Vital and Health Statistics

Questionnaire Design in the Cognitive Research Laboratory

Series 6: Cognition and Survey Measurement No. 1

This report describes a three-phase research project exploring the role of laboratory studies in designing and testing questionnaires, determining how methods and theories of cognitive sciences can contribute to designing and testing questionnaires, and comparing current questionnaire development and pretesting procedures with alternative procedures.

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This research was part of a larger project entitled, "Laboratory-based Research on the Cognitive Aspects of Survey Methodology," being conducted by the National Center for Health Statistics under grant SES 84–03415 from the National Science Foundation (NSF). Monroe G. Sirken, Ph.D., was the principal investigator for this grant. Murray Aborn, Ph.D., was the NSF program director.

This research was performed under DHHS contract 282-84-2123 from NCHS to National Opinion Research Center (NORC). Roger Tourangeau, Ph.D. was the principal investigator. NORC subcontracted part of the work to Bolt, Beranek, and Newman, Inc. William Salter, Ph.D., was coinvestigator. Judith T. Lessler, Ph.D., was the NCHS project officer. The final version of this report was written by Judith T. Lessler, Ph.D., under professional services contract 87A04641720. Jared B. Jobe, Ph.D., was the project officer for that contract and is the technical editor and reviewer for Series 6.

Foreword

In 1986, the National Center for Health Statistics (NCHS) established the National Laboratory for Collaborative Research in Cognition and Survey Measurement with research grant support from the National Science Foundation (NSF). The National Laboratory's mission is to promote and advance interdisciplinary research on the cognitive aspects of designing questionnaires. This research is conducted in collaboration with the Nation's universities and other Federal agencies. By improving questionnaire designs and the methods of designing questionnaires, the National Laboratory hopes to improve the quality of survey statistics produced by NCHS and other Federal agencies.

The National Laboratory's mission is carried out by its Questionnaire Design Research Laboratory (QDRL) and Collaborative Research Program (CRP). QDRL serves primarily as a workplace in which NCHS and other Federal agencies conduct cognitive interviews in developing, designing, and testing questionnaires prior to their use in national surveys. CRP, on the other hand, conducts a contract research program with scientists who investigate the cognitive aspects of designing questionnaires on specified health topics. Although these investigations are conducted in the contractors' own laboratories, they are designed to yield results applicable to NCHS surveys.

This report, "Questionnaire Design in the Cognitive Research Laboratory," is the first to appear in *Vital and Health Statistics*, Series 6. This series is dedicated to reports on cognition and survey measurement that emanate from the National Laboratory. The final technical reports of the contractors participating in the National Laboratory's contract research program as well as reports of intramural projects will be published in Series 6.

This report is of a project that investigated the cognitive issues in asking questions about dental health in the National Health Interview Survey. As important as its substantive findings are, it is the study's innovative methods of conducting cognitive interviews that are most distinctive. It was the first study to demonstrate the utility of conducting cognitive interviews in a laboratory setting as a method for developing and testing designs of survey questionnaires. That successful demonstration was an important step on the road that ultimately led to the establishment of the National Laboratory at NCHS and the questionnaire design laboratories at the Bureau of Labor Statistics and the Bureau of the Census.

I was the principal investigator for the larger project Laboratory Based Research on the Cognitive Aspects of Survey Methodology, which was supported by a NSF grant out of which this study was funded. During the period that she was a Service Fellow at NCHS, Judith T. Lessler provided technical oversight to the National Opinion Research Center (NORC), the contractor, and Bolt, Beranek, and Newman (BBN), the subcontractor, for this study. Roger Tourangeau was the principal investigator at NORC and William Salter at BBN. Jared B. Jobe was the NCHS project officer for a professional services contract with Judith T. Lessler to prepare the final version of this report. To all these talented people, my personal thanks for making this a most successful project.

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Contents

Foreword iii

Introduction 1

Part A: Exploratory studies 4
- Design 5
- Results 6
- Conclusions 10

Part B: Questionnaire development through laboratory experiments 12
- Design 12
- Results 14
- Conclusions 16

Part C: Field and laboratory testing of questionnaires 17
- Design 17
- Results 21
- Methodological results 25
- Conclusions 28

Summary conclusions and suggested protocol for laboratory and field testing 29
- Planning 29
- Exploratory studies 29
- Developmental methods 30
- Testing methods 30

References 31

Appendixes

I. Pretest of the dental health supplements to the 1986 National Health Interview Survey 33

II. Field pretest of the dental health supplements to the 1986 National Health Interview Survey 50

List of text figures

1. Model of the question-answering process 4
2. Answering questions on number of events in a reference period 7
3. Strategies for answering questions with unfamiliar terms 8
4. Experimental design for questioning strategies designed to influence response to questions on mouth rinse and dietary fluoride 12
5. Experimental design for questioning strategies designed to influence response to questions on purpose of water fluoridation 13
6. Experimental design for questioning strategies designed to influence response to questions on dental sealants and own water fluoridation 13
7. Experimental design for questioning strategies designed to influence recall of number of dental visits 13

List of text tables

A. Summary of laboratory and field-testing activities for the design and testing of the 1986 dental supplement to the National Health Interview Survey 3

B. Summary of recall and estimation strategies used by respondents and methods to facilitate their use during an interview 6

C. Problems with the initial draft of the dental health supplement detected in the laboratory and the Greensboro field test 10
D. Results of the Part B experiments 15
E. Wording of experimental and standard versions of the dental supplement and summary of differences 19
F. Summary of Portland field test and Chicago laboratory test 21
G. Summary of results from the Portland field test for experimental and standard versions of the dental supplement 22
H. Summary of results from the Chicago laboratory test for experimental and standard versions of the dental supplement 23
J. Summary of major results from Portland field test and Chicago laboratory test 25

Questionnaire Design in the Cognitive Research Laboratory

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Introduction

For years, survey researchers have developed questionnaires and conducted questionnaire design research. However, the improvements in questionnaire design have been less impressive than those in other phases of the survey measurement process, such as sampling and data processing. The reason may be that other survey activities are more scientifically based than questionnaire design, which remains essentially an art. Is it possible that the cognitive sciences could provide the underpinnings for questionnaire design research, comparable to the support provided by the statistical and computing sciences in the development of modern sampling and data processing methods?

Both survey researchers and cognitive scientists are concerned with the manner in which individuals handle information. However, they have used different approaches and methods. Survey researchers wish to both measure and control the errors associated with the survey response task (Bradburn, 1983). They conduct pretests and quality-check studies to evaluate the effects on response error of question wording, response categories, ordering of questions, and other aspects of the questionnaire (Schuman & Presser, 1981). Survey researchers, especially those in Federal statistical agencies, make relatively little use of controlled laboratory experiments to investigate questionnaires.

Cognitive scientists, on the other hand, are concerned with the mental systems people use in processing information. They study thinking, memory, understanding, judgment, and so on. They typically conduct controlled laboratory experiments, striving to eliminate all factors except those relating to the cognitive issues being investigated (Neisser, 1982). The possibility of using cognitive science for designing questionnaires is being explored by the National Center for Health Statistics (NCHS) through a comprehensive program for investigating the cognitive aspects of survey methodology (CASM).

NCHS initiated its CASM program following participation by NCHS staff in the Advanced Seminar on the Cognitive Aspects of Survey Methodology, which was organized by the Committee on National Statistics. The seminar brought together a group of cognitive scientists and survey methodologists to discuss potential linkages between the disciplines of survey research and cognitive psychology (Jabine, Straf, Tanur, & Tourangeau, 1984). A number of innovative ideas for collaboration between survey researchers and cognitive scientists were developed at that conference. The project described in this report is one of a number of such collaborative projects that have been conducted by NCHS under funding from the National Science Foundation (Interagency Agreement No. SES-840 3415). Staff from the National Opinion Research Center (NORC) and Bolt, Beranek, and Newman, Inc. (BBN) participated in this project.

The project constituted one large experiment in which we explored the use of laboratory methods and the cognitive sciences for the design and testing of questionnaires. In the past, laboratory studies have played a limited role in the design and testing of questionnaires. In part, this is due to an underlying theory of survey error that states that the measurements in a survey are a random variable induced by the general conditions of the survey (Hansen et al., 1961). The general conditions include the interviewers, the survey instruments and procedures, the respondents, the interaction between the respondents and interviewers, and the general economic and social milieu at the time that the survey is conducted. This assumption that the general conditions induce the measurements to behave as random variables implies that one should study the properties of the questionnaire under conditions that, as far as possible, simulate general conditions. However, conducting all studies as field studies entails great expense and complexity (Lessler & Kulka, 1983).

Sudman and Bradburn (1974) identified three general types of factors that affect the quality of survey measurements—factors associated with the response task, those associated with interviewer characteristics and behaviors, and those associated with characteristics of the respondents. After a review of a large number of studies, they concluded that factors associated with the response task have the greatest impact on the quality of the survey results. Thus, it seems reasonable to hypothesize that laboratory studies focused on the response task can be used to study and improve survey measurement instruments, that is, questionnaires.

In this project, we examined the use of an innovative method for the design and testing of questionnaires. This method was a departure from the usual field-testing procedures that were used by NCHS for questionnaire development. Instead, we examined the use of the experimental

methods of cognitive science for questionnaire development. The survey questions developed using this innovative method were compared with those developed by the exclusive use of field testing.

The purpose of the project was to test the methodology of questionnaire development, not to focus on a single questionnaire. Thus, it had a generative component directed at integrating cognitive science theories and techniques with the traditional methods of questionnaire development so that future questionnaire development efforts at NCHS could be more effective. The methods that we developed will continue to evolve, reflecting accumulating knowledge and experience about the ways in which those methods can be meshed with the needs of NCHS and its institutional setting.

Using the planned 1986 dental health supplement to the National Health Interview Survey (NHIS) as the subject, we investigated three questions:

- What role can laboratory studies play in the design and testing of questionnaires?
- How might the methods and concepts of the cognitive sciences contribute to the design and testing of questionnaires?
- How did the then-current development and pretesting procedures used by NCHS compare—in terms of cost, timing, and knowledge gained—with potential alternative procedures that might employ a combination of laboratory testing, application of cognitive science techniques, and field testing?

NCHS selected NHIS as the subject survey from among some 20 surveys and data systems it maintains. NHIS was chosen for two reasons: There has been a long history of research on various aspects of the survey, and it was the focus of the CASM seminar. Choosing NHIS allowed us to take advantage of the knowledge gained through this history.

NHIS is the main source of information on the health of the civilian noninstitutionalized U.S. population. In the survey, conducted annually, data are collected from a national sample of approximately 50,000 households. The U.S. Bureau of the Census serves as the field agent for NCHS and collects data using household interviews. An adult household member may report for himself or herself, for children, and for other related members of the household who are either infirm or absent during the interview. The aim of the survey is to provide national data on the incidence of acute illness, the prevalence of chronic conditions and impairments, the extent of disability, the use of health care services, and other health-related topics.

The questionnaire has two parts: A core set of health, socioeconomic, and demographic items, and one or more sets of supplementary health items. The core items are repeated each year. The supplementary items change yearly and are designed to respond to changing needs for data; thus, they cover a large variety of topics.

Core items include information on:

- Demographic factors—age, sex, race, education, and family income
- Disability days during the 2-week period preceding the interview
- Physician visits during the 2-week period
- Health condition responsible for disability days and/or doctor visits
- Long-term activity limitations associated with chronic conditions and impairments; health condition responsible for the disability
- Number of hospitalizations during the year preceding the interview; reason for hospitalization
- Interval since last doctor visit

The supplements are designed to meet the data needs of researchers from universities, health care and policy organizations (both private and public), and specialists within the Department of Health and Human Services, such as the National Institutes of Health and various organizations within the Centers for Disease Control. New questionnaires are designed each year to meet these special needs. Supplement topics have included immunizations, home health care, health insurance, alcohol consumption, dental visits, health maintenance behavior, and so on.

The design and testing of supplement questionnaires extend over a 2-year period. At the time that the current study began, the testing process typically involved two field pretests, one conducted in the late winter or early spring and one conducted in the summer of the year before the supplement was to be fielded. The first and second pretests typically involved 300 and 200 households, respectively, in two different sites. The U.S. Bureau of the Census conducted the pretest under conditions that simulated the interviewing conditions in the survey.

The agency sponsoring an NHIS supplement is heavily involved in the development process, which is complex and time consuming. In the past, schedules for the development activities have not always permitted coding and analysis of the data collected in the pretests. The pretests were evaluated through observation of the interviews and through debriefing of the interviewing staff.

The project described here was a three-phase effort. All three phases were concentrated on the draft dental health supplement for the 1986 NHIS, which is used to obtain respondent reports on visits to dentists and other dental care practices. (See appendix I.) Part A of the study involved a variety of exploratory techniques (such as protocol analysis, in which respondents thought aloud as they answered questions and the resulting verbalizations were transcribed and analyzed) to identify potential problems in the draft of the dental supplement and to test preliminary solutions. Part B involved more formal methods to test approaches for improving comprehension of items and to stimulate more accurate recall of dental visits. A complex factorial experiment was conducted to compare different

versions of the dental supplement; item wordings and item introductions were systematically varied in the different versions. The Part B results led to the development of an experimental version of the supplement. In the final phase, Part C, this experimental version of the dental questionnaire was compared with a version that had been developed using the standard NHIS field-testing procedures. Two split-ballot experiments were conducted, one in a field test held in Portland, Maine, and the other in a laboratory experiment, conducted at NORC's offices in Chicago. The laboratory experiment included the collection of data from dental records to check the accuracy of interview reports regarding the number of dental visits. Table A summarizes both the laboratory and field-testing activities.

Table A. Summary of laboratory and field-testing activities for the design and testing of the 1986 dental supplement to the National Health Interview Survey

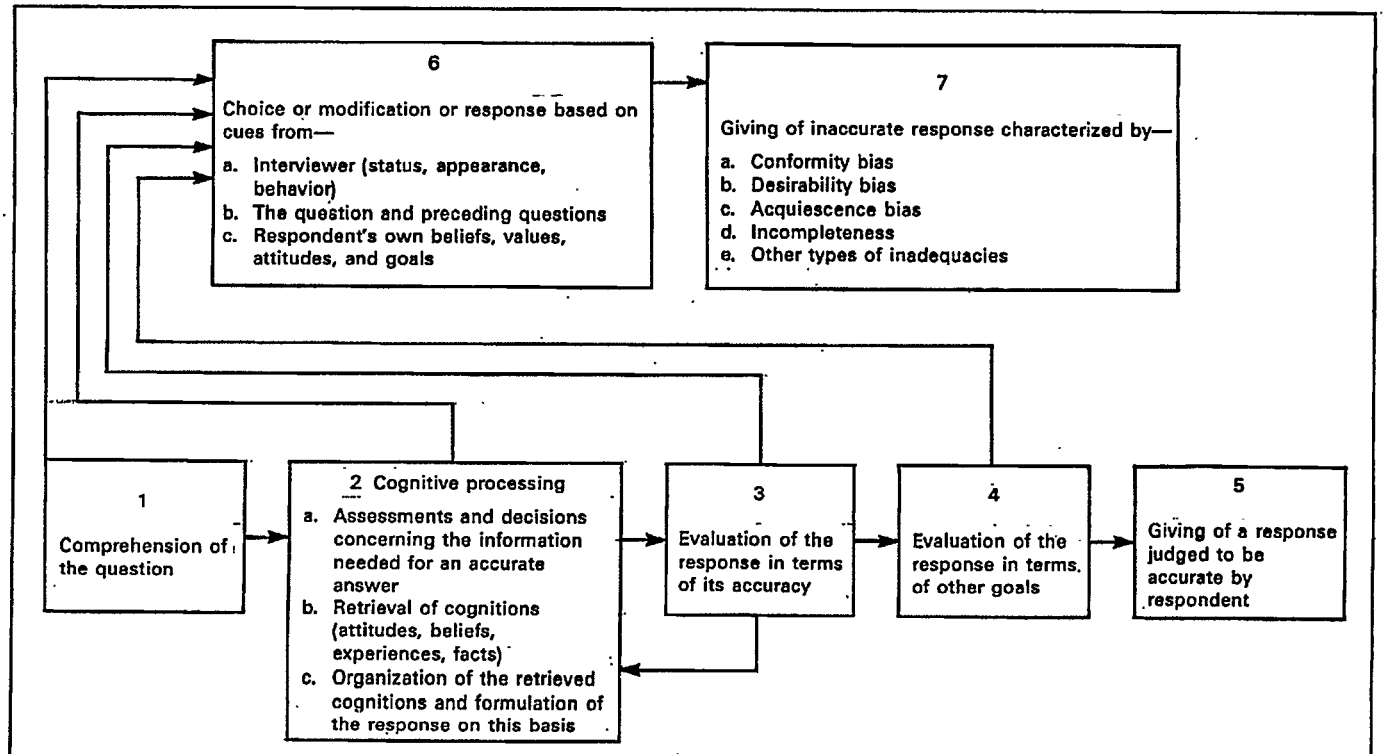
Time period	*Laboratory activity*	*Field activity*
1984	None.	Development of draft questionnaire and OMB clearance package for first field pretest.
Winter 1985	Part A:	
	Preliminary investigation of recall and response issues in the current draft of the 1986 supplement, with major focus on dental questionnaire.	Formatting and printing of questionnaire drafts.
		Development of interviewer instruction manuals.
		Selection of first pretest site.
	Investigation of respondent estimation strategies and inferences from lack of knowledge.	
	Part B:	
	Design of experimental studies for Part B. Submission of OMB clearance package for Part B.	
Spring-summer 1985	Part B:	
	Laboratory testing of alternative questioning strategies and refinements of questionnaires.	Greensboro pretest of questionnaire. Debriefing of interviewers and decisions as to quality of results.
	Part C:	
	Development of a sampling plan and alternative questionnaires for full-scale laboratory and field testing in Part C. Development of OMB clearance package for laboratory component of second field pretest.	Review of laboratory results and comparison with first field pretest results.
	Comparison of laboratory results with those obtained in the first pretest.	Development of second pretest questionnaire and OMB clearance package. Development of interviewer instructions and selection of second pretest site.
Fall 1985	Part C:	
	Portland test. Observation of interviewing process by CASM staff.	Portland field test. Debriefing interview with field staff.
	Debriefing of field interviewers.	Qualitative analysis of field results. Revision of questionnaires.
	Coding and keying of questionnaire data. Preliminary tabulation of field data.	Printing of final NHIS 1986 questionnaires.
Winter 1986	Part C:	
	Recruitment of laboratory respondents. Laboratory interviews. Collection of dental visit data.	None.
	Comparison of laboratory results with field results. Assessment of knowledge gained by testing mode.	

NOTE: OMB is Office of Management and Budget. CASM is coginitive aspects of survey methodology.

Part A: Exploratory studies

The initial phase of the study was exploratory. In the Part A studies, we sought to identify plausible hypotheses for further investigation along with useful methods for investigating these hypotheses. We focused on the question-answering process. Oksenberg and Cannell (1977) presented a model of the question-answering process, which is summarized in figure 1. According to their model, the question-answering process consists of:

1. Comprehension of the question. In this step the respondent tries to understand what is being asked.
2. A cognitive processing step in which the respondent makes some decisions as to the information needed in order to give an accurate response, attempts to recall information, and then formulates a response based on the recall of information.
3. An evaluation step in which the respondent judges the accuracy of the response. At this point the respondent may undertake additional thought—again assessing the type of information needed, attempting to recall more information, and reformulating the response.



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. Copyright; reproduced by permission.

Figure 1. Model of the question-answering process

4. A second evaluation step in which the respondent may evaluate the response in terms of other goals. For example, the respondent may hesitate to report certain events or attitudes because he or she perceives them to be socially unacceptable.
5. As a result of the second evaluation step, the respondent may decide to give a response that he or she judges to be accurate or may modify the response based on other considerations. These other considerations may include cues from the interviewer as to an acceptable response, the respondent's values and beliefs, and cues from other questions. The respondent may or may not be aware of how these other cues produced a modification in the response.

The Part A research was focused on the cognitive processing phase of the question-answering process. Initial drafts of several supplements to the 1986 NHIS had already been developed when the study began. We carefully examined each of the supplements and the core interview to identify potential topics for study. We decided to limit the study to the dental health questionnaire and to focus on two issues:

- Strategies for recalling or estimating the number of events in a reference period
- Strategies for answering questions containing unfamiliar terms

These issues had three important advantages as topics for the initial investigation of the usefulness of the cognitive/laboratory approach. First, there was a considerable body of extant research in the cognitive sciences on both topics. This meant that there were precedents that could serve as models for our work.

Second, the two issues are important to most surveys that focus on objective events. Many questions require that respondents report on the number of events in a specific retrospective reference period. Examples from NHIS include requests for information on the number of visits to dentists, to doctors, and to hospitals and number of illness days. A considerable proportion of the questions in NHIS contain terms that may be unfamiliar to some respondents. For example, respondents are asked whether any member of the family is covered by CHAMPVA (Civilian Health and Medical Program of the Veterans' Administration) insurance, whether anyone has diverticulitis, thrombophlebitis, and so on. In many cases, we would not expect the respondent to know what these things are unless the answer is "yes." It is assumed that the respondent will reason that, if he does not know what the thing is, then he does not have it, and therefore the answer is "no."

Finally, these two issues were relevant to almost every question in the dental health supplement, allowing us to achieve the applied goal of examining a questionnaire while still dealing with issues of general theoretical and methodological importance.

In summary, the specific objectives of Part A were:

- To gain detailed knowledge of the response process and use this knowledge to develop alternative versions of the questionnaire that had potential for facilitating response
- To evaluate the use of the laboratory setting and the techniques of cognitive science for discovering problems and suggesting potential solutions
- To compare the cognitive laboratory findings with findings from a field test of the same questionnaire

Design

During Part A, a series of laboratory investigations and a field pretest of the dental health questionnaire were conducted. The laboratory studies were focused on only the dental health questionnaire; in the field pretest, the dental health questionnaire and two other supplements—one on health insurance and one on vitamin and mineral use—were tested. The dental health questionnaire is shown in appendix I.

Because one of the goals of the study was to develop the laboratory approach, a variety of laboratory methods were examined during Part A. The response process and problems with the questionnaire were examined by using detailed comprehension probes and by using a standard technique drawn from the cognitive sciences called protocol analysis, in which respondents are encouraged to think aloud as they solve a problem or, in this case, answer a question. (The terms *protocol analysis* and *think-aloud protocols* are used interchangeably in this report.) For the laboratory testing, we used several different versions of the questionnaire. These versions were designed to reveal the components of the response process and were not intended to be those that would ultimately be used in a national survey. Parallel lines of research were carried out in NORC, BBN, and NCHS.

NORC used an intensive laboratory pretesting approach, concentrating on the issue of how people respond to items containing unfamiliar terms. A total of 32 interviews were conducted; items were tested using different questionnaires, often with several followup questions. In the followup questions, respondents were asked about the strategies they used to answer the question or about their understanding of a particular question. For example, the draft dental supplement contained a number of items on the use of fluoride products. One version of the supplement used at NORC included a series of probes on whether respondents had ever heard of fluoridation, which were followed by a series of questions about specific products that might contain fluoride. The purpose of these items was to assess the familiarity of a number of terms (such as fluoride mouth rinses and fluoride tablets) that appeared in the draft supplement. Another version of the supplement did not contain these items but did contain a question on how respondents knew whether their own water was or was not fluoridated. This followup probe, it was hoped, would help to identify the process by which respondents answered the question about public water fluoridation.

At BBN, the research focused on the items in which respondents were asked about the number of times they had visited a dentist during the 2-week and 12-month

periods preceding the interview. Protocol analysis was used. In parallel items, respondents were also asked about doctor visits and visits to automobile mechanics. The aim in using several parallel items was both practical and theoretical. The practical point was to increase the number of observations per respondent. The theoretical point was to test the generality of the estimation and recall strategies we observed. Although we did not expect to see major differences between recalling dental visits and recalling other sorts of similar events, we thought it important to check this possibility. A total of 12 respondents were interviewed at BBN.

In the NCHS study, a mixed approach was employed. The entire dental questionnaire was tested, collecting think-aloud protocols for selected items and using a range of followup probes for others. A total of 26 interviews were conducted, the bulk with NCHS staff in Hyattsville, Md. The details of the design of the Part A laboratory studies are in the Part A report (Lessler, Mitzel, Salter, & Tourangeau, 1985).

The field pretest was conducted in Greensboro, N.C., during March 1985. Experienced NHIS interviewers were trained in the use of the three supplements and conducted some 380 household interviews. Each interviewer was accompanied by an observer, who took notes on the problems experienced by the respondents. Some of the staff who had participated in the laboratory experiments observed the NHIS pretest. The pretest findings were summarized in a series of debriefing sessions and debriefing reports. The pretest was designed to simulate the general conditions of NHIS. Therefore, specific probes on comprehension were not used during the interview. However, at the end of the interview both the observer and the interviewer were encouraged to query the respondents about difficulties that they had with the questionnaire.

Results

We obtained several types of findings from the Part A studies. We gained insight into the question-answering process, identified problems with the questionnaire, learned much about the operation of laboratory studies, and began to develop an understanding of the relative effectiveness of the laboratory and field-testing approach for exploring problems with the questionnaire. In this section, we discuss each type of finding.

Substantive results

Recall strategies—It was apparent that respondents used a range of recall and estimation strategies for dealing with the items concerning the number of dental visits. Table B, reproduced from Lessler et al. (1985), summarizes four of the major strategies observed in the Part A interviews. It is worth noting that the anchoring-and-adjustment strategy (first identified by Tversky & Kahneman, 1974, in a different context) may be particularly well suited for dental visits. Because most people know they are supposed to go to a dentist twice a year for a checkup, "two visits" provides a natural starting point (or anchor) for their answers. Another strategy used by some respondents was to decompose the questions about dental visits into simpler or more specific questions. For example, respondents might first recall visits to the orthodontist and then recall visits to other dentists. A third

Table B. Summary of recall and estimation strategies used by respondents and methods to facilitate their use during an interview

Strategy	*How to facilitate*
Anchoring and adjustment	
Initial recall or response followed by reasonableness assessment, further recall, and adjustment.	Ask respondents to evaluate their confidence in their answers. Suggest strategies of performing reasonableness assessment. Invoke a decomposition strategy to stimulate further recall.
Decomposition	
Additive: Recall of visits for specific reasons, problems, persons, time of year, etc., followed by summation.	Use checklist of treatments, types of visits, and types of providers to stimulate recall of additional categories. Suggest decomposing the year into smaller units to ease recall.
Multiplicative: Recall of rate of visits and multiplication by duration of reference period. Recall of interval and division into duration of reference period.	Probe to see if specific recall of visits can verify that the calculated number is correct.This is a way to invoke an anchoring-and-adjustment strategy. Assist in division or multiplication.
Temporal skeleton	
Building in the mind a conception of the reference period with markers at the ends. Recalling events and landmarks associated with them in order to assess overlap with reference period.	Suggest personal landmarks to the respondent that might assist in anchoring either the reference period or the recalled events. Use a temporal skeleton in a decomposition strategy (i.e., partition recall period into smaller units).
Context	
Cues surrounding the events used by the respondent to stimulate recall. Cues include getting there, being there, problems with teeth, treatments received, paying the dentist, thoughts and feelings about the visits, as well as episode-to-episode and person-to-person cuing.	Suggest specific cues (e.g., ask who usually takes the children to the dentist). Read a checklist of conceptual items. Allow respondents to provide a narrative description of their own or the family's dental visits to facilitate person-to-person and episode-to-episode cuing. Encourage the respondent to use personal recall aids such as checkbooks and calendars during reporting.

SOURCE: Lessler et al., 1985.

strategy involved building a temporal skeleton for the 1-year reference period involving landmark events, such as the beginning of the school year or holidays. Sometimes use of a temporal skeleton triggered specific memories, and sometimes it served as a basis for dating events recalled using other strategies or cues. A final strategy was to organize the search for events by retrieving contexts for the events. Some respondents, for example, remembered specific visits by thinking about where they go to the dentist and how they get there.

Before respondents engaged in a detailed recall of events, they made an assessment of whether there was anything to recall. In essence, they first asked themselves a question similar to, "Did I ever go to a dentist in the approximate timeframe?" If the answer to this quick assessment was "no," the recall process ended. This is illustrated in figure 2.

There appeared to be two general strategies for making the initial assessment—respondents could recall a fact or a specific visit. They then judged whether this recall information implied that there were visits in the reference period. For example, one respondent commented that he followed the "twice yearly rule," meaning that he attempted to adhere to the recommended two dental checkups per year. Others appeared to recall a specific visit to decide that they had no events in the reference period. This is typified by a respondent who, when answering the first question on the number of visits in the previous 2 weeks, commented that the last time he went was just before Thanksgiving. This was several months prior to the 2-week reference period, so he quickly concluded that he had no visits in that period.

In subsequent phases of the research, we attempted to use this information to influence the response to questions on the number of dental visits. Because the respondent stops trying to recall events if the answer to the quick assessment is "no," a false negative to this first stage of the response process is a serious problem. Thus, we speculated that we could improve the cognition phase of the question-answer process by preventing false negatives in the initial step and by providing cues to assist in the recall. One consistent finding of previous research in cognitive science and survey methods (Tourangeau, 1984) is that a recall is improved if:

- Multiple cues for recall are given
- The respondent is allowed more time to recall events
- The respondent puts more effort into the recall process

In subsequent sections of this report, we explain how we tried to improve recall and our success in doing so.

Unfamiliar terms—Perhaps our clearest conclusion from Part A concerning items with unfamiliar terms is that respondents answer these questions even when they do not understand the terms, and they do so without asking for clarification of the terms. Other studies (Schuman & Presser, 1981) have shown that respondents are reluctant to give "don't know" responses to attitude questions about very obscure issues. The Part A studies revealed a similar reluctance for items about behavior. Figure 3 summarizes the strategies that respondents used when trying to understand and interpret unfamiliar terms.

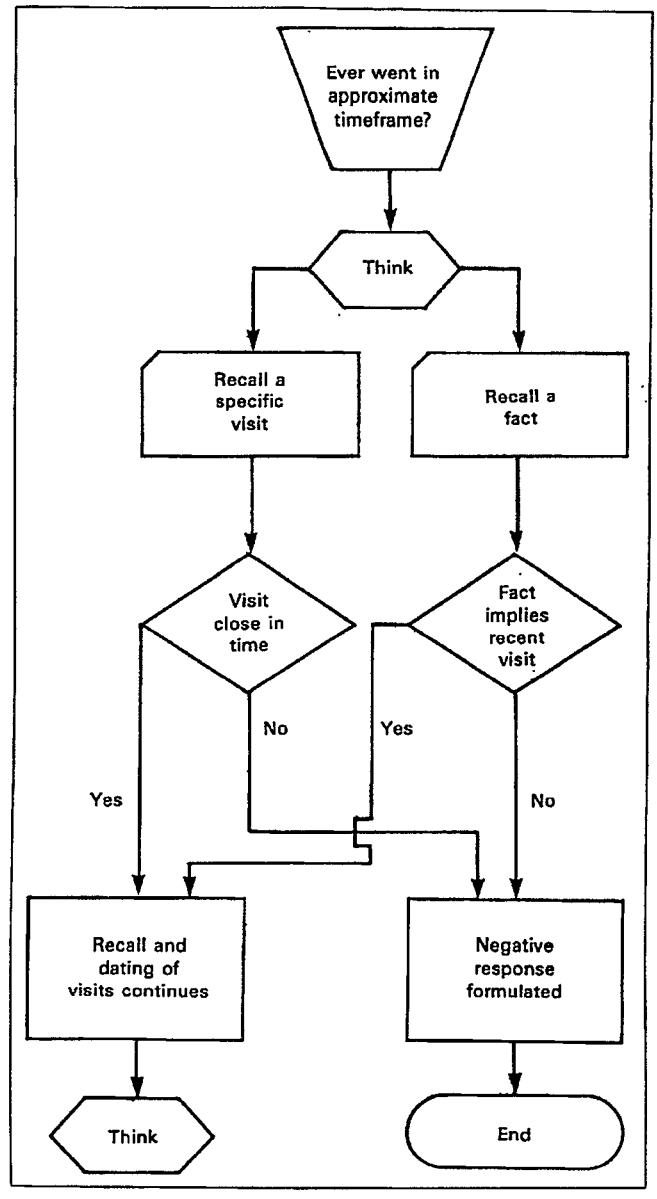


Figure 2. Answering questions on number of events in a reference period

In three items on the initial questionnaire (appendix I), respondents were asked about use of dental care products with which they might be unfamiliar—fluoride mouth rinse, dietary fluoride, and dental sealants. Some respondents did employ the strategy assumed in construction of the questionnaire: They reasoned that because they did not know what the item was, no one had used it. This is illustrated by the far right branch in figure 3.

Some respondents incorrectly interpreted the terms. For example, some interpreted dental sealants to mean fillings; others confused fluoride mouth rinses with ordinary mouthwashes. These incorrect interpretations generally resulted in incorrect answers.

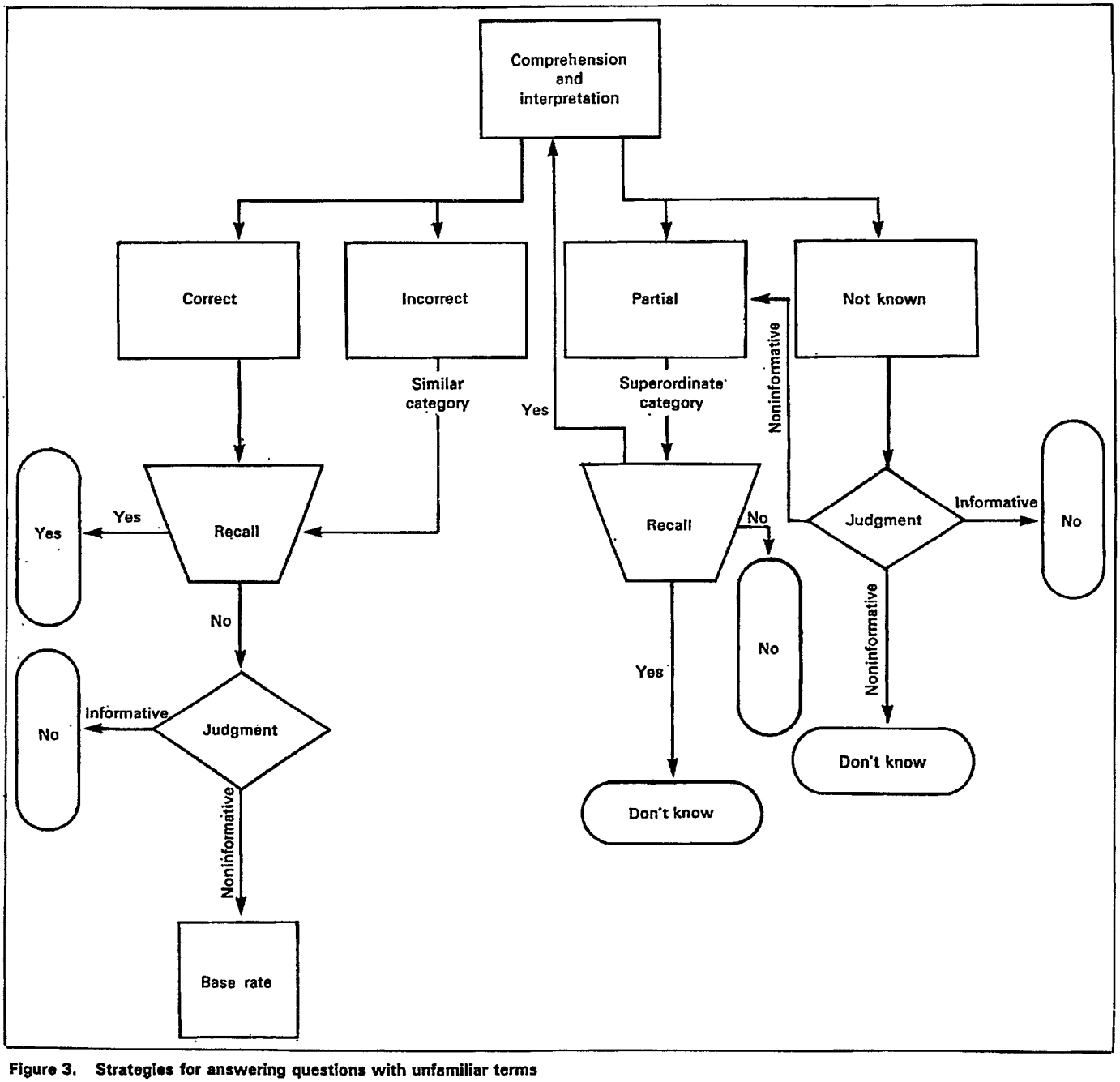


Figure 3. Strategies for answering questions with unfamiliar terms

In some cases the respondent gave a partial interpretation of the term, most often considering some superordinate category. Often this was sufficient for the respondent to answer the question. Respondents who did not use any mouth rinses could safely answer the question even if they did not distinguish fluoride mouth rinses from mouthwashes. Respondents who used no dietary supplements did not need to know what dietary fluoride was. If this partial interpretation strategy was not sufficient basis for an answer, the respondent had to further consider the response. This is illustrated by the respondent who commented that he used mouthwash but did not know whether it contained fluoride; those who took vitamins but were uncertain whether they contained fluoride; and those who had had something placed on their teeth but were uncertain as to whether they were dental sealants.

When respondents were forced to rely on a judgment process rather than recall of specific events or facts their judgments took the form of inferences that were apparently based on the relative frequency, or base rate, of the behavior in question as well as the diagnostic value of the absence of specific information. Such base-rate inferences were made by respondents who reported that their water was fluoridated and gave as the rationale for their answer the belief that "most places" have fluoridated water. Other respondents appeared to reason that they would know if

fluoride had been added to the water. Because they did not specifically know, they assumed that their water was not fluoridated. Such inferences based on lack of knowledge have been observed in other domains by Genter and Collins (1981).

The results suggested several strategies for improving the response to questions with unfamiliar terms. We speculated that we would achieve improved response if the terms were defined in the question or if base-rate information were supplied. In addition, we noted that several of the questions that contained unfamiliar terms concerned multiple behaviors. For example, in the question on fluoride mouth rinse, the respondent was asked to simultaneously consider home, school, and work use of fluoride mouth rinses. This complicated the formulation of the answer, and in subsequent phases of the study we decomposed the complex question into several simpler questions.

Problems with the questionnaire

We were interested in whether the problems that were identified in the field test would be identified in the laboratory studies. Table C summarizes the problems detected by the two sources of testing.

The laboratory studies and the field studies were successful in identifying problems with the initial draft of the dental health supplement. In both sites of testing, comprehension problems were identified; however, the laboratory study was more efficient in detecting the problems (assuming, of course, that all problems detected in the laboratory would also be detected in the field). Fewer respondents were used in the laboratory (62 versus 380). In fact, the problems with the question on reasons for visit, which was the question that had the most severe problems, were identified after the first six laboratory interviews. Travel costs were less, and staff working in the laboratory had the opportunity to quickly modify the questionnaires in order to explore in more detail the ideas that came up in the initial interviews. In contrast, because of the long planning time, the need to train a fairly large interviewing staff, and the necessary process of obtaining clearance from the Office of Management and Budget, staff working on the field test did not have the flexibility to use a variety of techniques.

The greater efficiency of the laboratory is directly attributable to the techniques that were used. Many of the comprehension problems that were detected would probably have remained undetected with the same number of respondents in a field test. Respondents in the pretest often answered the questions confidently without noticeable delay and did not reveal their underlying confusions. The confusions became apparent only when the respondents were probed about their understanding of items or asked specific followup questions designed to assess their comprehension of items. In the field, the observers and interviewers did not directly attempt to assess understanding during the interview and had to depend either on the respondent's spontaneously indicating some problem or on inconsistencies in answers. Because respondents may not themselves be aware that they have misinterpreted a question and because they are apparently reluctant to volunteer lack of knowledge (which was true in the laboratory as well as in the field), the frequency with which problems are detected will be much lower in the field setting.

Another technique that contributed to the greater efficiency of the laboratory was the manner in which the observations were recorded. In the field, observers took notes on apparent problems; the interviewer continued with the questioning. Thus, the observer, who was writing an observation of the response to a previous question, could miss observing problems with succeeding questions. In the laboratory, video and audio recordings were used to make the observation of the response process. Thus, an on-site observer was not needed, and deliberate detailed observation of the interview could be made by reviewing the recorded session.

The use of a greater variety of techniques in the laboratory also provided somewhat deeper insight into the causes and extent of problems. All of the research techniques that were used in the exploratory studies—response protocols, comprehension probes, and the provision of alternative items designed to vary in specific ways (e.g., questions that varied the amount of information given to the respondents)—provided converging evidence for the conclusions. In addition, the response protocols allowed us to identify not only problems but also response strategies that were not revealed in the field testing.

The field test did reveal several problems that were not evident in the laboratory. Interviewer reactions to the questions were not noted in the laboratory, and the disruptive use of flash cards was not detected. Field interviewers also had excellent insights into the language problems experienced by respondents and generated hypotheses for improved wording. An NHIS interviewer was the source of the suggestion that the term "fluoridation" be replaced by the phrase "adding fluoride to the water," a change that was subsequently proven effective.

Based on this comparison, the laboratory should be the main setting for discovering problems with questionnaires and field tests should be reserved for testing more refined instruments.

Laboratory methods

The findings from Part A suggested a number of broad conclusions about the methods for pretesting instruments in the laboratory setting. The intensive observational techniques employed in the laboratory allowed us to identify problems using only a few respondents. However, it was apparent that it was important to test a range of respondents. For example, it was difficult to study items on the use of fluoride products in Chicago because its water supply is fluoridated and few people actually used fluoride vitamins or fluoride mouth rinses. The few interviews that were conducted in a nonfluoridated area produced interesting differences from the Chicago results. In addition, it was

Table C. Problems with the initial draft of the dental health supplement detected in the laboratory and the Greensboro field test

Dental visits in prior 2 weeks	
Laboratory:	Difficulty in locating the boundary of the reference period and deciding if a recent visit was in or out of the period.
Greensboro field test:	No problems noted.
Dental visits in prior 12 months	
Laboratory:	Tendency to give approximate answers based upon self-perceived usual behavior.
	Difficulty in locating the boundary of the reference period.
	Problems recalling visits for other family members.
	Difficulty determining the number of visits when there were large numbers of visits.
Greensboro field test:	Approximate answers encouraged by use of the word "about."
Reasons for dental visits	
Laboratory:	Tendency to report the type of treatment received as the reason for visiting the dentist, whereas the sponsor was interested in assessing the impact of recall systems on the reasons for visits to the dentist.
	Inability to choose a single category because the categories were not mutually exclusive.
Greensboro field test:	Reporting of treatment rather than motivation. Respondents were intended to report on a series of treatments but did not.
	Reporting of reason for first visit in previous 12 months, which did not meet the sponsor's goal of determining why people who had had a series of visits for a particular problem initiated this series.
Use of toothpaste	
Laboratory:	Tendency to think that the initial part of this question was silly because most people use toothpaste.
	Different interpretations of the time period for the question. These ranged from reporting on the brand that was used on the day of the interview to brands used most often in the past year.
Greensboro field test:	Toothpaste was used by most everyone.
	Feeling that the use of a response card was unnecessary.
Use of dietary fluoride	
Laboratory:	Misunderstanding of the term "dietary fluoride."
	Respondents did not ask for an explanation of the term.
	Confusion of dietary flouride with diet drops.
	Some respondents did not report separately the home and school components of the question.
Greensboro field test:	Confusion of dietary fluoride with fluoride mouth rinse, ordinary vitamins, and weight reduction products.
Use of fluoride mouth rinse	
Laboratory:	Confusion of fluoride mouth rinse with ordinary mouthwash.
Greensboro field test:	Confusion of fluoride mouth rinse with ordinary mouthwash.
Dental sealants	
Laboratory:	Confusion of dental sealants with other products, including fillings and fluoride treatments that are applied at the dentist.
Greensboro field test:	Confusion of dental sealants with other products.
Loss of all natural teeth	
Laboratory:	Confusion because of awkward placement of question. Some respondents thought that the question referred to a member of their family who lives elsewhere. This was because they had spent some time talking about the care of teeth, which implied that everyone in the household had teeth.
Greensboro field test:	No problems noted.
Public water fluoridation	
Laboratory:	Misunderstanding of the term "fluoridation." People had no specific knowledge of whether their water was fluoridated and based their answers on inference.
Greensboro field test:	Misunderstanding of the term "fluoridation." The phrase "adding fluoride to the water" would be better understood.
	Disruptive use of the flash card, which was not necessary.

apparent that the response task differed for self-versus-proxy response. Parents who reported for their children had a more difficult recall and reporting task than those who reported only for themselves.

The think-aloud protocols were useful for identifying response strategies as well as potential problems. Although protocol analysis has its limits (Ericsson & Simon, 1980), if used carefully, it can provide strong indications regarding the process underlying response to survey questions. The difficulties inherent in accurately recalling and placing dental visits in a reference period were manifest during the collection of the response protocols. In some cases the respondents spent 20–30 minutes trying to accurately recall visits for their entire family. Only short recall periods were observed in the field tests, indicating that there is great potential for inaccurate reporting in the actual survey.

Numerous issues can be studied when designing and testing a questionnaire, and often the observations have an impressionistic quality that makes it difficult to communicate the results to others. This contributes to the conclusion that questionnaire design is an art rather than a science. The decision to organize the research around the two general issues of recall of the number of events in a reference period and response to unfamiliar terms proved to be effective. It provided useful rubrics for thinking about and organizing the findings.

Conclusions

The use of the laboratory for the design and testing of questionnaires is an evolving process. New methods will continue to be developed, and NCHS will continue to seek the best balance between laboratory studies and field testing. However, based on our experience, we conclude that the laboratory is an effective site for exploratory studies directed at identifying the response process and response problems. We suggest the following protocol.

At least three organizations participate in the development and testing of NHIS supplement questionnaires—NCHS, the U.S. Bureau of the Census, and the sponsoring agency or agencies that need the survey information.

Typically, the sponsoring group specifies its information requirements and may provide initial drafts of the questionnaires. Staff of NCHS and the U.S. Bureau of the Census then develop and test the survey instruments. Many surveys have staff of these three general types. Once the information needs are identified the three types of staff jointly should develop a plan for both the laboratory and field testing. If previous questionnaires are available or drafts have been provided by the sponsoring groups, the staff working on the instruments can conduct an appraisal of the forms to identify response issues and potential problems. These issues and problems can then be classified into broader categories that can be used to guide the research. We found that this process contributed to a fuller understanding of the needs of the sponsoring group and also pointed up uncertainties in the sponsor's goals. The first steps in many sciences are observation and classification. An explicit focus on these steps before beginning experimentation and testing may contribute to moving questionnaire development into the realm of science.

The laboratory can be used for the initial stages of testing. The range of laboratory respondents should reflect the characteristics that are known to affect response. Given such attention to variety and the use of the intensive observational and probing techniques, the number of laboratory respondents need not be large (20–50). The laboratory testing will be most effective if it is guided by explicit hypotheses as to the response task implied by the items, problems that arise in the response process, and methods for improving the response. Think-aloud interviews that are recorded and reviewed can be used to generate such hypotheses. Unanticipated processes and problems will appear even with careful prior analysis.

Because of the wide experience of the field staff, we conclude that the early laboratory results should be supplemented by field tests on nine or fewer respondents. Our laboratory studies did not incorporate this feature, and we think that some of the excellent insights and experience of the field interviewers will be useful for guiding the laboratory studies. Staff from the laboratory can observe the field test so that the laboratory efforts can adequately reflect the household situation.

Our studies were improved by the need to write reports in which we described our findings to others. We found that this caused us to reflect on the results and generated discussions that improved subsequent efforts. The parties involved in the development of the survey instruments should meet frequently to summarize and assess the current results. Severe time pressures face staff when developing the survey instruments. The laboratory seems to be very well suited to an iterative testing process with short cycles of testing and evaluation. This type of approach is almost impossible to implement in a full-scale field test. Thus, the laboratory method is perhaps most efficient if it is designed to take advantage of this cyclic potential, and the periodic reporting and assessment can contribute to assuring the accumulation of knowledge about the question-answer process.

Part B: Questionnaire development through laboratory experiments

The goal of Part B was to conduct a series of laboratory experiments directed at identifying questioning strategies that influence the question-answering process. In Part A we observed respondents as they answered different types of questions and noted differences among respondents and questions. Although we had a notion as to what types of differences we might observe, our work was not guided by formal hypotheses as to the nature of these differences. Based on the Part A observations, in Part B we developed specific hypotheses concerning the effect of different types of questions on the recall and comprehension of items in the dental supplement. Again we had a dual focus. We were trying to find improved ways of asking the dental health questions, and we were examining laboratory methods that might be used to identify the improved questions. Whereas in Part A we examined observational methods, in Part B we examined experimental methods.

Part B was carried out over a 3-month period. We were exploring our ability to quickly build on the Part A exploratory studies by using the laboratory method. We were concerned with a number of questions. Can we design and test different questionnaires in a short time? Will we be able to recruit respondents, administer the experiments, and analyze the results within the 3-month period? Will the small sample sizes be sufficient to detect differences? Given that sample sizes are small, are there ways in which we can magnify the differences we are trying to detect?

In summary, in Part B we focused on answering questions concerning methods. As our test vehicle, we included experiments directed at (1) improving recall and estimation of the number of dental visits, (2) increasing the comprehension of items that contain potentially unfamiliar terms, and (3) fostering specific strategies for dealing with unfamiliar terms.

Design

Experimental design

Comprehension issues—The results from Part A concerning items with unfamiliar terms and other comprehension issues suggested four hypotheses about techniques that might improve answers to the dental supplement:

- Encourage respondents who do not understand a question to give "don't know" responses
- Use simpler language or define technical terms
- Decompose complicated items into a series of simpler items
- Provide accurate base-rate information

In each case, the rationale for these approaches was straightforward. We reasoned that people who understood the question were more likely to answer it correctly. Therefore, respondents might be prevented from giving erroneous substantive answers to questions that they did not understand if they were encouraged to give "don't know" responses instead. Alternatively, respondents' comprehension might be improved by defining unfamiliar terms or eliminating them entirely in favor of simpler terms. Some of the experimental items contained a number of qualifying phrases intended to clarify the exact scope of the questions. The Part A results suggested that these qualifications sometimes created more confusion than they cleared up. For this reason, decomposing items with qualifying phrases into a series of simple questions seemed a promising approach. Finally, respondents often seemed to rely on base-rate information in answering questions with unfamiliar terms. These answers could perhaps be made more accurate if respondents were given more accurate information regarding the relevant base rate.

Several items lent themselves to the investigation of these hypotheses. Figure 4 summarizes the experimental design for the fluoride mouth rinse and dietary fluoride questions. Versions of these items varied in whether a definition was given for these terms, decomposition was used to simplify the items, or the then-current draft was followed. For the question on the purpose of water fluoridation, we investigated both the effect of lowering the threshold for giving a "don't know" response and the use of

Comprehension		
Better definitions	*Decomposition*	*Control*
Number of respondents		
32	32	32

Hypotheses:
1. Better definitions and decomposition improve understanding of items, thereby reducing overreporting of use of fluoride mouth rinse.
2. Better definitions and decomposition improve postinterview comprehension test on these items.

Figure 4. Experimental design for questioning strategies designed to influence response to questions on mouth rinse and dietary fluoride

defined wording. Figure 5 summarizes this experiment. We also examined the impact of better definitions and the provision of base-rate information in the questions on dental sealants and whether respondents' own water is fluoridated. This design is summarized in figure 6.

Recall issues—In the dental supplement (appendix I), respondents are asked to report the number of dental visits made by each member of the family in a 2-week reference period that immediately precedes the week of interview. The 2-week items are followed by similar questions about dental visits during the previous year.

The Part A results suggested a number of possible strategies for increasing the accuracy of recall. Context cues were often used by respondents in recalling specific dental visits. In Part B, we sought to encourage the use of context cues by asking a series of items regarding the context of the visits (Is there a particular dentist's office, dental clinic, or some other place that _____ usually goes for dental care? Does anyone in the family go to an orthodontist? When _____ needs to go to the dentist, how does he/she usually get there?). We thought that these context items would encourage retrieval before respondents could make a quick, possibly erroneous judgment that they had no visits to report. In addition, the context items might facilitate the process of retrieving individual visits. We varied whether respondents received these context items; in the versions of the supplement that included them, the context items appeared immediately before the 2-week dental visit items.

The Part A results also suggested that people often recalled dental visits by thinking of the reasons for specific visits. To encourage the use of this cue for retrieval, we included in some questionnaires a list of the reasons that people might go to the dentist. The reasons list was included as part of the introduction to the second dental visit item, which concerned the total number of visits to the dentist during the past year.

Finally, based on Part A results, we surmised that respondents might recall additional visits if they tried to answer the question a second time; in addition, landmark events were often used by respondents to date visits. This strategy can result in a reduction in the number of visits reported as well as an increase because the respondent gets a better idea of when in time the visit occurred. To encourage the use of this strategy, we added to some questionnaires an item in which respondents were asked to recall an important event near the beginning of the 1-year reference date and to try to answer the 12-month visit item again using the landmark event. The landmark probe is obviously complex, involving a second try as well as the generation of a landmark event. In order to separate the two effects, we also developed a second-guess probe, in which respondents were simply asked to answer the 12-month visit question a second time without generating a landmark event. The landmark or second-guess probe appeared immediately after the 12-month item in the versions of the supplement in which they were used.

Altogether, then, there were three treatment variables: context items versus no context items; reasons list versus no reasons list; landmark probe versus second-guess probe versus no followup probe. These variables were crossed, giving a total of 12 versions of the dental visit items, each of which was administered to eight respondents. Appendix I shows the exact wording that was used. Figure 7 summarizes the experimental design and our hypotheses.

Comprehension	*Lower threshold for a "Don't know" response*	*No threshold manipulation*
	Number of respondents	
Defined wording	24	24
Original wording	24	24

Hypotheses:
1. Defined wording will produce more people incorrectly stating the purpose of public water fluoridation.
2. Lowering the threshold for a "Don't know" response will produce more people who say they do not know the purpose of public water fluoridation.
3. An interaction effect with threshold manipulation will have a greater impact on those that receive the original wording.

Figure 5. Experimental design for questioning strategies designed to influence response to questions on purpose of water fluoridation

Comprehension	*Base-rate manipulation*		
	High	*Low*	*None*
	Number of respondents		
Defined wording	16	16	16
Original wording	16	16	16

Hypotheses:
1. Reporting of the use of dental sealants will be greater for the high base-rate group than for the low base-rate group.
2. Reporting of own water fluoridation will be greater for the high base-rate and no base-rate groups.
3. Through an interaction effect, better definitions will reduce the impact of threshold manipulation.

Figure 6. Experimental design for questioning strategies designed to influence response for questions on dental sealants and own water fluoridation

Probe	*Context cues*		*No context cues*	
	Reason cues	*No reason cues*	*Reason cues*	*No reason cues*
	Number of respondents			
Landmark probe	8	8	8	8
Second-guess probe	8	8	8	8
No probe	8	8	8	8

Hypotheses:
1. Context cues and reason cues will prevent false negatives to the initial process, thereby increasing the number of respondents who report *at least one* visit.
2. Context and reason cues will improve recall of dental visits, thereby increasing the number of visits reported.
3. Followup probes will enhance the reporting of the number of visits. Landmark probe will decrease the number of reported visits by assisting in the test phase of the recall process. Second-quess probe will increase the number of reported visits by stimulating additional recall. Effect of both probes is likely to be greater among those who did not receive introductory cues.

Figure 7. Experimental design for questioning strategies designed to influence recall of number of dental visits

Procedure

Because the experiments concerned different items in the dental supplement, it was possible to carry out all

experiments with a single group of 96 respondents. A unique questionnaire for each respondent was printed using a microcomputer. Treatments for one experiment were nested within treatments for other experiments and ordered from highest to lowest and then lowest to highest. This assured that a particular experiment was balanced across all levels of the other experiments. Respondents were randomly assigned to one questionnaire version. The ability to use a microcomputer to print quickly alternative questionnaires prevented collating errors when assembling the treatments for each respondent and assured correct random assignment of the treatments. An additional eight respondents were administered the original version of the dental supplement.

Personal interviews were conducted with the 104 respondents. The respondents were recruited through advertisements and handbills in which the study was described in very general terms, including the facts that it concerned health issues and would last about an hour. Respondents were promised $10.00 for participation and were given a telephone number to call. Potential respondents were screened over the telephone to eliminate persons under 18 and students from the University of Chicago. The interviews were scheduled in a second telephone contact.

The 104 respondents were residents of Hyde Park and neighboring areas. Although we had hoped to select roughly equal numbers of persons with and without children and with varying levels of education, our recruitment efforts did not yield a large enough pool of potential respondents to balance the sample on both variables. We did succeed in recruiting equal numbers of respondents living with children and with no children. However, we were unable to recruit equal numbers at each level of education. In addition, the high-education group included fewer respondents with children than the other two groups. Most of the respondents were black (81 respondents) and female (65 respondents).

The respondents were interviewed at NORC's offices in Chicago. The interviews were conducted in person by three experienced NORC interviewers. Before starting the interview, the interviewer gave each respondent a consent form that explained that the purpose of the survey was "to develop better questions" for the National Health Interview Survey and gave assurances regarding the confidentiality of their answers. All of the respondents agreed to participate and were then interviewed. The interview began with a series of items on household composition and demographic characteristics; this portion of the interview included eight standard items drawn from the core NHIS questionnaire. The dental health supplement followed these initial questions.

After the dental supplement was completed, respondents filled out a short questionnaire designed to assess comprehension of some of the terms in the supplement and were asked to sign a permission form allowing us to recontact them for a second interview. All the respondents agreed to the reinterview. Respondents were then paid $10.00 for their participation. The initial interview generally took about one-half hour to complete.

After a week to 10 days, respondents were contacted and interviewed over the telephone. We were able to complete the reinterview with 73 of the respondents. The telephone reinterview included only the questions from the dental health supplement. Each respondent received the same version of the supplement and the same reference dates as in the initial interview but was questioned by a different interviewer. During the reinterview, respondents were asked to check their answers to the dental visit items by consulting dental bills, checkbooks, and other records; in addition, they were asked to check the brand names of toothpastes and mouthwashes actually present in their homes.

Any government activity that requires collection of the same data from nine or more people requires clearance by the Office of Management and Budget (OMB). OMB provides an oversight function directed at assuring that data collection efforts are scientifically sound, that the information is actually needed, that the requests for information do not place undue burden on the public, and that citizens have an opportunity to comment on planned data collection activities. The entire OMB clearance process takes some 3–5 months, including the within-agency clearance. Anticipating that we would want to administer the same questionnaire to more than eight people during Part B, we began the OMB clearance process well before Part A began. This created some operational difficulties. We had not anticipated that the Part A studies would be as successful as they were in suggesting different questioning strategies and had anticipated that in Part B we would still be searching for insight into the question-answer process. Instead, when we reached Part B we were ready to posit specific hypotheses about the impact of different questions. It would have been helpful at that point to collect validation information from an external source to confirm our laboratory results. We were not able to do this because we lacked the necessary OMB clearance.

Results

Experimental results

An alpha level of .05 was used throughout Parts B and C. Marginal results are reported for an alpha of .15 or less. Statistical values are presented only for significant and marginal results. Results from the Part B experiments are summarized in table D, which shows those experiments in which we found differences between the experimental groups.

Results on comprehension—In the first experiment on comprehension, two items using the term "public water fluoridation" (standard version) were contrasted with two using the phrase "fluoride added to the water" (simpler version). This apparently minor variation in the questions had considerable impact on the answers. The simpler

Table D. Results of the Part B experiments

Dental visit experiments

1. Percent of respondents with at least 1 visit in prior 12 months

	Self reports	
	Reason cues	No reason cues
Context cues	67	42
No context cues	75	66

	Reports of other family members	
	Reason cues	No reason cues
Context cues	77	58
No context cues	70	56

2. Mean number of dental visits in prior 12 months

	Self reports	
	Reason cues	No reason cues
Context cues	2.34	0.84
No context cues	2.13	1.47

	Reports of other family members	
	Reason cues	No reason cues
Context cues	1.95	0.75
No context cues	0.93	0.81

Purpose of water fluoridation

Percent of respondents correctly answering by type of wording

	Defined wording	Original wording
Prevent tooth decay	60	43
Other	23	28
Don't know	17	29

Use of flouride mouth rinse

Percent of respondents who gave correct answers

	Original wording	Defined wording	Decomposed wording
Correct	56	69	75
Incorrect	44	31	25

wording yielded more correct answers regarding the purpose of fluoridation (60 percent) than the standard wording (43 percent). The difference approached significance. (Logit analysis was used; $z = 1.79$ and $p < .08$.) Compared with the standard wording, the simpler wording also increased the number answering "don't know" in response to the question about whether their own water was fluoridated (52 versus 21 percent) and decreased the number answering "yes" (23 versus 66 percent). Both of these related effects are significant ("don't know" rate: $z = 2.72, p < .03$; "yes" rate: $z = -4.3, p < .001$). In Chicago, the water is in fact fluoridated, so the simpler wording reduced the rate of correct responses. These results suggest that when people understand the question better, they are more willing to admit that they do not know the answer. This increased willingness to give a "don't know" response may or may not affect the rate of apparently correct responses, depending on respondents' strategies for guessing the answer and the actual situation in their communities.

The other two comprehension studies produced one more noteworthy finding. Results for the fluoride mouth rinse item suggested that either defining the term or breaking the question into several simpler ones (e.g., Does anyone use a mouthwash? Does this mouthwash contain fluoride?) reduced apparent overreporting. Overreporting could be assessed using responses to a later item in which respondents were asked the brand name of the mouth rinse. In both experimental versions of the question, the distinction between fluoride mouth rinses and ordinary mouthwashes was emphasized; most overreporting involved confusion between the two.

In two experiments, we tried and failed to affect answers by providing base-rate information. Thus, we are not entirely certain what processes respondents use to answer questions when they have little specific information on which to base their answer. Two-thirds of the respondents in the standard wording group correctly answered that their drinking water was fluoridated; however, the bulk of them did not know the purpose of fluoridation and, based on the Part A results, we doubt that their answers reflected definite information about their own water supply either. However, their answers were unaffected by the base-rate information we provided, and what exactly served as the basis for these answers remains unclear to us.

Results on recall—The variable with the most consistent impact on the reported number of dental visits was the reasons list. Respondents who were read the reasons list prior to the 12-month visit item reported making an average of 2.1 visits during the past year. Respondents who received a version without the reasons list reported an average of 1.2 dental visits. Despite the small sample size, this difference approached significance ($F(1, 91) = 3.72$, $p < .06$). The results were similar when the proportion of respondents reporting at least one visit was examined.

The picture was somewhat less clear for visits by other members of the respondent's family. Again, the reasons variable had a marginally significant effect ($F(1, 71) = 2.29, p < .14$) on the average number of visits per other family member. This main effect appeared to be qualified by an interaction with the other two experimental variables. In particular, the reasons list produced the highest level of reporting when combined with the context items and either one of the followup probes. For the interaction of both context and reasons, $F(1, 71) = 2.42, p < .13$. Because, on the average, fewer visits were reported for other family members than for self, this result suggests that recall for events involving other people is more difficult and a number of retrieval cues may be necessary to prompt further recall. More generally, this result underscores the importance of examining both self and proxy respondents in assessing the effects of an experimental variable.

Use of laboratory methods

The Part B studies clearly demonstrated that the laboratory approach lends itself to testing a large number of variations in a short time. Although it is not impossible to carry out large-scale field experiments, it would be extremely difficult to do so at comparable cost or with comparable speed. In addition, the logistical difficulties of

carrying out a field test with so many versions of the questionnaire would be considerable, if not insurmountable.

Conclusions

The Part B studies clearly demonstrated that the laboratory approach lends itself to testing a large number of variations in a short time. A number of the posited effects of different questioning strategies were demonstrated. The multiple versions of the questionnaire embodied specific hypotheses about the source of reporting error rather than a scattershot effort to identify the best version. Although the laboratory method does not absolutely require the development of hypotheses, the control that the laboratory affords and the strong tradition of hypothesis testing within the laboratory setting foster the development of general hypotheses.

The laboratory approach was not without its limitations. We encountered two major problems in Part B. First, the samples that we used were too small and too homogeneous. Second, we observed little variation across respondents on several key items.

The samples for laboratory studies can be larger and more varied. Our study was the first of its kind. We did not have the opportunity to develop a pool of potential respondents with known characteristics. A continuing laboratory program could develop such a respondent pool by tapping alternative sources of subjects, offering larger incentives, and developing an ongoing recruitment effort.

Another limitation of the laboratory studies is that the setting is very different from the setting of most surveys. In the laboratory, the respondents are not distracted by children, neighbors, or the television; they have made some commitment to the response task by showing up at the laboratory; and they can give full attention to the task. This is an advantage because it permits the use of more detailed observational techniques. It is also a disadvantage because there is no guarantee that the processes observed in the laboratory are the same as those used by respondents in the field. In Part C, we examined the transferability of results to the field setting.

Part C: Field and laboratory testing of questionnaires

Part C was the final phase of the project. Again we had several goals. We compared two versions of the dental supplement, a version that was based on the laboratory development activities (the experimental version) and one that was based on the field pretesting activities (the standard version). The goal of the comparison was to determine if the questioning methods that appeared to be successful in the laboratory would be successful in the field. The general conditions of field surveys are quite different from those of the laboratory. The laboratory will not be a good setting for the design and testing of questionnaires unless it can be used to examine processes that operate in the field. We need to know what types of effects are observed in both settings and, when differences across settings are observed, the reasons for these differences. Thus, we were concerned with whether questions that seemed to be better in the laboratory would also seem to be better in the field.

Again, we undertook several activities directed at examining testing methods. The two questionnaires that were compared in the field were also compared in the laboratory in order to obtain more information about factors that might have different effects with a change in setting. Because of tight time schedules and the operational problems associated with testing alternative versions in a field pretest, previous NHIS development efforts had been focused largely on a qualitative assessment of a single version of the supplement. This assessment consisted of oral debriefings of the interviewers immediately after the pretest and both written and oral debriefings of the observers. The comparison of two questionnaires in a field test offered an opportunity to examine whether a more quantitative assessment would yield different results from a qualitative assessment. Thus, we keyed and tabulated the results from the pretest and compared qualitative and quantitative conclusions.

The gathering of validation data in a laboratory setting was also examined. Validation studies for health surveys usually consist of record-check studies in which the information in medical records is compared with respondent reports. These studies are difficult to conduct. Locating the health care providers is difficult, as is the matching of events reported in the survey and in the records, obtaining permission to gain access to records, and gathering the information in a timely manner. We examined the gathering of validation data in the laboratory setting by attempting to gain access to the dental records of the laboratory respondents.

Finally, we made an initial attempt to bring some of the unique features of the field setting into the laboratory for examination. During observation of the field tests, we noted that there was a big difference in the pace at which the interview was conducted in the laboratory and in the field. Several of our treatments were designed to induce the respondent to devote more time to the question-answer process. We speculated that these treatments would be less effective in a fast-paced interview. The rapid pace of the field interviews is probably due to the social context in which the interviews are conducted. Interviewers visit respondents' households without an appointment and most often encounter respondents who are in a hurry to move on to their everyday activities. NHIS interviews are often very long, averaging 1¼ hours, and respondents are often reluctant to spend this time, putting interviewers under pressure to complete the interview quickly. In contrast, laboratory respondents come in prepared to devote an hour or so to the response task. Thus, we attempted to systematically vary the pace of the laboratory interviews to begin to get an idea whether we could simulate field conditions and observe their impact.

In summary, we had several objectives in Part C:

- To determine if the questioning strategies that appeared successful in the laboratory were also successful in the field
- To continue to examine the impact of site of testing on the results
- To assess how conclusions based on observation alone would differ from those that also included tabulations of the pretest data
- To begin to gauge whether some of the general conditions of the field setting could be studied in the laboratory

Design

Questionnaire versions

In an ideal comparison, the two versions of the dental supplement would have been developed in complete independence, but, in fact, there was some interaction between the two teams developing the dental supplement. Staff of this project served as observers during the Greensboro pretest and so had access to the results of the pretest. The report on the first phase of this project was disseminated

widely, so the team developing the standard version of the dental supplement had access to early laboratory results. The two versions, thus, do not differ as dramatically as they might have. Both the standard version and the experimental version of the dental supplement questionnaire are shown in appendix II. The major differences between the two versions involve items covering four areas: (1) public water fluoridation; (2) 2-week and annual dental visits; (3) fluoride mouth rinses; and (4) dietary fluoride. These are summarized in table E.

In addition to the differences detailed in table E, there were several other differences between the two versions that we mention only briefly here. Both versions of the dental supplement contained items to determine the reason for the last dental visit by each family member. The standard version contained a single item for this purpose; the experimental version contained a preliminary item concerning the treatment received and a followup item to determine how the person ended up receiving the treatment. The two versions differ so sharply that it was impossible to make quantitative comparisons between them. The interviewers at the Portland pretest expressed a preference for the experimental version. Both versions also included items about dental sealants and provided definitions of this term; the exact wording of the items differed somewhat, but, perhaps because of the relative rarity of this treatment, no marked quantitative or qualitative differences between the two were observed. Finally, both versions contained items to elicit the brand of toothpaste that family members used. There was only a slight difference in the phrasing of these items. The Portland interviewers seemed to prefer the experimental version, but no quantitative differences between the two versions were apparent.

Portland pretest

Interviewers—Twenty-four experienced interviewers from the U.S. Bureau of the Census were flown to Portland, Maine, to carry out the pretest interviews. They received 1 day of training to familiarize themselves with the instruments to be used in the pretest. Aside from the NHIS core questionnaire, the instruments included the two versions of the dental supplement and supplements on health insurance coverage, vitamin and mineral intake, and occupational health issues.

Respondents— Each interviewer was assigned 16 dwelling units on a block (or set of adjoining blocks) that had been preselected and prelisted. The blocks were selected purposively to represent different income levels. Additional addresses were listed on each assignment sheet to allow for vacant units and nonresponse. The respondent for a family was selected using the standard NHIS respondent rule: Any adult family member could serve as the respondent for the family; other adult members present were also encouraged to participate.

Although the preselected dwelling units were to have been sent an advance letter explaining the purpose of the interview, most of the respondents did not appear to have received any letter and, thus, were approached "cold" by the interviewer. A total of 385 interviews included at least some data from the dental supplement and are analyzed here.

Experimental procedure—In the Portland pretest, two factors were systematically varied—the version of the dental supplement questionnaire and whether the full NHIS core questionnaire or a shortened version (the partial core) was administered. The shortened core included the household enumeration items, various demographic items, and items covering limitation of activity. The assignment of a household to an experimental group was not, strictly speaking, random. Rather, the first eight households interviewed by each interviewer received a full core; the remainder received the partial core. Experimental and standard versions of the dental supplement were simply alternated.

The interviews were generally conducted with an observer present. The observers included staff from this project, from NCHS, from the U.S. Bureau of the Census, and from other interested agencies. The qualitative results described later, however, reflect the comments of the interviewers only.

Chicago laboratory test

The NORC experiment differed from the Portland pretest in several respects. The most dramatic differences were that the respondents were interviewed at NORC's offices in Chicago rather than in their own homes and that they were asked if they would permit us to contact their dentists in order to verify the accuracy of the answers. These and other differences in the two studies are summarized in table F.

Interviewers—Two experienced U.S. Bureau of the Census interviewers from the Chicago area agreed to join NORC's staff temporarily to carry out the Chicago experiment interviewing. One of the interviewers had also participated in the Portland pretest. The two interviewers were trained in a half-day session in which the dental supplement was emphasized.

Respondents—One hundred forty-six persons completed the interview. Roughly one-sixth of them were selected from the files of two cooperating dental practices in the area. After persons were selected from the dental practice files, they were telephoned by a member of the project staff and asked to participate. The participation rate was low. Of the 176 persons initially selected, only 22 actually completed an interview. The purpose of recruiting some of the respondents through a dental practice was to ensure that records would be available for at least a portion of the sample and to enable us to "salt" the sample with a number of respondents who had visited dentists during the 2-week reference period.

The remainder of the sample was recruited via posters placed at stores in the neighborhood around NORC's offices, advertising in a local newspaper, and a recruiting table set up at a nearby hospital. In the poster and advertisements, volunteers were requested for a study concerning health. Respondents were promised $10.00 for their participation, which, they were told, would last about an

Table E. Wording of experimental and standard versions of the dental supplement and summary of differences

Experimental version	*Standard version*
Public water fluoridation	
Wording:	
1a. As you understand it, what is the purpose of adding fluoride to the public drinking water?	Now I'm going to ask you some questions about WATER FLUORIDATION.
b. Does the water that you drink at home come from a public water system or is it from another source, such as a well?	As you understand it, what is the PURPOSE of public WATER FLUORIDATION?
c. Has this public water supply had fluoride added to it?	a. Is your home drinking water supply part of a PUBLIC water system, or is it from a well, spring, or cistern?
	b. Is YOUR home drinking water supply FLUORIDATED?
Differences: Experimental version used simpler language in order to facilitate comprehension of the items.	
Dental visits	
Wording:	
The next questions are about receiving dental care.	HAND CALENDAR
2a. Is there a particular dentist's office, dental clinic, or some other place that you usually go for dental care?	These next questions are about receiving dental care.
b. Altogether, how many DIFFERENT PLACES do family members go for dental care?	3a. During the 2 weeks (outlined in red on that calendar), beginning Monday (*date*) and ending this past Sunday (*date*), did anyone in the family go to a dentist? Include all types of dentists, such as orthodontists, oral surgeons, and all other dental specialists, as well as dental hygienists.
3a. Does anyone in the family go to an orthodontist?	b. Who was this?
b. Who is this?	c. During those 2 weeks, did anyone else in the family go to a dentist?
c. Anyone else?	d. During those 2 weeks, how many times did _____ go to a dentist?
4a. When _____ needs to go to the dentist, who usually makes the appointment for _____ ?	4a. During the past 12 months (that is, since (*12-month date*) a year ago), how many visits did _____ make to a dentist? (Include the (*Number in 3d*) visit(s) you already told me about.)
b. When _____ needs to go to the dentist, how does _____ usually get there?	b. How long has it been since _____ LAST went to a dentist?
5a. During the 2 weeks (outlined in red on that calendar), beginning Monday (*date*) and ending this past Sunday (*date*), did anyone in the family go to a dentist? Include all types of dentists, such as orthodontists, oral surgeons, and all other dental specialists, as well as dental hygienists.	
b. Who was this?	
c. During those 2 weeks, did anyone else in the family go to a dentist? Ask for each person with "Dental visit" in 5b.	
d. During those 2 weeks, how many times did _____ go to a dentist?	
The next questions concern visits to the dentist that anyone in the family may have made in the past year. To help you remember possible visits I will read a list of reasons some people have for going to the dentist. Do not answer as I read the list. It is just to jog your memory.	
Some people go to the dentist for a check-up and to have their teeth cleaned, or to have a tooth filled or capped—	
Some go because they are in pain or because a tooth broke or a filling fell out—	
Some people go as part of a series of treatments for gum disease, a root canal, or to have false teeth fitted—	
And some go as part of a series of orthodontic treatments—to have their teeth straightened.	
6a. During the past 12 months, (that is, since (*12-month date*) a year ago), how many visits did _____ make to a dentist? (Include the (*Number in 5d*) visit(s) you already told me about.)	
b. When did _____ LAST go to a dentist? If respondent mentions month and year and NOT an interval, fill 6c and mark 6b.	
c. What was the month and year of this visit?	
For the questions that I have just asked you, it is very important that we get the most accurate answers possible. We know that it is sometimes hard to remember whether a visit was before or after (*12-month date*). We have found that it helps some people to think of important events that happened about a year ago. For example, this might be a birthday, a new job, a holiday, or a vacation.	

Table E. Wording of experimental and standard versions of the dental supplement and summary of differences—Con.

Experimental version	*Standard version*
7. What important event happened about a year ago?	
_____ (Specify)	
You report that_____ made no visits since (*12-month date*).	
8a. When you think about (*Event in 7*) do you remember any visits that _____ made since (*12-month date*).	
b. How many? You reported that _____ made (*Number in 6a*) visits since (*12- month date*).	
c. Thinking about (*Event in 7*) did any of the (*Number in 6a*) visits that _____ made occur before (*12-month date*)?	
d. How many?	
e. When you think about (*Event in 7*) do you remember any additional visits that _____ made since (*12-month date*).	
f. How many?	

Differences: Experimental version used three approaches to stimulate recall. Items 2-4 concerning the context of dental visits; the list of reasons why people might visit the dentist that introduces question 6; and a reasking of the question on number of visits in the prior 12 months after asking the respondents to generate a landmark event.

Fluoride mouth rinse

Wording:	
Sometimes people use fluoride to protect their teeth. For example, some mouth rinses contain fluoride, others do not.	8a. Recently, some MOUTH RINSES have been developed that contain FLUORIDE to reduce tooth decay. Does anyone in the family now use a mouth rinse that contains FLUORIDE, such as ACT, Fluorigard, Listermint with Fluoride, StanCare, or a similar product?
12a. Schools and work places may have fluoride mouth rinse programs. Does anyone in the family take part in such a program?	b. Who is this?
b. Who is this?	c. Anyone else?
c. Is this at school or at work?	d. Does _____ use this fluoride mouth rinse at home, at school, or at work?
d. Is anyone else in a mouth rinse program?	e. What is the name of the mouth rinse?
e. Does anyone in the family now use a mouth rinse or mouthwash that has fluoride in it?	
f. Who is this?	
g. Anyone else?	
h. What is the name of the fluoride mouth rinse that _____ uses?	

Differences: Experimental version defines fluoride mouth rinse and decomposes the question so as to allow the respondent to separately consider school and home use of fluoride mouth rinses. Standard version defines fluoride mouth rinse by explicitly listing brands of fluoride mouth rinse that were commercially available at the time of the pretest.

Dietary fluoride

Wording:	
Sometimes doctors or dentists prescribe pills or drops with fluoride in them.	9. Does _____ now use FLUORIDE tablets, drops, or FLUORIDE vitamin supplements which are intended to be SWALLOWED?
13a. Does anyone in the family now take vitamins with fluoride in them?	
b. Who is this?	
c. Anyone else?	
d. Does anyone in the family now take any other kind of fluoride drops, pills, or tablets?	
e. Who is this?	
f. Anyone else?	

Differences: The experimental version attempts to improve understanding by decomposing the question so that the different types of products are asked separately.

Table E. Wording of experimental and standard versions of the dental supplement and summary of differences—Con.

Experimental version	*Standard version*
Dental sealants	
Wording:	
14a. Dental sealants are special plastic coatings that are painted on the tops of the back teeth to keep them from decaying. They are put on by a dentist or a dental hygienist. They are different from fillings, caps, crowns, and fluoride treatments. Has anyone in the family had dental sealants placed on their teeth?	10a. The chewing surfaces of teeth may be coated with plastic dental sealants to prevent tooth decay. These sealants are NOT fillings, caps, or crowns. Has anyone in the family had plastic dental SEALANTS applied to the teeth?
b. Who is this?	b. Who is this?
c. Anyone else?	c. Anyone else?
Differences: The experimental version describes the procedures used to apply the sealants in order to promote understanding. Both versions specifically exclude the types of treatments that were confused with dental sealants in previous rounds.	

hour. They were instructed to call NORC to set up an appointment. Volunteers were asked a few screening questions over the telephone to eliminate persons under 18 years of age, full-time students, and persons who had not seen a dentist within the past 3 years. Those recruited at the hospital were screened and given an appointment in person.

Experimental procedure—A total of eight versions of the interview were developed. A 2 × 2 × 2 factorial design was used—questionnaire version (standard or experimental) and core (full or partial) were the levels of the first two factors. These were the same factors employed in Portland. Finally, one-half of the interviews were administered at a fast pace; the other half were administered at a slow pace. The rationale for including this last variable was simple: It represented an effort to increase the realism of the laboratory interviews. As respondents showed up for their appointment, they were randomly assigned to an experimental condition. The interviews were typically conducted in an unoccupied office. A few were observed by project staff, and an additional half dozen were tape recorded, but the vast majority were not observed.

Dental information—After the interview was completed, respondents were asked to list all dentists they and other members of the family had seen within the last 2 years. The respondents were then asked to sign a form giving us permission to contact their dentists and to obtain information to verify their answers to several of the items. Parents living with minor children were also asked to sign permission slips on behalf of their children. When other adult family members were covered by the interview, the respondent was given permission forms to take home for the other adults to sign and return. Followup calls were made to encourage the return of these additional permission slips and to resolve questions about the addresses of the dentists.

At the conclusion of the interviews, each dentist who had been named by a respondent was sent a data abstraction form with the person's name and a copy of his or her permission slip. The data abstraction form contained questions about the number of visits the person had made during the 2-week and 1-year reference periods. If the dentist had not replied within 2 weeks, a followup call was made.

Results

Portland pretest

By means of the Portland field test, we were able to examine how well the questioning strategies that were developed in the laboratory could be transferred to the field setting. Table G summarizes the results by questionnaire version for the Portland field test. In performing the statistical tests for differences, we took into account the clustering within interviewers and segments. Thus, the error variances were based on only 23 degrees of freedom and included the impact of variance among interviewers. Because of this approach, few of the differences were statistically significant.

Dental visits—Relatively few people reported any visits to the dentist during the 2-week period preceding the

Table F. Summary of Portland field test and Chicago laboratory test

Portland pretest	*Chicago laboratory test*
24 experienced interviewers	2 experienced interviewers
Purposive sample of blocks	Respondents recruited from dental practices and through advertisements and recruiting tables
Interviews conducted in respondent's home	Interviews conducted in laboratory
Interviews generally observed	Interviews generally not observed
2-way design varying version of dental supplement and completeness of core	3-way design varying version of dental supplement, completeness of core, and pace of interview
No validation data	Records data from dentists

Table G. Summary of results from the Portland field test for experimental and standard versions of the dental supplement

Core	Experimental supplement	Standard supplement
	Average number of dental visits in prior 12 months	
Total	1.8	1.6
Shortened core	2.1	1.6
Complete core	1.6	1.6
	Percent of persons using fluoride mouth rinse at home	
Total	11	10
Shortened core	15	8
Complete core	6	11
	Percent of persons using fluoride mouth rinse at school	
Total	6	1.5
Shortened core	6	1
Complete core	6	2
	Percent of correct answers on household use of fluoride mouth rinse[1]	
Total	42	57
Shortened core	49	57
Complete core	26	56
	Percent of correct answers on purpose of public water fluoridation	
Total	78	67
Shortened core	80	66
Complete core	76	68
	Percent of respondents giving correct answers on own water fluoridation	
Total	46	37
Shortened core	48	39
Complete core	44	49

[1]Judged correct if brand reported contained fluoride.

interview. Overall, the proportion of people with one or more 2-week visits was less than 10 percent. The analysis of variance indicates that the proportion did not vary significantly as a function of the experimental variables.

Table G shows the average number of annual visits reported in the four experimental groups. It appears that the combination of the shortened core and the experimental version of the supplement produced the highest levels of reporting, but the analysis of variance revealed that neither the main effect nor the interaction was significant either for the initial answers to the experimental version or for the final answers that reflect responses to the landmark followup probe. The landmark probe did tend to increase the level of reporting, netting an additional 49 visits.

Fluoride mouth rinse—Both versions of the dental supplement included items on the use of fluoride mouth rinses, and both contained a definition of the term. The items differed in that the experimental version contained separate questions about school programs, and the major brands of fluoride mouth rinse were listed in the standard version. Both of these features appear to be effective. Table G shows that more participants in school programs are picked up through the experimental version, but use of the standard version reduces reports mentioning nonfluoride brands. The analysis of variance revealed a marginally significant main effect for the version used ($F(1, 22) = 4.1$, $p < .10$), with the experimental version producing higher overall rates of reported use.

Public water fluoridation—Use of the experimental version of the dental supplement produced a higher rate of correct responses concerning the purpose of public water-fluoridation than the standard version; 78.0 percent of respondents given the experimental version answered "to prevent tooth decay" or gave a related answer, compared with 67.0 percent of respondents given the standard version. This effect was marginally significant ($F(1, 22) = 2.9$, $p < .11$).

The item regarding whether the respondent's own water was fluoridated yielded small and inconsistent differences between the two versions of the supplement.

Dietary fluoride—The two versions of the supplement produced no significant differences in the reported use of dietary fluoride supplements. The general feeling among the staff was that overreporting would be the biggest problem with this question, and the experimental version did have marginally fewer reports.

Chicago laboratory test

The Chicago laboratory test was carried out by two interviewers. Because so few interviewers were used and because they were not selected randomly, it made little sense to attempt to generalize across interviewers in analyzing the data from the NORC study. Instead, we treated the interviewer variable as a fixed factor in the analysis, along with the more substantive variables in the experimental design—the version of the dental supplement, the use of the full or shortened core, and the pace of the interview. The basic analyses thus involve four-way analyses of variance, or logit analyses. We will focus on the effects of the substantive variables and discuss interviewer effects only when the main results are qualified by interactions with the interviewer variable.

Note that, for some of the items, we cannot expect to replicate the findings from Portland. The use of supplementary sources of fluoride is considerably lower in Chicago, where the water is fluoridated, than in Portland, where it is not. This reduced sharply our ability to look at comparisons involving these items.

Time of administration—On the average, it took respondents nearly 9 minutes to complete the dental supplement portion of the interview. The pace variable, as expected, had a marked effect on the times; supplements conducted under the fast pace took 7.9 minutes to complete versus 9.6 minutes for those conducted under the slow

pace. The difference was significant ($F(1, 130) = 16.8, p < .001$). The two versions of the supplement also took different amounts of time, with the experimental version requiring an average of 10.6 minutes, compared with 6.9 minutes for the standard version. This large difference was also significant ($F(1, 130) = 75.4, p < .001$). None of the other experimental variables, either singly or in combination, had a significant effect on the time for the supplement, although one of the interviewers was significantly faster than the other. The pace variable thus seems to have been successfully implemented, and the experimental version, with its added items and more elaborate introductions and definitions, required more time to administer than the standard version.

The pace variable also significantly affected the time it took to complete the core interview, the slow pace adding an average of more than 3 minutes ($F(1, 130) = 5.99, p < .05$). The full core required almost 13 more minutes, on the average, than the shortened version, a highly significant difference ($F(1, 130) = 80.87, p < .001$). Table H summarizes some of the results from the Chicago laboratory tests.

Dental visits—As expected, none of the experimental variables had significant effects on responses to the 2-week dental visit items. We examined responses to the 1-year visit items separately for the respondents and for other family members.

The number of self-reported 12-month dental visits varied considerably, with responses ranging from zero to 50 visits. The distribution is quite skewed, with most respondents reporting two or fewer visits. In order to reduce the impact of the few cases with a large number of visits, we deleted data for persons reporting 12 or more visits, and we analyzed the square root of the number of visits reported as well as the raw number. The results from all analyses were the same; therefore, we present the findings based on the raw figures here.

Table H shows the average number of self-reported visits for the 1-year reference period. There was an interaction between the pace and version variables. As we expected, with the slow pace, the experimental version produced higher levels of reporting than the standard version (2.7 visits for the experimental version versus 2.0 for the standard). This pattern was reversed for the respondents interviewed at the fast pace (1.7 for the experimental version versus 3.4 for the standard), a reversal we did not expect. The overall interaction was significant ($F(1, 129) = 6.7, p < .05$). The pace variable also interacted with the shortened core, and slow pace with the complete core led to relatively high levels of reporting (3.1 visits for the fast shortened group and 2.9 visits for the slow complete group). The interaction was significant ($F(1, 129) = 4.8, p < .05$).

Table H also shows the mean number of annual dental visits reported for other family members. (For households with more than one additional family member, a mean was first taken for the other family members.) For other family members, the completeness variable interacted with the version of the supplement. The experimental version produced higher levels of reporting with the shortened core (an average of 2.3 visits versus 1.4 visits for the standard core); with the complete core, the two versions did not differ as much (1.2 for the experimental version versus 1.9 for the standard version). This is the same pattern that was observed in the Portland pretest. In Chicago, the interaction was significant ($F(1, 83) = 6.4, p < .05$). However, the pattern is further qualified by an interaction with the pace variable: It is apparent only when the interview was conducted at the fast pace. The interaction involving three variables was also significant ($F(1, 83) = 4.6, p < .05$).

Fluoride mouth rinse and dietary fluoride—The use of dietary fluoride supplements and fluoride mouth rinses was relatively rare in our sample: This comes as little surprise, as Chicago's water supply is fluoridated. Neither item revealed any differences by version or by any of the other experimental variables.

Public water fluoridation—As in Portland, the experimental version of the item concerning the purpose of public water fluoridation produced a higher percentage of correct

Table H. Summary of results from the Chicago laboratory test for experimental and standard versions of the dental supplement

Supplement and respondent	Total, both paces	Fast pace: Total	Fast pace: Shortened core	Fast pace: Complete core	Slow pace: Total	Slow pace: Shortened core	Slow pace: Complete core
	Average number of dental visits in prior 12 months						
Experimental supplement:							
Self	2.2	1.7	1.7	1.8	2.7	2.3	3.2
Others	1.7	2.0	3.0	1.1	1.5	1.8	1.2
Standard supplement:							
Self	2.7	3.4	4.5	2.4	2.0	1.3	2.7
Others	1.7	1.8	1.2	2.5	1.6	1.7	1.4
	Percent of respondents giving correct answer to question on the purpose of public water fluoridation						
Experimental supplement	76.7	77.1	88.2	66.7	76.3	75.0	77.8
Standard supplement	52.9	60.3	77.2	44.4	45.9	50.0	42.0
	Percent of respondents giving correct answer to the question on own water fluoridation						
Experimental supplement	53.5	54.3	58.8	50.1	52.6	40.0	66.7
Standard supplement	67.3	58.4	55.6	61.1	75.7	66.7	84.2

responses than the standard version. Apparently, at least some people know what fluoride is for but may not recognize the term "public water fluoridation." A logit analysis revealed a significant ($p < .05$) main effect for the version variable; 76.7 percent of the respondents who were given the experimental supplement correctly named the purpose of fluoridation, compared with versus 52.9 percent of those who received the standard version. The logit analysis also revealed a marginally significant ($p < .15$) advantage for the shortened core (71.2 percent correct versus 57.5 percent for the complete core) and an uninterpretable marginal interaction involving the version, completeness, and interviewer variables. The item in which respondents were asked whether their own water was fluoridated revealed only a marginal main effect for version, with the experimental version producing a lower rate of "yes" responses and a high rate of "don't know" responses. This replicated the prior Part B results.

Overall results: Summary

The experimental version of the dental supplement differed from the standard version in four main respects. It had simpler language than the standard version for the items concerning public water fluoridation. In addition to the main items regarding annual dental visits, it included a series of warmup items regarding the context of dental visits, a list of reasons for possible visits, and a followup item asking respondents to try again. It gave a general definition of fluoride mouth rinses (as opposed to the standard version's definition, in which particular brand names were mentioned), and contained a separate question regarding participation in school mouth rinse programs. Finally, an item about the use of dietary fluoride was decomposed into a series of items. The last difference produced no marked effects, perhaps because so few people use dietary fluoride supplements that it was difficult to observe much variation across versions.

Portland results—Overall, the Portland pretest, despite its larger sample size, yielded few significant effects involving the version of the supplement and no effects at all involving the length of the core interview. A number of factors reduced the power of the design. The sampling error estimates include interviewer variance and are more substantial than might be inferred from the nominal sample size of 971 persons. The data were clustered by household and by segment and interviewer. (These last two sources of variation are completely confounded.) Because of the clustering, the variance estimates for most analyses are based on 23 degrees of freedom. This conservative approach makes it unlikely that results will reach conventional levels of significance. We therefore relaxed our criterion for reporting results in this summary, discussing findings "significant" at the .10 level, especially when the findings are replicated in other studies reported here.

Despite these sources of imprecision, the Portland pretest produced a few noteworthy results involving the version of the supplement. First, respondents interviewed with the experimental version were likelier to correctly identify the purpose of fluoridation (78.0 percent versus 67.0). Although only marginally significant, the result is consistent with the earlier Part B findings and, as it turned out, with the results from the Part C Chicago experiment. Second, the Portland results suggested that the experimental version produced higher levels of reporting of dental visits only when administered in conjunction with the shortened core. We suspect that the shortened core probably produced a more leisurely interviewing pace and that this slower pace was a prerequisite for the effectiveness of the warmup items in the experimental version. This hypothesis was put to the test in the Chicago experiments, where it received some support. The final two findings involve the fluoride mouth rinse items. The experimental version produced significantly higher levels of reported usage overall and, most dramatically, higher levels of reported participation in school programs. This difference apparently reflected the decomposition of the mouth rinse item in the experimental version, which contained a separate question on school programs. The standard version produced lower rates of erroneous reports involving nonfluoride brands. The standard version explicitly mentioned the brand names of the relevant mouth rinses.

Chicago results—The Chicago experiment confirmed the Portland results in several respects. Once again, the experimental version with its simplified language produced higher rates of correct answers to the item about the purpose of fluoridation. The expected pace-by-version interaction did, in fact, appear in answers to the annual dental visit items. There were a number of surprises as well.

The pattern for annual dental visits was more complicated than we had predicted. We had expected the two versions to differ only when the pace was slow; with a slow pace, the experimental version would, we thought, produce higher levels of reporting. The results for the slow-pace respondents confirmed this prediction. With a fast pace, for which we expected little difference between versions, the standard version in fact produced the higher level of reporting. In addition to the pace-by-version interaction, pace and the completeness of the core interview had an unexpected interactive effect on self-reported visits. Finally, for visits by other family members, we observed the same interaction originally noted in Portland—the experimental version produced higher reporting only with the shortened core—rather than the pace-by-version interaction we had predicted. This interaction, however, was present only in the interviews conducted at a fast pace.

The Chicago results departed from the Portland results regarding the two versions of the mouth rinse items. In Portland, the experimental version produced a higher level of reporting, especially reporting of participation in school programs; in Chicago, the two versions did not differ significantly. The absence of school mouth rinse programs in Chicago probably accounts for the difference.

Comparison—Table J provides a summary of the results of the two experiments. Considering the number of methodological differences between the studies, we find the convergence in the results quite impressive. Although there

Table J. Summary of major results from Portland field test and Chicago laboratory test

Item	*Portland results*	*Chicago results*
Public water fluoridation		
Purpose	Experimental version produced marginally higher identification of purpose.	Experimental version produced significantly higher identification of purpose; marginal effect for shortened core.
Own water	No effect.	Experimental version produced marginally higher rate of "don't know" responses and marginally lower rates of "yes" responses.
Annual dental visits		
Level of reporting	No effect; cell means indicate that experimental version produced higher average reporting only with shortened core.	Significant pace × version interaction: With fast pace, standard version produced higher reporting; with slow pace, experimental version produced higher reporting; for others, experimental version produced higher reporting only with shortened core.
Fluoride mouth rinse		
Level of reporting	Experimental version produced significantly higher rate of reporting overall and an especially high rate for participation in school programs.	Experimental version generally produced somewhat higher rate of reported use, but differences not significant.
Reporting of brands	Standard version produced fewer reports of nonfluoride brands.	No effect.

are differences between the results of the two studies, they are generally differences of degree (e.g., a finding that is significant in one study is apparent but not significant in the other) or differences that reflect the fact that Chicago has fluoridated water, whereas Portland does not.

The pace and completeness variables produced some interesting findings. The Chicago results for annual dental visits by other family members resembled the Portland results more closely when the interviews were conducted under the fast pace. Further, the Chicago dental visit results resembled those of our earlier Part B study when the core was shortened and the pace was slow. Under these conditions, the experimental version produced higher levels of reporting than the standard version. In the Part B study, only a few demographic items were used in place of the NHIS core, and the interviews were conducted at a slower pace than those we observed in the Portland pretest. These findings suggest that important characteristics of the field setting can be duplicated in the laboratory, and that it is important to do so if the results are to be generalizable.

Methodological results

In this component of the study, we also examined the advantages and disadvantages of various methods of testing a questionnaire. As stated earlier, we were particularly interested in (1) the impact that site of testing has on the results, (2) whether qualitative assessments yield different conclusions from more quantitative assessments, and (3) whether it is possible to replicate some of the general conditions of the field setting in the laboratory. We think that an understanding of these matters is very important because it will provide guidance as to how laboratory testing can be integrated with field testing. Therefore, in this section, we review some of the difficulties we had in the operation of both the field and laboratory testing and present some potential ways to avoid these problems. In addition, we present our results on the differences between a qualitative assessment and a quantitative assessment of the two instruments, and we comment on the need for and possibility of taking account of the general survey conditions during laboratory testing.

Field test

When this study began, the NHIS questionnaire process included two large field pretests. They were evaluated qualitatively by means of a debriefing of the interviewers and the observers. Because of the time pressures, data were not always analyzed quantitatively and thus were not always used in the evaluation of the results. Because generally only one version of the questionnaire was used in each pretest, there would have been no basis for comparison even if tabulations had been done. In this study, however, the results of the Portland pretest were mailed to NORC from the field, coded, keyed, and tabulated in time for the debriefing of the observers. Thus, the quantitative results can be compared with those of the qualitative assessment.

Operational features of the pretest—Although offering advantages for analysis, the introduction of two versions of the questionnaire created a number of practical problems. The laboratory version of the questionnaire arrived late at the U.S. Bureau of the Census; consequently it was not formatted and printed as carefully as the standard version. Moreover, training for the experimental version was relegated to the last position in the training session. Finally, procedures for administering and coding the experimental instruments departed in various ways from what had been standard procedure for NHIS interviewers in the past. Interviewers strongly objected to such items as the

landmark followup probes and the reasons list, which differed markedly from the standard version.

These problems resulted from the isolation of this project from the previous testing environment and our resulting insensitivity to the NHIS institutional environment. The interviewers face a complex task that requires following a standard set of procedures and maintaining consistent behaviors throughout the interview. Because the training sessions were brief, it was especially difficult for them to adapt to the changes required for the experimental questionnaire. The problems with the printed version of the questionnaire aggravated this difficulty. In retrospect, we see that we should have worked more closely with the U.S. Bureau of the Census to overcome these problems.

In future design studies, efforts should be directly aimed at overcoming the transition from laboratory to field testing. To alleviate the operational problems outlined earlier, we concluded that field staff should be included in the exploratory and developmental phases. The success of the testing phase is dependent on having procedures that can be implemented in the traditional NHIS environment. This means that the field staff should be brought into the design process sooner, should be considered a partner in the development of the questionnaire, and should be kept informed of the findings and reasoning that motivate decisions. Field staff have excellent insights into interviewers' reactions to certain procedures and can anticipate respondents' difficulties in answering certain questions. We did little to take advantage of this expertise in the current study.

Qualitative and quantitative assessment of differences—The qualitative assessment of the results consisted of (1) oral debriefings with the interviewers immediately after the pretest and (2) both written comments and an oral debriefing of the observers. The qualitative assessment of the results on the dental visit items indicated that the interviewers had severe problems administering the landmark followup probe. They were very critical of these items and were not able to administer them correctly. Interviewers also objected to reading the reasons list that preceded the 12-month question, and they reported that some respondents objected to hearing the list. Interviewers did not have problems in administering the 12-month question; they merely found its treatment jarringly different from the treatment used for other questions. These difficulties could have been avoided through consultations with interviewers earlier in the design process.

Analysis of the quantitative results revealed no significant differences between the experimental version and the standard version, although prior laboratory tests had registered differences between them and the pattern of differences was later replicated in the Part C laboratory study.

Because no significant differences were found between the standard and experimental versions of the dental visit items, we can conclude that, in this case, qualitative assessments are not necessarily reliable guides to quantitative results. Interviewers' strong objections to the experimental version would have led one to assume that it was unworkable. However, the tabulated results indicated few differences, and those that were present suggested that the experimental version produced more complete recall.

Quantitative analysis of field pretest results on items with unfamiliar terms substantiated findings from the previous two stages of development. The most dramatic instance involved the question on the use of fluoride mouth rinses in school programs. Portland has an extensive fluoride mouth rinse program in the public schools. In the experimental version of the question, home and school use of fluoride mouth rinses was decomposed. Nearly four times as many children who used fluoride mouth rinse were identified under this strategy, clearly indicating the superiority of the approach.

Tabulation of the results on the home use of mouth rinse revealed that the standard version was more successful in reducing overreporting. In the experimental version of the question, we tried to stress the distinction between fluoride and nonfluoride mouth rinses. In the standard version, we made the distinction by mentioning the four commercial brands of mouth rinse that contain fluoride. The success of the questions was evaluated by asking the respondent to report the brand used. The superiority of the standard version in reducing overreporting of nonfluoride mouth rinses substantiates a conclusion reached in earlier laboratory work: The clearer the distinction between the specific item in question and similar items, the more accurate the response.

However, the qualitative assessments of the items with unfamiliar terms did not always give the same results. For example, at the end of the debriefing sessions about the question on the use of fluoride mouth rinses in school, we concluded that the better question was the briefer version, which did not contain a separate question about school use of fluoride mouth rinses. Tabulation of the data led to the opposite conclusion. Similarly, for the question on the use of dietary fluoride, observers at the debriefing concluded that the shorter standard version would be preferable in that it would reduce the likelihood of overreporting of these products. However, the tabulated data showed less reporting on the experimental version.

After observing the interviewing and debriefing and tabulating the data, we conclude that both the qualitative and quantitative assessment are needed. The interviewer reactions and problems—a valuable source of information about problems in the questionnaire and possible solutions—are noted in the qualitative assessments. However, the qualitative assessments are not sufficient for noting things that appear only in the aggregate results. Each interviewer and observer sees about 10 completed interviews. Thus, only those differences that can be noted with sample sizes of 10 or less are apparent in the qualitative results. The quantitative assessment is needed to detect differences that are apparent only with larger sample sizes. There is a basic inconsistency in conducting a large-scale pretest and not tabulating the results. The purpose of large sample sizes is to detect small differences or rare problems. These will be apparent only from the tabulation of the data. To facilitate the quantitative assessment, questionnaire

data should receive the same editing in the pretest as in the main survey.

We also think that experimental designs with more than one version of the questionnaire should be employed in pretests. This takes advantage of the large sample sizes that are used and increases the information yield from the field test. Having the results from more than one version of the questionnaire provides some basis for determining why certain questions result in problems and what potential solutions exist. Exploratory and developmental studies in the laboratory can provide the basis for deciding which items to test further in the final testing phase. However, our experience tells us that special efforts will be needed to smooth the transition between the laboratory and the field.

Laboratory tests

The final laboratory study in Chicago yielded relatively little new information. The two versions of the questionnaire were not radically different, and most of the differences between them were already apparent in the field experiment. The site of the final laboratory study—a fluoridated area—may also have reduced its power to detect differences in the items involving use of fluoride products.

Although laboratory testing could be substituted to minimize the deleterious effects of not having a field test, it is not recommended. The main differences between the results of the two testing sites can probably be attributed to the fact that the laboratory experiment was not conducted in a fluoridated area, whereas the field test was. To make maximum use of the laboratory method in the last round of testing, the sample sizes would need to be increased. Also, special procedures, such as postinterview comprehension probes, might be used to increase the value of the laboratory testing. However, our recommendation is that field testing be done, if at all possible.

Our results indicate that, although there is consistency between the laboratory and the field, the general conditions of the field survey have an important effect on the outcomes. Currently, a field test is the best way of making sure that the questionnaires and procedures operate well under these conditions.

Both the laboratory testing and the field pretesting conducted in the current study were subject to large selection biases. The field pretest was conducted using a nonrandom sample of blocks; in addition, no attempt was made to persuade nonrespondents to participate. The nonresponse rate in the pretest was thus many times greater than that in the national survey. Relative to the actual survey, the pretest contained a higher proportion of people who were easy to interview. This may give an overly optimistic picture of the adequacy of the questionnaire. The laboratory respondents were also a nonrepresentative group. The small monetary incentive disproportionately attracted low-income respondents and persons located near the laboratory.

The selection biases inherent in both testing sites must be kept in mind when interpreting the results. Those associated with the field pretest could be reduced by requiring the interviewers to obtain a higher response rate, which they are capable of doing. Screening can be used to reduce the selection bias among the laboratory respondents. However, the bias cannot be eliminated in this way, since certain groups will never volunteer for screening. Recruitment among special subpopulations may be needed to overcome some of the selection bias associated with the laboratory approach. Contacting groups of retired people, mothers with children in day care, and so on may serve to increase the range of people in the laboratory studies. However, we did not try these procedures, and their effectiveness remains to be demonstrated.

Validation study—The validation study conducted in conjunction with the Chicago laboratory study was something of a disappointment. We encountered a number of difficulties in obtaining validation data regarding dental visits. We had hoped to reduce the data collection costs by recruiting a large portion of the sample from a small number of cooperating dental practices. Although two practices agreed to participate in the study, the patients themselves were very difficult to recruit. Less than one-sixth of the sample ultimately came from the two practices. Thus, the validation study was no more efficient than one that could have been conducted in connection with a field experiment.

We encountered all of the usual problems with record-check validation studies. The respondents made errors in the names and addresses of the dental practices. The dentists took a long time to return the validation questionnaires, and many did not do so at all. In one case we had to visit the dental office to get the information. Approximately 40 percent of the respondents lacked complete validation information. The lack of agreement between respondent reports and reports of the dental office was sometimes difficult to interpret (as when dentists denied ever having seen a patient), perhaps indicating a problem in the records or an error in identifying the dentist. We made no attempt to resolve differences between the respondent's report and that of the dentist, so we have no information as to what produced the discrepancy. Resolving such differences would have been an expensive and time-consuming effort. A more successful validation study would have required greater effort than the resources of this project would allow.

If a sample of persons is to be selected from a health care provider, a means for directly contacting the patients must be negotiated. The return rate on a mail solicitation (which was used with patients at one practice) is much too low to obtain an adequate number of respondents. Alternative procedures that could be tried are: (1) obtain permission to contact the patients by telephone; (2) obtain the cooperation of the health care provider early and use a prospective recruitment effort (e.g., place a recruitment poster in the office); or (3) hire the staff of the provider to make the direct contact with the patient.

Another way in which the validation study might be improved would be to use the respondent to help resolve differences between the survey data and the record data. These discrepancies could be discussed with the

respondent, and matching errors (such as contacting the wrong provider) could be corrected. Debriefings, reinterviews, and interviews with other family members could also be used to assess the quality of the responses.

Conclusions

On reviewing the results of the final phases of our work, we arrive at a number of general conclusions. We conclude that field testing with two or more versions of the survey instruments should be employed in the final phases of testing. The evaluation of the field test should include tabulations directed at answering specific questions as to differences among the alternative methods as well as a directed qualitative assessment of the operational characteristics of the various methods. A formal debriefing questionnaire for each of the interviewers and observers could be used to direct the qualitative assessment toward the most important issues. This could be combined with group meetings that allow discussion and elaboration of the observations.

The instruments that are included in the field test could be developed through a series of laboratory studies similar to those that we conducted in Parts A and B of our study. The laboratory studies should be augmented with small-scale field tests and consultations with field staff in order to ease the transition from the laboratory to the field. Our experience and our analytic results tell us that the general conditions are important when one is considering the methods to be employed in a survey and that some results can be transferred from the laboratory to the field setting. Our attempt to manipulate the pace of the interview is a preliminary indication that it will be possible to study field conditions in the laboratory. Much, however, remains to be learned about the limits and the scope of our ability to study field conditions in the more controlled laboratory setting. This should be a topic in a continuing assessment of laboratory and field methods.

Summary conclusions and suggested protocol for laboratory and field testing

We conclude that laboratory testing and the cognitive sciences can play an important role in the design and testing of questionnaires. Using laboratory testing and such cognitive techniques as protocol analysis, comprehension probes, and experimental manipulation of questions, we were able to identify some of the processes respondents used in formulating answers, to analyze the problems they experienced, and to develop hypotheses about how questions might be improved. Many problems that were identified in the first field pretest were pinpointed in the laboratory in less time, with fewer respondents, with less professional effort, and at lower cost. The laboratory setting can also be used to gain greater insight into the source of respondent difficulties. Concepts from the cognitive sciences were used to guide the development of alternative questions, and subsequent laboratory testing revealed that these changes were often successful in improving responses. Many of the laboratory findings were confirmed during subsequent field testing.

Field testing remains a vital component of the questionnaire development process. Problems with handling and administering materials became apparent only in field tests. Moreover, interviewers are in a position to offer excellent suggestions for clarifying the wording of some questionnaire items. We conclude that laboratory testing can increase the efficiency of field testing. The procedures used by NCHS for the design of the NHIS supplements can be improved by using a combination of both approaches. Based on our evaluation of both the laboratory and field-testing activities, we recommend the following prototype for the design process. Our prototype takes the form of a series of individual recommendations for each stage of the process.

At NCHS and in many other settings the survey research staff often consists of three types of people: (1) statisticians and survey methodologists concerned with the development of the measurement and analysis methods, (2) survey methodologists and field staff concerned with refinement and implementation of the measurement methods, and (3) substantive experts who are sponsoring the survey in order to answer specific substantive questions. We see the laboratory testing as a way to bring these three parties into closer, more effective collaboration.

Our suggested protocol includes the following four phases: (1) planning, (2) exploratory studies, (3) laboratory development and testing of instruments, and (4) field testing. This phasing represents a progression in which each successive phase becomes more like the setting (general measurement conditions) of the actual survey.

Planning

The research effort devoted to the development of the questionnaires needs to be carefully planned. This is, of course, a precept for all research efforts which is easier to state than execute. Careful and early planning is particularly important in the government setting, in which time is tight and government clearances are required for some testing activities. The transfer of methods from the laboratory to the field will be eased if all three components of the research staff are involved in the early planning.

We found that an early attempt to categorize the research issues was helpful in guiding our research. We therefore suggest that response issues be identified for each survey item and that these issues then be classified into more general categories.

Exploratory studies

The theories and methods of cognitive science are an excellent tool for exploring the measurement issues associated with the survey items. Initial stages of testing using a variety of respondents can be done in the laboratory. The range of laboratory respondents should reflect characteristics that have been known to affect response. Given such attention to variety, the number of laboratory respondents need not be large.

We suggest that the laboratory testing be guided by explicit hypotheses as to the response task implied by the items, problems that arise in the response process, and methods for improving the response process. Protocol analysis (think-aloud interviews) can be used to generate such hypotheses.

Early laboratory results can be supplemented by field pretests on nine or fewer respondents. Using experienced field staff to conduct these tests and having laboratory staff observe the tests may facilitate the development of measurement methods that fully take into account the conditions of the field setting.

Experienced field staff can also serve as consultants in the laboratory, assisting in planning and commenting on results. The three types of staff that are concerned with the survey should be involved in all stages of testing. Time

should be devoted to interpreting the results at each stage and planning for the next stage.

Developmental methods

The development of questionnaires should involve iterative laboratory testing and experimental designs. It may be desirable to include techniques that increase the differences among alternative methods. This type of experimentation may reveal the underlying response process and allow subsequent development of questions that facilitate this process.

Techniques that will be useful in the development activities include debriefing the respondents and recording the interviews. The researchers sponsoring the survey can review the recordings, thus gaining direct experience with the measurement methods and problems.

The important differences to be measured in the survey should be reflected in the area where the laboratory study is conducted and the group of people interviewed. To fulfill this requirement, it may be necessary to move the laboratory to different areas.

The tabulated laboratory results should be the basis for choosing the preferred questioning strategies. The laboratory setting allows for detailed analysis of the results and a flexible iterative testing strategy, so discoveries in each round of testing can be used in succeeding rounds.

Again, all parties should be involved in the questionnaire development program so as to ease the transition from the laboratory to the field.

Testing methods

Results of the laboratory testing will suggest alternative approaches to asking the questions. These approaches can be tested in a large-scale field test that will be used as the basis for the final questionnaire construction. The tests must be designed so that the information needed to evaluate the design is included, and the data from the field test should be tabulated as a guide to decisions about the questionnaires.

In choosing the versions to be tested, the site of testing, and the sample sizes to be used in the field test, planners should consider which choices will provide maximum statistical power. The field staff and the sponsor should participate in the design and interpretation of the field test.

In addition, based on our experience, we have the following practical suggestions concerning operation of a laboratory testing program.

Respondents can be recruited in a variety of ways. Sufficient incentives and a convenient testing site are needed. Respondents should be screened by telephone and scheduled for appointments. Mailed reminders of appointments are likely to increase the participation rate.

The place dedicated to testing should include access to audiovisual equipment and, if possible, a one-way glass that permits observation.

If necessary, laboratory testing should be moved to different sites to ensure representation of specific subgroups.

A variety of staff will be needed. We recommend a mix of survey methodologists and statisticians, cognitive psychologists, clerical assistants, and field interviewers.

The testing process will be most efficient if quick reaction to discoveries at different rounds of testing is possible. Thus, OMB clearances must be broad enough to allow such modifications.

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Appendixes

Contents

I. Pretest of the dental health supplements to the 1986 National Health Interview Survey 33
Part A pretest questionnaire 33
Part B questions 35

II. Field pretest of the dental health supplements to the 1986 National Health Interview Survey 50
Part C field pretest questionnaire—standard version 50
Part C field pretest questionnaire—experimental version 52

Appendix I
Pretest of the dental health supplements to the 1986 National Health Interview Survey

Part A pretest questionnaire

Section O. DENTAL CARE PAGE		PERSON 1
HAND CALENDAR. **These next questions are about receiving dental care.** **1a. During the 2 weeks (outlined in red on that calendar), beginning Monday *(date)* and ending this past Sunday *(date)*, did anyone in the family go to a dentist? Include all types of dentists, such as orthodontists, oral surgeons, and all other dental specialists, as well as dental hygienists.** ☐ Yes ☐ No *(2)*		
b. Who was this? *Mark "Dental visit" box in person's column.*	1b.	1 ☐ Dental visit
c. During these 2 weeks, did anyone else in the family go to a dentist? ☐ Yes *(Reask 1b and c)* ☐ No		
d. *Ask for each person with "Dental visit" in 1b:* **During these 2 weeks, how many times did —— go to a dentist?**	d.	☐ Number
Mark box if under two years old. **2a. During the past 12 months (that is, since *(12-month date)* a year ago), about how many visits did —— make to a dentist? (Include the *(number in 1d)* visit(s) you already told me about.)**	2a.	996 ☐ Under 2 *(NP)* _____ Visits 000 ☐ None
Mark "2-week dental visit" box in person's column if visit(s) reported in 1d. **b. ABOUT how long has it been since —— LAST went to a dentist?**	b.	1 ☐ Past 2 weeks not reported *(Mark 1b, ask 1d)* 2 ☐ 2-week dental visit 3 ☐ Over 2 weeks, less than 6 months 4 ☐ 6 months, less than 1 year 5 ☐ 1 year, less than 2 years 6 ☐ 2 years, less than 5 years 7 ☐ 5 years or more 0 ☐ Never
01 *Refer to number of visits in 2a.*	01	1 ☐ At least one visit in 2a *(3)* 8 ☐ Other *(NP)*
HAND CARD 01. **3. Which one of these reasons BEST describes why —— visited the dentist during the past 12 months?** *If more than one visit in 2a:* **Please give me the reason for the FIRST visit.** **1. Called for check-up by dentist's office** **2. Went for check up on own** **3. Went because of pain or discomfort** **4. Advised by family member or friend** **5. Advised by physician or another dentist** **8. Some other reason** *Circle one reason only.*	3.	1 2 3 4 5 8 ☑ _____ *Specify*
4a. Does anyone in the family now use toothpaste? ☐ Yes ☐ No *(5)* ☐ DK *(5)*		
b. Who is this? *Mark "Toothpaste" box in person's column.*	4b.	1 ☐ Toothpaste
c. Anyone else? ☐ Yes *(Reask 4b and c)* ☐ No		
Ask for each person with "Toothpaste" in 4b: **d. Does —— now use any ONE of those brands?** *HAND CARD 02.* **1. Colgate** **2. Crest** **3. Gleem** **4. Aquafresh** **5. Macleans** **6. Aim** **7. Any other toothpaste with fluoride** **8. Any other toothpaste.** *If multiple brands:* **Which brand does —— use most often?** *Circle one brand only.*	d.	1 2 3 4 5 6 7 8
5a. Does anyone in the family now use dietary fluoride drops, tablets, or vitamin fluoride supplements which are intended to be swallowed, either at home or at school? ☐ Yes ☐ No *(6)* ☐ DK *(6)*		
b. Who is this? *Mark "Fluoride supplements" box in person's column.*	5b.	1 ☐ Fluoride supplements
c. Anyone else? ☐ Yes *(Reask 5b and c)* ☐ No		

FORM HIS-1(88)X1 (1986) (1-4-88) Page 10

Section O. DENTAL CARE PAGE, Continued		PERSON 1
6a. Does anyone in the family now use a fluoride mouth rinse which is intended NOT to be swallowed? ☐ Yes ☐ No *(7)* ☐ DK *(7)*		
b. Who is this? *Mark "Fluoride mouth rinse" box in person's column.*	6b.	1 ☐ Fluoride mouth rinse
c. Anyone else? ☐ Yes *(Reask 6b and c)* ☐ No		
Ask for each person with "Fluoride mouth rinse" in 6b: **d. Does — — use this fluoride mouth rinse at home, at school, or at work?**	d.	1 ☐ Home 2 ☐ School 3 ☐ Work
7a. Dental sealants are plastic coatings used to prevent tooth decay on the chewing surfaces of teeth. Has anyone in the family had dental sealants placed on his/her teeth? ☐ Yes ☐ No *(8)* ☐ DK *(8)*		
b. Who is this? *Mark "Dental sealants" box in person's column.*	7b.	1 ☐ Dental sealants
c. Anyone else? ☐ Yes *(Reask 7b and c)* ☐ No		
8a. Is there anyone in the family who has lost ALL of his or her natural teeth? ☐ Yes ☐ No *(9)*		
b. Who is this? *Mark "Lost all teeth" box in person's column.*	8b.	1 ☐ Lost all teeth
c. Anyone else? ☐ Yes *(Reask 8b and c)* ☐ No		
Now I'm going to ask about fluoridation. *HAND CARD 03.* **9. As you understand it, which one of the reasons on this card best describes the purpose of public water fluoridation?** **1. To reduce pollution** **2. To improve the taste of water** **3. To reduce tooth decay** **4. To purify water** **9. Don't know** *Circle one reason only*	9.	1 2 3 4 9
Ask only if 3 circled in 9. **10. Is YOUR home drinking water supply fluoridated?**	10.	1 ☐ Yes 2 ☐ No 9 ☐ DK

FOOTNOTES

Part B questions

DENTAL CARE PAGE

The next questions are about receiving dental care.

Ask for each family member 3+ years:

	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5
C.1 Is there a particular dentist's office, dental clinic, or some other place that _____ usually goes for dental care?	__yes __no	__yes __no	__yes __no	__yes __no	__yes __no

C.2 All together, how many different places (do you/do family members) go for dental care?

_____ *places*

C.3a. (Do you/does anyone in the family) go to an orthodontist?

____yes ____no *(C.4)*

b. Who is this?

Mark "orthodontia" box in person's column.

	__orhtodontia	__orthodontia	__orthodontia	__orthodontia	__orthodontia

c. Anyone else?

____yes *(Reask C.3b and c)* ____no

Skip if respondent lives alone. Otherwise:
Ask for each family member 3+:

C.4 When _____ needs to go to the dentist, who usually makes the appointment for him/her?	_____ *Specify*	_____ *Specify*	_____ *Specify*	_____ *Specify*	_____ *Specify*
C.5 When _____ needs to go the the dentist, how does he/she usually get there?	_____ *Specify*	_____ *Specify*	_____ *Specify*	_____ *Specify*	_____ *Specify*

DENTAL CARE PAGE

The next questions are about receiving dental care.

PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5

HAND CALENDAR

1a. During the 2 weeks outlined in red on that calendar, beginning Monday *(date)* and ending this past Sunday *(date)* did anyone in the family go to a dentist? Include all types of dentists such as orthodontists, oral surgeons, and all other dental specialists, as well as dental hygienists.

____*yes* ____*no (2)*

---

b. Who was this?
Mark "dental visit" box in person's column.

	__*dental visit*	__*dental visit*	__*dental visit*	__*dental visit*	__*dental visit*

---

c. During those 2 weeks, did anyone else in the family go to a dentist?

____*yes (Reask 1b and c)* ____*no*

Ask for each person with "dental visit" in 1b:

d. During those 2 weeks, how many times did _____ go to the dentist?

	____ *number*	____ *number*	____ *number*	____ *number*	____ *number*

The next questions concern visits to the dentist that you/and your family may have made in the past year. To help you remember possible visits I will read a list of reasons some people have for going to the dentist. Do not answer as I read the list. It is just to jog your memory.

Some people go to the dentist for a check-up and to have their teeth cleaned,...
or to have a tooth filled or capped...

Some go because they are in pain or because a tooth broke or a filling fell out...

Some people go as part of a series or treatments for gum disease, a root canal, or to have false teeth fitted...

And some go as part of a series of orthodontic treatments—to have their teeth straightened.

	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5
Mark box if under two years old.	__(2	__(2	__(2	__(2	__(2
2a. During the past 12 months, that is since *(12-month date)* a year ago, how many visits did _____ make to a dentist? (Include the *(number in 1d)* visit(s) you already told me about.)	____ *number*	____ *number*	____ *number*	____ *number*	____ *number*

Mark "2 week dental visit" box in persons's column if visit(s) reported in 1d.

b. How long has it been since _____LAST went to a dentist?

	__2-week	__2-week	__2-week	__2-week	__2-week visit
	__>2-weeks, <6-months	__>2-weeks, <6-months	__>2-weeks, <6-months	__>2-weeks, <6-months	__>2-weeks, <6-months
	__6-months, <1-year	__6-months, <1-year	__6-months, <1-year	__6-months, <1-year	__6-months <1-year
	__1-year, <2-years	__1-year, <2-years	__1-year, <2-years	__1-year, <2-years	__1-year, <2-years
	__2-years, <5-years	__2-years, <5-years	__2-years, <5-years	__2-years, <5-years	__2-years, <5-years
	__5+ years	__5+ years	__5+ years	__5+ years	__5+ years
	__never	__never	__never	__never	__never

LANDMARK PROBE

2c. For the questions that I have just asked you, it is very important that we get the most accurate answers possible. Sometimes it is hard to remember whether a dental visit was before or after(12-month date) It can help to think of important events that happened about a year ago. For example,this might be a birthday, a new job, a holiday, or a vacation. What important event happened about a year ago?

_____
Specify

Thinking about(Event in 2c) I would like you to answer the question again.
During the past 12 months, that is since (12-month date)a year ago, how many visits did _____ make to a dentist?

____ number	____ number	____ number	____ number	____ number

SECOND GUESS PROBE

2c. For the questions that I just asked you it is very important to get the best answers we can. It can be hard to rember EXACTLY what happened since(12-month date). Please think about the past year again.
Now please answer the question again.
During the past 12 months, that is since (12-month date)a year ago, how many visits did _____ make to a dentist?

____ number	____ number	____ number	____ number	____ number

==========

PURPOSE OF FLUORIDATION

LOW DK THRESHOLD X CURRENT WORDING
!1

==========

We find that many people do not know the reasons for some of the things that are done to the public drinking water.

3a. Do you know the purpose of public water fluoridation?

____*yes*
____*no*

3b. As you understand it, what is the purpose of public water fluoridation?
DO NOT READ CATEGORIES

____ *Prevent tooth decay, protect teeth, or related response*

____ *Other* _____
Specify

==========

@
LOW DK THRESHOLD X DEFINED WORDING
!3

==========

We find that many people do not know the reason for some of the things that are added to the public drinking water.

3a. Do you know the purpose of adding fluoride to the water?

____*yes*
____*no*

3b. As you understand it, what is the purpose of adding fluoride to the public drinking water?
DO NOT READ CATEGORIES

____ *Prevent tooth decay, protect teeth, or related response*

____ *Other* _____
Specify

____ *DK*

==========

@
NO THRESHOLD MANIPULATION X CURRENT WORDING
!2

==========

3a. As you understand it, what is the purpose of public water

fluoridation?

DO NOT READ CATEGORIES

____ *Prevent tooth decay, protect teeth, or related response*

____ *Other* _____
Specify

____ *DK*

==========

@

NO THRESHOLD MANIPULATION X DEFINED WORDING

!4

==========

3a. As you understand it, what is the purpose of adding fluoride to the public drinking water?

DO NOT READ CATEGORIES

____ *Prevent tooth decay, protect teeth, or related response*

____ *Other* _____
Specify

____ *DK*

==========

@

OWN WATER FLUORIDATION

HIGH BASE RATE X CURRENT WORDING

!1

==========

The majority of people live in places where the water is fluoridated.

3c. Is YOUR home drinking water supply fluoridated?

____ *yes*
____ *no*
____ *DK*

==========

@

HIGH BASE RATE X DEFINED WORDING

!4

==========

The majority of people live in places where fluoride has been added to the public drinking water.

3c. Has YOUR home drinking water had fluoride added to it?

____ *yes*
____ *no*
____ *DK*

==========

@

LOW BASE RATE X CURRENT WORDING

'2

Nearly half of Americans live in places WITHOUT public water fluoridation.

3c. Is YOUR home drinking water supply fluoridated?

____ yes
____ no
____ DK

@
LOW BASE RATE X DEFINED WORDING
!5

Nearly half of all Americans live in places that have NOT added fluoride to the public drinking water.

3c. Has YOUR home drinking water had fluoride added to it?

____ yes
____ no
____ DK

@
NO BASE RATE MANIPULATION X CURRENT WORDING
!3

3c. Is YOUR home drinking water supply fluoridated?

____ yes
____ no
____ DK

@
NO BASE RATE MANIPULATION X DEFINED WORDING
!6

3c. Has YOUR home drinking water had fluoride added to it?

____ yes
____ no
____ DK

@
SECTION 2.1 (BETTER DEFINITIONS)

	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5

Now we are going to ask about some things that people may be doing to take care of their teeth.

4a. Does anyone in the family now use toothpaste?

____yes ____no ____DK

---

b. Who is this?
Mark "toothpaste" box in person's column.

	__toothpaste	__toothpaste	__toothpaste	__toothpaste	__toothpaste

---

c. Anyone else?

____yes (Reask 4b and c) ____no

Ask for each person with "toothpaste" in 4b:

d. Does _____ now use any ONE of those brands?

HAND CARD 02

1. Colgate	1	1	1	1	1
2. Crest	2	2	2	2	2
3. Gleem	3	3	3	3	3
4. Aquafresh	4	4	4	4	4
5. Macleans	5	5	5	5	5
6. Aim	6	6	6	6	6
7. Any other toothpaste with fluoride	7	7	7	7	7
8. Any other toothpaste.	8	8	8	8	8

If multiple brands: Which brand does _____ use most often?

Circle only one brand.

	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5

Sometimes people use fluoride to protect their teeth. For example some mouth rinses contain fluoride. Others do not.

5a. Does anyone in the family now use a mouth rinse or mouth wash that has fluoride in it? This could be either at home or at school or at work.

____yes ____no (6) ____DK (6)

b. Who is this?
Mark "fluoride mouth rinse" box in person's column.

__fluoride mouth rinse	__fluoride mouth rinse	__fluoride mouth rinse	__fluoride mouth rinse	__fluoride mouth rinse

c. Anyone else?

____yes (Reask 5b and c) ____no

Ask for each person with "fluoride mouth rinse" in 5b:

d. Where does _____ use this fluoride mouth rinse: at home, at school, or at work?

__*home*	__*home*	__*home*	__*home*	__*home*
__*school*	__*school*	__*school*	__*school*	__*school*
__*work*	__*work*	__*work*	__*work*	__*work*

	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5

Sometimes people take pills with fluoride in them.

6a. Does anyone in the family take either vitamins with fluoride in them or other kinds of tablets, pills, or drops that have fluoride in them?

____yes ____no (7) ____DK (7)

b. Who is this?
Mark "fluoride supplements" box in person's column.

__*fluoride supplements*	__*fluoride supplements*	__*fluoride supplements*	__*fluoride supplements*	__*fluoride supplements*

c. Anyone else?

____yes (Reask 6b and c) ____no

SECTION 2.2 (DECOMPOSED QUESTIONS)

	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5

4a. Does anyone in the family now use toothpaste?

____yes ____no ____DK

b. Who is this?
Mark "toothpaste" box in person's column.

__*toothpaste*	__*toothpaste*	__*toothpaste*	__*toothpaste*	__*toothpaste*

---

c. Anyone else?

____*yes (Reask 4b and c)* ____*no*

Ask for each person with "toothpaste" in 4b:

d. Does _____ now use any ONE of those brands?

HAND CARD 02

1. Colgate	1	1	1	1	1
2. Crest	2	2	2	2	2
3. Gleem	3	3	3	3	3
4. Aquafresh	4	4	4	4	4
5. Macleans	5	5	5	5	5
6. Aim	6	6	6	6	6
7. Any other toothpaste with fluoride	7	7	7	7	7
8. Any other toothpaste.	8	8	8	8	8

If multiple brands: Which brand does _____ use most often?

Circle only one brand.

	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5
5a. Does any one in the family now use a mouth rinse? ____*yes* ____*no (6)* ____*DK (6)*					
b. Who is this? *Mark "mouth rinse" box in person s column.*	__ mouth rinse	__ mouth rinse	__ mouth rinse	__ mouth rinse	__ mouth rinse
c. Anyone else? ____*yes (Reask 5b and c)* ____*no*					
Ask for each person with "mouth rinse" in 5b: **d. Does the mouth rinse that _____ uses contain fluoride?** *Mark "contains fluoride" box in person's column.*	__*contains fluoride* __*DK*	__*contains fluoride* __*DK*	__*contains fluoride* __*DK*	__*contains fluoride* __*DK*	__*contains fluoride* __*DK*
e. Where does _____ use this fluoride mouth rinse at home, at school, or at work?	__*home* __*school* __*work*	__*home* __*school* __*work*	__*home* __*school* __*work*	__*home* __*school* __*work*	__*home* __*school* __*work*
	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5
6a. Does anyone in the family now take vitamins with fluoride in them either at home or at school? ____*yes* ____*no (6d)* ____*DK (6d)*					
b. Who is this? *Mark "fluoride vitamins" box in person's column.*	__*fluoride vitamins*	__*fluoride vitamins*	__*fluoride vitamins*	__*fluoride vitamins*	__*fluoride vitamins*
c. Anyone else? ____*yes (Reask 6b and c)* ____*no*					
d. Does anyone in the family now take any other kind of fluoride drops, pills or tablets? ____*yes* ____*no (7)* ____*DK (7)*					
e. Who is this? *Mark "other fluoride supplement" box in person's column.*	__other flouride	__other fluoride	__other fluoride	__other fluoride	__other fluoride

	supplement	supplement	supplement	supplement	supplement

f. Anyone else?

____*yes (Reask 5e and f)* ____*no*

CURRENT WORDINGS

	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5

4a. Does anyone in the family now use toothpaste?

____*yes* ____*no* ____*DK*

b. Who is this?
Mark "toothpaste" box in person's column.

	__*toothpaste*	__*toothpaste*	__*toothpaste*	__*toothpaste*	__*toothpaste*

c. Anyone else?

____*yes (Reask 4b and c)* ____*no*

Ask for each person with "toothpaste" in 4b:
d. Does _____ now use any ONE of those brands?

HAND CARD 02

1. Colgate	1	1	1	1	1
2. Crest	2	2	2	2	2
3. Gleem	3	3	3	3	3
4. Aquafresh	4	4	4	4	4
5. Macleans	5	5	5	5	5
6. Aim	6	6	6	6	6
7. Any other toothpaste with fluoride	7	7	7	7	7
8. Any other toothpaste.	8	8	8	8	8

If multiple brands: Which brand does _____ use most often?

Circle only one brand.

	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5
5a. Does anyone in the family now use a fluoride mouth rinse which is intended NOT to be swallowed? ____*yes* ____*no (6)* ____*DK (6)*					
b. Who is this? *Mark "fluoride mouth rinse" box in person's column.*	__fluoride mouth rinse	__fluoride mouth rinse	__fluoride mouth rinse	__fluoride mouth rinse	__fluoride mouth rinse
c. Anyone else? ____*yes (Reask 5b and c)* ____*no*					
Ask for each person with "fluoride mouth rinse" in 5b: d. Does _____ use this fluoride mouth rinse at home, at school, or at work?	__*home* __*school* __*work*	__*home* __*school* __*work*	__*home* __*school* __*work*	__*home* __*school* __*work*	__*home* __*school* __*work*
	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5
6a. Does anyone in the family now use dietary fluoride drops, tablets, or vitamin fluoride supplements which are intended to be swallowed, either at home or at school? ____*yes* ____*no (7)* ____*DK (7)*					
b. Who is this? *Mark "fluoride supplements" box in person's column.*	__*fluoride supplements*	__*fluoride supplements*	__*fluoride supplements*	__*fluoride supplements*	__*fluoride supplements*
c. Anyone else? ____*yes (Reask 6b and c)* ____*no*					

DENTAL SEALANTS

HIGH BASE RATE X CURRENT DEFINITION.

!1	PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5

Now I am going to ask you about a procedure that has become

more popular recently.

7a. Dental sealants are plastic coatings used to prevent tooth decay on the chewing surfaces of the teeth. Has anyone in the family had dental sealants placed on his/her teeth?

____yes ____no (8) ____DK (8)

---

b. Who is this?
Mark "dental sealants" box in person's column.

__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant

---

c. Anyone else?

_____yes (Reask 7b and c) ____no

@
HIGH BASE RATE X BETTER DEFINITION.
!4

PERSON 1	PERSON 2	PERSON 3	PERSON 4	PERSON 5

Now I am going to ask you about a procedure that has become more popular recently.

7a. Dental sealants can be used to prevent tooth decay. They are put on by a dentist or a dental hygienist. They are different from fillings, caps, crowns, and flouride treatments. Dental sealants are special plastic coatings that are put on the tops of the back teeth to keep them from decaying. Has anyone in the family had dental sealants placed on his/her teeth?

____yes ____no (8) ____DK (8)

---

b. Who is this?
Mark "dental sealants" box in person's column.

__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant

---

c. Anyone else?

_____yes (Reask 7b and c) ____no

@
LOW BASE RATE X CURRENT DEFINITION

Now I am going to ask you about a new procedure that is rarely used.

7a. Dental sealants are plastic coatings used to prevent tooth decay on the chewing surfaces of the teeth. Has anyone in the family had dental sealants placed on his/her teeth?

____yes ____no (8) ____DK (8)

---

b. Who is this?
Mark "dental sealants" box in person's column.

__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant

---

c. Anyone else?

_____yes (Reask 7b and c) ____no

è
LOW BASE RATE X BETTER DEFINITION

Now I am going to ask you about a new procedure that is rarely used.

7a. Dental sealants can be used to prevent tooth decay. They are put on by a dentist or a dental hygienist. They are different from fillings,caps, crowns, and flouride treatments. Dental sealants are special plastic coatings that are put on the tops of the back teeth to keep them from decaying. Has anyone in the family had dental sealants placed on his/her teeth?

____*yes* ____*no (8)* ____*DK (8)*

b. Who is this?
Mark "dental sealants" box in person's column.

__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant

c. Anyone else?

_____*yes (Reask 7b and c)* ____*no*

è
NO BASE RATE MANIPULATION X CURRENT

7a. Dental sealants are plastic coatings used to prevent tooth decay on the chewing surfaces of the teeth. Has anyone in the family had dental sealants placed on his/her teeth?

____*yes* ____*no (8)* ____*DK (8)*

b. Who is this?
Mark "dental sealants" box in person's column.

__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant

c. Anyone else?

_____*yes (Reask 7b and c)* ____*no*

è
NO BASE RATE MANIPULATION X BETTER DEFINITION

7a. Dental sealants can be used to prevent tooth decay. They are put on by a dentist or a dental hygienist. They are different from fillings,caps, crowns, and flouride treatments. Dental sealants are special plastic coatings that are put on the tops of the back teeth to keep them from decaying. Has anyone in the family had dental sealants placed on his/her teeth?

____*yes* ____*no (8)* ____*DK (8)*

b. Who is this?

Mark "Dental sealants" box in person's column.	__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant	__Dental sealant

c. Anyone else?

_____*yes (Reask 7b and c)* _____*no*

Appendix II
Field pretest of the dental health supplements to the 1986 National Health Interview Survey

Part C field pretest questionnaire—standard version

RT 69

Section P. DENTAL HEALTH PAGE		PERSON 1 (3—4)
Now I'm going to ask you some questions about WATER FLUORIDATION.		
1. As you understand it, what is the PURPOSE of public WATER FLUORIDATION? *Do not read answer categories, circle the ONE that best fits respondent's answer.* 1. Prevent tooth decay, protect teeth, or related response 8. Some other reason 9. Don't know	1.	(5) 1 8 → 9 _____ (Specify)
2a. Is your home drinking water supply part of a PUBLIC water system, or is it from a well, spring, or cistern?	2a.	(6) 1 ☐ Public water system 8 ☐ Other 9 ☐ DK
b. Is YOUR home drinking water supply FLUORIDATED?	b.	(7) 1 ☐ Yes 2 ☐ No 9 ☐ DK
HAND CALENDAR. These next questions are about receiving dental care. 3a. During the 2 weeks (outlined in red on that calendar), beginning Monday *(date)* and ending this past Sunday *(date)*, did anyone in the family go to a dentist? Include all types of dentists, such as orthodontists, oral surgeons, and all other dental specialists, as well as dental hygienists. ☐ Yes ☐ No *(4)*		
b. Who was this? *Mark "Dental visit" box in person's column.*	3b.	(8) 1 ☐ Dental visit
c. During those 2 weeks, did anyone else in the family go to a dentist? ☐ Yes *(Reask 3b and c)* ☐ No		
Ask for each person with "Dental visit" in 3b: d. During those 2 weeks, how many times did —— go to a dentist?	d.	(9—10) ☐ Number of times
Mark box if under two years old. 4a. During the past 12 months (that is, since *(12-month date)* a year ago), how many visits did —— make to a dentist? (Include the *(Number in 3d)* visit(s) you already told me about.)	4a.	(11—13) 995 ☐ Under 2 *(NP)* _____ Visits 000 ☐ None
Mark "2-week dental visit" box in person's column if visit(s) reported in 3d. b. How long has it been since —— LAST went to a dentist?	b.	(14) 1 ☐ Past 2 weeks not reported *(Mark 3b, ask 3d)* 2 ☐ 2-week dental visit 3 ☐ Over 2 weeks, less than 6 months 4 ☐ 6 months, less than 1 year 5 ☐ 1 year, less than 2 years 6 ☐ 2 years, less than 5 years 7 ☐ 5 years or more 0 ☐ Never
P1 *Refer to 4a.*	P1	(15) 1 ☐ Only 1 visit *(5a)* 2 ☐ More than 1 visit *(5b)* 8 ☐ Other *(NP)*
5. [a. What was the REASON —— last went to the dentist? b. What was the REASON —— began the series of dental visits?] *Do not read answer categories, circle all that apply.* 1. To get my teeth cleaned 2. Went in for a check-up or examination on my own 3. Was called in for a check-up or examination by the dentist 4. Something was wrong, bothering or hurting me 8. Other	5.	(16—17) 1 2 3 4 8 → _____ (Specify)
FOOTNOTES		

Page 4 FORM HIS-1(SS)X2 (1986) (7-25-85)

Section P. DENTAL HEALTH PAGE — Continued

		PERSON 1
6a. Is there anyone in the family who has lost ALL of his or her natural teeth? ☐ Yes ☐ No *(7)*		
b. Who is this? *Mark "Lost all teeth" box in person's column.*	6b.	1 ☐ Lost all teeth [18]
c. Anyone else? ☐ Yes *(Reask 6b and c)* ☐ No		
P2 *Refer to 6b.*	P2	1 ☐ "Lost all teeth" marked in 6b *(NP)* [19] 8 ☐ Other *(NP)*
Do not ask for persons with "Lost all teeth" marked in P2 **7. {Now I am going to ask about what persons in the family use when they brush their teeth.} What does —— use when brushing —— teeth?** *If more than one category, ask:* **Which has —— used most often during the past 2 weeks?** 1. Colgate, Crest, Aim, Aquafresh; 2. Close-Up, Ultra-Brite; 3. Pepsodent; 4. Check-up; 5. Denquel, Sensodyne, Protect, Promise; 6. Topol; 8. Other products; 9. Don't know	7.	[20–21] 1 2 3 4 5 6 8 7 9 *(Specify)*
8a. Recently, some MOUTHRINSES have been developed that contain FLUORIDE to reduce tooth decay. Does anyone in the family now use a mouthrinse that contains FLUORIDE, such as ACT, Fluorigard, Listermint with Fluoride, StanCare, or a similar product? ☐ Yes ☐ No *(P3)* ☐ DK *(P3)*		
b. Who is this? *Mark "Fluoride mouthrinse" box in person's column.*	8b.	1 ☐ Fluoride mouthrinse [22]
c. Anyone else? ☐ Yes *(Reask 8b and c)* ☐ No		
Ask 8d and e for each person with "Fluoride mouthrinse" in 8b: **d. Does —— use this fluoride mouthrinse at home, at school, or at work?**	d.	[23] 1 ☐ Home 2 ☐ School 3 ☐ Work
e. What is the name of the mouthrinse?	e.	[24–25] Name 99 ☐ DK
P3 *Refer to age.*	P3	1 ☐ Under 17 *(9)* [26] 2 ☐ 17 and over *(NP)*
9. Does —— now use FLUORIDE tablets, drops, or FLUORIDE vitamin supplements which are intended to be SWALLOWED?	9.	[27] 1 ☐ Yes 2 ☐ No 9 ☐ DK
10a. The chewing surfaces of teeth may be coated with plastic dental sealants to prevent tooth decay. These sealants are NOT fillings, caps, or crowns. Has anyone in the family had plastic dental SEALANTS applied to the teeth? ☐ Yes ☐ No ☐ DK *(Section Q)*		
b. Who is this? *Mark "Dental sealants" box in person's column.*	10b.	1 ☐ Dental sealants [28]
c. Anyone else? ☐ Yes *(Reask 10b and c)* ☐ No		

FOOTNOTES

FOAM HIS-1(SBIXZ (1986) (7-25-85)

Part C field pretest questionnaire—experimental version

RT 69

Section P. DENTAL HEALTH PAGE		PERSON 1 (3–4)
1a. As you understand it, what is the purpose of adding fluoride to the public drinking water? *Do not read answer categories, circle the ONE that best fits respondent's answer.* 1. Prevent tooth decay, protect teeth, or related response 8. Some other reason 9. Don't know	1a.	(5) 1 8 9 _____ *(Specify)*
b. Does the water that you drink at home come from a public water system or is it from another source, such as a well?	b.	(6) 1 ☐ Public water system 8 ☐ Other source *(2)*
c. Has this public water-supply had flouride added to it?	c.	(7) 1 ☐ Yes 2 ☐ No 9 ☐ DK
The next questions are about receiving dental care. *Mark box if under two years old.*		(8) 0 ☐ Under 2 *(NP)*
2a. Is there a particular dentist's office, dental clinic, or some other place that —— usually goes for dental care?	2a.	1 ☐ Yes 2 ☐ No } *(NP)*
b. Altogether, how many DIFFERENT PLACES do family members go for dental care?	b.	(9–10) _____ Places
3a. Does anyone in the family go to an orthodontist? ☐ Yes ☐ No *(4)*		
b. Who is this? *Mark "Orthodontia" box in person's column.*	3b.	(11) 1 ☐ Orthodontia
c. Anyone else? ☐ Yes *(Reask 3b and c)* ☐ No		
If respondent lives alone go to 5. *Mark box if under two years old.*		(12–13) 0 ☐ Under 2 *(NP)*
4a. When —— needs to go to the dentist, who usually makes the appointment for ——?	4a.	_____ *(Specify)*
b. When —— needs to go the the dentist, how does —— usually get there?	b.	(14–15) _____ *(Specify)*
HAND CALENDAR 5a. During the 2 weeks (outlined in red on that calendar), beginning Monday *(date)* and ending this past Sunday *(date)*, did anyone in the family go to a dentist? Include all types of dentists, such as orthodontists, oral surgeons, and all other dental specialists, as well as dental hygienists. ☐ Yes ☐ No *(6)*		
b. Who was this? *Mark "Dental visit" box in person's column.*	5b.	(16) 1 ☐ Dental visit
c. During those 2 weeks, did anyone else in the family go to a dentist? ☐ Yes *(Reask 5b and c)* ☐ No		
Ask for each person with "Dental visit" in 5b. d. During those 2 weeks, how many times did —— go to the dentist?	d.	(17–18) ☐ Number of times

FOOTNOTES

FORM HS-1158(X3) (1986) (7-31-86)

Section P. DENTAL HEALTH PAGE — Continued		PERSON 1
The next questions concern visits to the dentist that anyone in the family may have made in the past year. To help you remember possible visits I will read a list of reasons some people have for going to the dentist. Do not answer as I read the list. It is just to jog your memory		19—21
Some people go to the dentist for a check-up and to have their teeth cleaned, or to have a tooth filled or capped —		
Some go because they are in pain or because a tooth broke or a filling fell out —		
Some people go as part of a series of treatments for gum disease, a root canal, or to have false teeth fitted —		
And some go as part of a series of orthodontic treatments — to have their teeth straightened.		
Mark box if under two years old.		998 ☐ Under 2 *(NP)*
6a. During the past 12 months, (that is since *(12-month date)* a year ago), how many visits did — — make to a dentist? (Include the *(Number in 5d)* visit(s) you already told me about.)	6a.	000 ☐ None _____Visits
Mark "2 week dental visit" box in person's column if visit(s) reported in 5d.		22
b. When did — — LAST go to a dentist? *If respondent mentions month and year and NOT an interval, fill 6c and mark 6b.*	b.	1 ☐ Past 2 weeks not reported *(Mark 5b; ask 5d)* 2 ☐ 2-week dental visit 3 ☐ Over 2 weeks, less than 6 months 4 ☐ 6 months, less than a year 5 ☐ 1 year, less than 2 years *(6c)* 6 ☐ 2 years, less than 5 years 7 ☐ 5 years or more 0 ☐ Never *(NP)*
c. What was the month and year of this visit?	c.	23—26 ____ Month ____ Year
P1 *Refer to 6b for all persons.*	P1	27 1 ☐ 2+ years or NEVER in 6b for all persons *(10a)* 8 ☐ Other *(7)*

Section P. DENTAL HEALTH PAGE — Continued

PERSON 1

For the questions that I have just asked you, it is very important that we get the most accurate answers possible. We know that it is sometimes hard to remember whether a visit was before or after *(12-month date)*. We have found that it helps some people to think of important events that happened about a year ago. For example, this might be a birthday, a new job, a holiday, or a vacation.

7. What important event happened about a year ago?

_____ *(Specify)*

P2 — *Refer to 6a and b. Mark first applicable box.*

P2: 1 ☐ 2+ years in 6b *(NP)* 2 ☐ No visits in 6a *(8a)* 3 ☐ 1+ visits in 6a *(8c)* — 28

You reported that — made no visits since *(12-month date)*.

8a. When you think about *(Event in 7)* do you remember any visits that — made since *(12-month date)*. — 8a: 1 ☐ Yes 2 ☐ No *(NP)* — 29

b. How many? — b: _____ Number *(9a)* — 30–

You reported that — made *(Number in 6a)* visits since *(12-month date)*.

c. Thinking about *(Event in 7)* did any of the *(Number in 6a)* visits that — made occur before *(12-month date)*? — c: 1 ☐ Yes 2 ☐ No *(8e)* — 33

d. How many? — d: _____ Number — 34–

e. When you think about *(Event in 7)* do you remember any additional visits that — made since *(12-month date)*. — e: 1 ☐ Yes 2 ☐ No *(9a)* — 37

f. How many? — f: _____ Number — 38–

HAND CARD P1

9a. Which of the treatments on this card did — receive at — last dental visit? — 9a: 41

Mark all that apply. Follow first applicable skip.

A. Teeth straightened, that is, orthodontia. — ☐ A (NP)

B. Teeth cleaned
C. An x-ray taken
D. An examination or check-up
E. A fluoride treatment

☐ B ☐ C ☐ D ☐ E } *(9b)*

F. Tooth filled
G. Treatment for gums
H. Work done on a crown or cap
I. Work done on a root canal
J. Work done on a bridge
K. Work done on a partial denture
L. Work done on a complete denture
M. A tooth pulled
N. Other oral surgery

☐ F ☐ G ☐ H ☐ I ☐ J ☐ K ☐ L ☐ M ☐ N } *(9d)*

O. Other treatment *(Specify)* — ☐ O

Anything else? _____ *(Specify)* *(9d)*

b. Was — notified by the dentist's office that it was time for a check-up or examination? — b: 1 ☐ Yes (NP) 2 ☐ No 9 ☐ DK — 42

c. Did — go just to get *(Treatment B–E in 9a)* or did — go because something was bothering or hurting —? — c: 1 ☐ Routine care only 2 ☐ Problem only 3 ☐ Both 9 ☐ DK } *(NP)* — 43

(Some people go to the dentist because they think that they might have a problem; other people go to the dentist for an examination or a check-up and the dentist discovers that they have a problem.)

HAND CARD P2

d. Which of these best describes how — ended up getting *(Treatment F–O in 9a)*?
Thought there might be a problem before seeing dentist *(self)*
Dentist discovered the problem *(dentist)*

d: 1 ☐ Self 2 ☐ Dentist 9 ☐ Other _____ *(Specify)* — 44

FORM HIS-1(58)X3 (1984) (7-31)

Section P. DENTAL HEALTH PAGE — Continued

		PERSON 1
10a. Is there anyone in the family who has lost ALL of his or her natural teeth? ☐ Yes ☐ No *(11)* ☐ DK *(11)*		
b. Who is this? *Mark "Lost all teeth" box in person's column.*	10b.	1 ☐ Lost all teeth [45]
c. Anyone else? ☐ Yes *(Reask 10b and c)* ☐ No		
P3 *Refer to 10b.*	P3	1 ☐ "Lost all teeth" marked in 10b *(NP)* [46] 8 ☐ Other *(NP)*
Do not ask for persons with "Lost all teeth" in P3. **11a. {Now I am going to ask about some things that people may be doing to take care of their teeth.} What does —— use when —— brushes —— teeth — toothpaste, tooth powder, or something else?**	11a.	1 ☐ Toothpaste [47] 8 ☐ Other ↓ *(Specify)*
Ask for each person with "Toothpaste" in 11a. **b. What brand does —— use?** *If more than one category, ask:* **Which has —— used most often during the past two weeks?** 1. Colgate, Crest, Aim, Aquafresh 2. Close-Up, Ultra-Brite 3. Pepsodent 4. Check-up 5. Denquel, Sensodyne, Protect, Promise 6. Topol 8. Other 9. Don't know	b.	1 2 3 4 5 6 8 ↓ 9 [48–49] *(Specify)*
Sometimes people use fluoride to protect their teeth. For example some mouth rinses contain fluoride, others do not. **12a. Schools and work places may have fluoride mouth rinse programs. Does anyone in the family take part in such a program?** ☐ Yes ☐ No *(12e)* ☐ DK *(12e)*		
b. Who is this? *Mark "Program" box in person's column.*	12b.	1 ☐ Program [50]
Ask for each person with "Program" in 12b: **c. Is this at school or at work?**	c.	1 ☐ School [51] 2 ☐ Work
d. Is anyone else in a mouth rinse program? ☐ Yes *(Reask 12b, c, and d)* ☐ No		
Sometimes fluoride mouth rinses are used at home. **e. Does anyone in the family now use a mouth rinse or mouth wash that has fluoride in it?** ☐ Yes ☐ No *(P4)* ☐ No *(P4)*		
f. Who is this? *Mark "Fluoride mouth rinse" box in person's column.*	f.	1 ☐ Fluoride mouth rinse [52]
g. Anyone else? ☐ Yes *(Reask 12f and g)* ☐ No		
Ask for each person with "Fluoride mouth rinse" in 12f: **h. What is the name of the fluoride mouth rinse that —— uses?**	h.	Name [53–54]
P4 *Refer to age.*	P4	1 ☐ Under 17 *(13)* [55] 2 ☐ 17 and over *(NP)*
Sometimes doctors or dentists prescribe pills or drops with fluoride in them. **13a. Does anyone in the family now take vitamins with fluoride in them?** ☐ Yes ☐ No *(13d)* ☐ DK *(13d)*		
b. Who is this? *Mark "Fluoride vitamins" box in person's column.*	13b.	1 ☐ Fluoride vitamins [56]
c. Anyone else? ☐ Yes *(Reask 13b and c)* ☐ No		
d. Does anyone in the family now take any other kind of fluoride drops, pills, or tablets? ☐ Yes ☐ No *(14)* ☐ DK *(14)*		
e. Who is this? *Mark "Other fluoride supplement" box in person's column.*	e.	1 ☐ Other flouride supplement [57]
f. Anyone else? ☐ Yes *(Reask 13e and f)* ☐ No		
14a. Dental sealants are special plastic coatings that are painted on the tops of the back teeth to keep them from decaying. They are put on by a dentist or a dental hygienist. They are different from fillings, caps, crowns and fluoride treatments. Has anyone in the family had dental sealants placed on their teeth? ☐ Yes ☐ No *(Section Q)* ☐ DK *(Section Q)*		
b. Who is this? *Mark "Dental sealants" box in person's column*	14b.	1 ☐ Dental sealant [58]
c. Anyone else? ☐ Yes *(Reask 14b and c)* ☐ No		

FORM HIS-1(58)X3 (1986) (7-31-85)

Reviews of New Reports

National Center for Health Statistics

Use of Dental Services and Dental Health: United States, 1986

Series 10, Number 165
(PHS) 88-1593

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An important measure of adequate dental care is the proportion of persons visiting a dentist. In 1986, more than half of the U.S. population age 2 years and over (57 percent) reported having had a dental visit in the previous year. Although the vast majority of Americans had visited a dentist, more than 11 million persons including 6 million children 2–4 years of age had never seen a dentist.

Data contained in a new report by the National Center for Health Statistics state that this large number of persons with no dental visits may be due to low incomes and lack of dental insurance. The proportion of persons in the lowest income group who had never seen a dentist (7.1 percent) was more than double the rate of persons in the highest income group (2.9 percent).

The report, "Use of Dental Services and Dental Health: United States, 1986," presents national estimates of the volume and timing of dental visits, coverage by private dental insurance, and use of preventive dental products.

The average number of dental visits per person per year was 2.0, slightly more than the average number reported in 1983 (1.9). Females had a higher number of dental visits per person per year (2.2) than males (1.9). White women had higher dental visit rates (2.3) compared with their male counterparts (2.0), to black females (1.5), or to black males (1.2).

For children aged 2–16 years, girls (63.7 percent) were as likely as boys (61.4 percent) to have visited the dentist in the past year. The proportion of white children with a dental visit in the past year was about 25 percent greater than the proportion of black children (64.8 percent and 50.8 percent, respectively).

In 1986, 9 out of 10 children used fluoride toothpaste. About 13 percent of all children used a fluoride mouth rinse at home, and about 7 percent of all children had dental sealants applied.

Nearly 38 percent of the population reported having some type of private dental insurance coverage. Males were more likely than females to have insurance coverage. Persons of minority groups were less likely to have private dental insurance—29 percent of black persons compared with 39 percent of white persons, and 31 percent of Hispanic persons compared with 38 percent of non-Hispanic persons.

These statistics were gathered during the 1986 National Health Interview Survey, a cross-sectional household interview survey conducted by the National Center for Health Statistics. Questions on dental health care were included for persons 2 years of age and over in the civilian noninstitutionalized population of the United States.

Authors: Susan S. Jack, M.S. and Barbara Bloom, M.P.A.

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