTERVIEWER RECORD FORM

7/27/89

Condition: Study 3 **Experimental** Date:

S#: Interviewer:

Sex:

DOB:

INTRODUCTION

As you answer these questions, I want you to think aloud. Tell me everything that comes into your mind. I'm just as interested in how you remember things as I am in what you remember. OK, first off...

1982 SMOKING CESSATION

I'd like to ask you about your smoking in the past. Do you remember taking part in a stop smoking program and becoming a subject in SRI's Smoking Research Project? You participated in several interviews held by SRI...

1. I want you to think back to the period in your life when you joined the quit smoking program just before participating in the SRI study. How well do you remember that period? [*pause*] Do you remember where you were living and what you were doing at the time? [*Prompt to think aloud*]

   When you took part in the program, what was happening in your life that made you want to stop smoking? [*Probe for a specific event.*]

   _____

   _____

2. These are some reasons people typically give for trying to stop smoking. [*Give STOP card to read.*] Which of these reasons apply to your attempt to stop smoking when you joined the ___ program? [*Mark all that apply*]

   a. Experienced some problems related to smoking (cough, shortness of breath, etc.) _____

   b. Felt I'd get benefit from a more active life, which smoking hinders _____

   c. Concerned about the possibility of lung cancer _____

   d. My physician advised me to quit _____

   e. Realized need for changing my lifestyle & quitting smoking was part of that _____

   f. Some of my friends convinced me of the value of quitting _____

g. Was experiencing some tension with friends and/or relatives & thought quitting smoking might lessen it _____

h. Concerned about the possibility of heart disease _____

i. Wanted to be a good example to those important to me by not smoking _____

j. Thought cigarette smoking was too much a dirty habit _____

k. Wanted to quit smoking to show that I have power & control over my actions _____

l. Someone important to me wanted me to quit smoking _____

3. Can you remember the stop-smoking program you were in before starting the SRI study? What kind was it (who offered it)?

ACS ALA SmokEnders Other _____

4. When you started the ____ stop smoking program, were you living alone?

Yes
No How many people age 18 or older were living with you? _____

Who was this? _____

Did he/she/any of them smoke cigarettes?

_____ No. adult smokers

5. Did the people you were living with make it easier or harder to give up smoking? [*Get description in subject's words; probe as needed.*]

_____

_____

[*Show DIFFICULTY Card <u>after</u> getting verbatim response for Qs 5, 9, & 11.*]
These are some standard categories for describing how others affected your attempt to stop smoking. Which of these statements best describes the people you were living with when you joined the ____ stop smoking program?

_____ They made it much more difficult

_____ They made it somewhat more difficult

_____ They made it somewhat easier

_____ They made it much easier

6. How much were you smoking in the month prior to participation in the stop-smoking program? [*Get open response then use scale below*]

_____ Less than 1/2 pack per day
_____ 1/2 to 1 pack per day
_____ 1 to 1-1/2 pack per day
_____ 1-1/2 to 2 packs per day
_____ 2 to 2-1/2 packs per day
_____ More than 2-1/2 packs per day

7. What kind of cigarettes were you smoking? _____
(brand)

Length (circle one)
Regular
King
100 mm
120 mm

Mentholated? Yes No

"Lights"? Yes No

[*If a SmokEnders participant, get brand before & during program.*]

8. Thinking back to the people who were your friends at the time, did they tend to be smokers or nonsmokers? [*Possible probe: Do you remember particular friends smoking or not smoking?*]

_____

So how many of your friends would you say smoked at that time? [*Read & show PROPORTION card.*]

_____ None of them
_____ A few of them
_____ Most of them
_____ All or nearly all of them

9. Did your friends make it easier or harder to give up smoking? [*Possible probes: How did they react when you smoked? How did you feel seeing them smoke while you were trying to stop?*]

_____

Which of these categories best describes the effect your friends had on your efforts to stop smoking? [*Read & show DIFFICULTY card.*]

_____ They made it much more difficult
_____ They made it somewhat more difficult
_____ They made it somewhat easier
_____ They made it much easier

10. At that time, were you working?

_____ Yes _____ No [*Skip to Q12*]

How about your co-workers? Did they tend to be smokers? [*Possible probe: Who were the smokers among your co-workers*]

_____

So how many of your co-workers would you say smoked? [*Read & show PROPORTION card.*]

_____ None of them

_____ A few of them

_____ Most of them

_____ All or nearly all of them

11. Did your co-workers make it easier or harder to give up smoking? [*Get open response & then use DIFFICULTY card.*]

_____

_____ They made it much more difficult

_____ They made it somewhat more difficult

_____ They made it somewhat easier

_____ They made it much easier

12. Earlier you said that you joined the stop smoking program because [*Mention reason and any specific events cited in Q2*] Looking at this calendar [*show calendar*], can you show me the month and year when you stopped smoking as part of the ____ program?

_____ (mo./yr. stopped)

13. After participating in the program, did you ever smoke again?

Yes No

13b. [*If "yes"*] What made you start smoking again?

_____

_____

13c. [*If applicable*] In what month did you start smoking again?

_____ (mo. restarted)

OTHER SMOKING CESSATION ATTEMPTS

Now I want to have you think about your smoking during a longer period. Specifically, I'm going to ask about all your other attempts to stop smoking when stayed off cigarettes for a week or more during the period from 1977 until 198_ [*year of program or year after if didn't stop for good then*]

As you answer these questions, I want you to continue to think aloud, telling me everything that comes into your head. First, can you remember what you were doing in 1977 . . . where you were living and what you were doing at work or at home? [*pause until subject reports*]

OK, so I want you to think about your life between when [*whatever said doing in 1977*] until 198_ when you were [*whatever told you earlier was doing when entered stop smoking program*].

Think about an attempt to stop smoking (other than the one in 198X that you've already described) when you stayed off cigarettes for a week or more. [*pause*] Do you have a particular attempt in mind?

14. Tell me, at that time WHY did you try to stop smoking? [*Complete Qs 14-18 for Time 1, then recycle for Time 2, etc.*]

	Time 1	Time 2	Time 3
Verbatim Reason Stopped	_____	_____	_____
	_____	_____	_____

15. What did you do to try to stop smoking? [*Record verbatim response*]

	Time 1	Time 2	Time 3
Verbatim method	_____	_____	_____
	_____	_____	_____

16. These are some methods for quitting that we ask everyone about. Which of these statements describe techniques you used to try to stop smoking that time? [*Show METHOD card. More than one may be marked.*]

a. Drugstore remedy (Nicoban, One-Step-at-a-Time, Bantron)	_____	_____	_____
b. Health Association Program (Five-Day Plan, American Heart Assoc., Amer. Cancer Society)	_____	_____	_____
c. Commercial program (Schick, SmokEnders)	_____	_____	_____
d. Individual counseling/ private therapy	_____	_____	_____

e. Group therapy	_____	_____	_____
f. Hypnosis	_____	_____	_____
g. Quit on own	_____	_____	_____

17. [*Unless final quit*] After this period of not smoking, what made you start smoking again?

	Time 1	Time 2	Time 3
Verbatim reason restarted	_____	_____	_____
	_____	_____	_____

These are some reasons people start smoking after quitting. Which of these reasons describe why you started smoking again? [*Show RESTART card. More than one may be marked.*]

Restart Reason Checklist

	Time 1	Time 2	Time 3
a. Problems in personal life	_____	_____	_____
b. Pressure from family/friends to start again	_____	_____	_____
c. Pressure on job	_____	_____	_____
d. Withdrawal symptoms	_____	_____	_____
e. Desire for cigarettes remained high	_____	_____	_____
f. Learned that your health was not affected by smoking	_____	_____	_____
g. Gaining weight	_____	_____	_____
h. Smoked without remembering resolution to quit	_____	_____	_____
i. Quitting smoking was disrupting life	_____	_____	_____
j. Found enjoyed smoking too much and nothing else was a good substitute	_____	_____	_____
k. Boredom	_____	_____	_____
l. Other	_____	_____	_____

18. [*Show calendar*] Now I'd like you to try to recall WHEN this period of not smoking took place. When did you stop smoking? How long did you stay off cigarettes? When did you start again?

Dates of Not Smoking	Time 1	Time 2	Time 3
a. Stopped (mo/yr)	_____	_____	_____
b. Time off cigarettes (mos.)	_____	_____	_____
c. Restarted (mo/yr)	_____	_____	_____

19. Were there any other attempts to stop smoking you haven't told me about, between 1977 and 198X? [*If subject says yes, repeat items 14 - 18 using next column. Go to Supplement if necessary.*]

RECAP

Sometimes people realize they've recalled something incorrectly after recalling more details, so lets check the smoking history we have for you between 1977 and 198_. In 1977 you were smoking and you smoked until... [*Recap reported periods of smoking and nonsmoking, including events causing a change in smoking status, in chronological order*]. Would you make any changes in this history?

CURRENT SMOKING

20. [*Choose appropriate version*] Do you now smoke cigarettes? *or* And you told me you quit for good so you do not now smoke cigarettes.

_____ Yes [*If current smoker*] How many cigarettes do you smoke in a typical day?

_____ cigarettes per day

_____ No [*Pick appropriate question format*]

When did you give up cigarettes for good?
or
So you quit for good in . . .

_____ mo/yr stopped for good

14. Tell me, at that time WHY did you try to stop smoking? [*Complete Qs 14-18 for Time 4, then recycle for Time 5, etc.*]

	Time 4	Time 5	Time 6
Verbatim Reason Stopped	_____	_____	_____
	_____	_____	_____

15. What did you do to try to stop smoking? [*Record verbatim response*]

	Time 4	Time 5	Time 6
Verbatim method	_____	_____	_____
	_____	_____	_____

16. Which of these statements match the method you used to try to stop smoking that time? [*Show METHOD card. More than one may be marked.*]

a. Drugstore remedy (Nicoban, One-Step-at-a-Time, Bantron)	_____	_____	_____
b. Health Association Program (Five-Day Plan, American Heart Assoc., Amer. Cancer Society)	_____	_____	_____
c. Commercial program (Schick, SmokEnders)	_____	_____	_____
d. Individual counseling/ private therapy	_____	_____	_____
e. Group therapy	_____	_____	_____
f. Hypnosis	_____	_____	_____
g. Quit on own	_____	_____	_____

17. [*Unless final quit*] After quitting this time, what made you start smoking again?

	Time 4	Time 5	Time 6
Verbatim reason restarted	_____	_____	_____
	_____	_____	_____

Which of these reasons describe why you started smoking again? [*Show restart list. More than one may be marked.*]

	Time 4	Time 5	Time 6
a. Problems in personal life	_____	_____	_____
b. Pressure from family/friends to start again	_____	_____	_____
c. Pressure on job	_____	_____	_____
d. Withdrawal symptoms	_____	_____	_____
e. Desire for cigarettes remained high	_____	_____	_____
f. Learned that your health was not affected by smoking	_____	_____	_____
g. Gaining weight	_____	_____	_____
h. Smoked without remembering resolution to quit	_____	_____	_____
i. Quitting smoking was disrupting life	_____	_____	_____
j. Found enjoyed smoking too much and nothing else was a good substitute	_____	_____	_____
k. Boredom	_____	_____	_____
l. Other	_____	_____	_____

18. [*Show calendar*] Now I'd like you to try to recall WHEN this period of not smoking took place. When did you stop smoking? How long were you off cigarettes? When did you start again?

Dates of Not Smoking	Time 4	Time 5	Time 6
a. Stopped (mo/yr)	_____	_____	_____
b. Time off cigarettes (mos.)	_____	_____	_____
c. Restarted (mo/yr)	_____	_____	_____

Were there any other times you haven't told me about, between 1977 and 198_, when you tried to stop smoking and stayed off cigarettes for more than one week? [*If subject says yes, repeat items 14 - 18 using next column.*]

INTERVIEWER RECORD FORM

8/1/89

Condition: Study 3 Control

Date:

S#:

Interviewer:

Sex:

DOB:

SMOKING CESSATION ATTEMPTS

I'm going to ask you about all the times you tried to stop smoking and stayed off cigarettes for a week or more during the period from 1977 until 198_ [*year after participation in the stop smoking program*].

1. How many times between 1977 and 198_ did you try to stop smoking and stay off cigarettes for a week or more? _____

2. When was your last attempt to stop during this period? [*Show calendar*]

   What month and year did you stop? [mo/yr] _____

   Did you start smoking again? _____ Yes When? [mo/yr] _____

   _____ No [*Go to Q4*]

   How long were you off cigarettes? [in mos.] _____

3. Was that the longest you ever stayed off cigarettes between 1977 and 19__?

   _____ Yes [*Go to Q4*] _____ No

   What was the longest you ever stopped smoking between 1977 and 198_?

   _____ months weeks [*Circle unit of time*]

   When did that cessation period start? [mo/yr] _____

   When did you start smoking again? [mo/yr] _____

4. What were the dates of the other times between 1977 and 198_ when you tried to stop smoking and stayed off cigarettes for a week or more? a. What month and year did you stop? b. How long were you off cigarettes? c. When did you start smoking again? [*Repeat #4 until S says there weren't any more times. Use Supplement if necessary.*]

	Time 1	Time 2	Time 3
a. Stopped smoking [mo/yr]	_____	_____	_____
b. Time off [in mos.]	_____	_____	_____
c. Started smoking again [mo/yr]	_____	_____	_____

1982 SMOKING CESSATION

Now I'd like to ask you more questions about the period when you were in the smoking cessation program and became a subject in SRI's Smoking Research Project.

5. As part of that program, you quit smoking when? [*Should be one of dates given above, if not see whether to add to set above.*]

_____/_____ mo/yr

5b. After participating in the program, how long did you stay off cigarettes?

[*If restarted*] Date restarted _____/_____ mo/yr

6. Can you remember what kind of stop smoking program it was (who offered it)?

ACS ALA SmokEnders Other _____

7. How much were you smoking in the month prior to participation in the program?

_____ Less than 1/2 pack per day

_____ 1/2 to 1 pack per day

_____ 1 to 1-1/2 pack per day

_____ 1-1/2 to 2 packs per day

_____ 2 to 2-1/2 packs per day

_____ More than 2-1/2 packs per day

8. What kind of cigarettes were you smoking?

_____
(brand)

Length (circle one)
Regular
King
100 mm
120 mm

Mentholated? Yes No

"Lights"? Yes No

[*If a SmokEnders participant, get brand before & during program.*]

9. Which of these reasons describe why you tried to stop smoking that time in 198X? [*Read STOP card. Mark all that apply*]

a. Experienced some problems related to smoking (cough, shortness of breath, etc.) _____

b. Felt I'd get benefit from a more active life, which smoking hinders _____

c. Concerned about the possibility of lung cancer _____

d. My physician advised me to quit _____

e. Realized need for changing my lifestyle & quitting smoking was part of that _____

f. Some of my friends convinced me of the value of quitting _____

g. Was experiencing some tension with friends and/or relatives & thought quitting smoking might lessen it _____

h. Concerned about the possibility of heart disease _____

i. Wanted to be a good example to those important to me by not smoking _____

j. Thought cigarette smoking was too much a dirty habit _____

k. Wanted to quit smoking to show that I have power & control over my actions _____

l. Someone important to me wanted me to quit smoking _____

10. In 198X, when you started the stop smoking program, were you living alone?

Yes
No

How many people age 18 or older were living with you? _____

Of these, how many smoked cigarettes? _____

11. Did the people you were living with make it easier or harder to give up smoking? [*Show DIFFICULTY card for Qs 11, 13 & 15.*]

_____ They made it much more difficult

_____ They made it somewhat more difficult

_____ They made it somewhat easier

_____ They made it much easier

12. At that time, how many of your friends smoked? [*Show PROPORTION card*]

_____ None of them

_____ A few of them

_____ Most of them

_____ All or nearly all of them

13. Did your friends make it easier or harder to give up smoking? [*Show DIFFICULTY card*]

_____ They made it much more difficult

_____ They made it somewhat more difficult

_____ They made it somewhat easier

_____ They made it much easier

14. At that time, were you working?

_____ Yes _____ No [*Skip to Q16*]

How many of your co-workers smoked? [*Show PROPORTION card*]

_____ None of them

_____ A few of them

_____ Most of them

_____ All or nearly all of them

15. Did your co-workers make it easier or harder to give up smoking? [*Show DIFFICULTY card*]

_____ They made it much more difficult

_____ They made it somewhat more difficult

_____ They made it somewhat easier

_____ They made it much easier

METHODS & REASONS

16. Now I'm going to read a list of methods that people use to stop smoking. In any of your attempts to quit between 1977 and 198_, not including the _____ stop smoking program in 198_, did you ever use a ... [*Read METHOD card*]

a. Drugstore remedy (Nicoban, One-Step-at-a-Time, Bantron) _____

b. Health Association Program (Five-Day Plan, American Heart Assoc., Amer. Cancer Society) _____

c. Commercial program (Schick, SmokEnders) _____

d. Individual counseling/private therapy _____

e. Group therapy _____

f. Hypnosis _____

g. Quit on own _____

17. Now I'm going to read a list of reasons why people start smoking again after trying to stop. In any of your attempts to quit smoking between 1977 and 198_ did you ever restart because of [*Read RESTART card*]

a. Problems in personal life _____

b. Pressure from family/friends to start again _____

c. Pressure on job _____

d. Withdrawal symptoms _____

e. Desire for cigarettes remained high _____

f. Learned that your health was not affected by smoking _____

g. Gaining weight _____

h. Smoked without remembering resolution to quit _____

i. Quitting smoking was disrupting life _____

j. Found enjoyed smoking too much and nothing else was a good substitute _____

k. Boredom _____

l. Other [Describe] _____

_____

CURRENT SMOKING

18. Do you now smoke cigarettes?

_____ Yes [*If yes*] How many cigarettes do you smoke in a typical day?

_____ cigarettes per day

_____ No [*Choose appropriate follow up question*]
When did you give up cigarettes for good?
or
So you gave up cigarettes for good on. . .
_____/____ mo/yr

4. Were there other times between 1977 and 198_ when you tried to stop smoking? [*If S says yes*] a. What month did you stop? b. How long were you off cigarettes? c. When did you start smoking again? [*Repeat #4 until S says there weren't any more times.*]

	Time 4	Time 5	Time 6
a. Stopped smoking [mo/yr]	_____	_____	_____
b. Time off [in mos.]	_____	_____	_____
c. Started smoking again [mo/yr]	_____	_____	_____

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