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Optimal Placement of Instructions and Definitions in Survey Questionnaires

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The findings and conclusions in this report are those of the author and should not be construed to represent any official USDA or U.S. Government determination or policy.

EXECUTIVE SUMMARY

Surveys of establishments often contain complex constructs that require instructions and definitions to aid comprehension. However, instructions and definitions are only useful to respondents if they are attended to when completing the questionnaire. Research findings on the optimal placement of instructions and definitions is mixed. Methodologists at the National Agricultural Statistics Service (NASS) are not always consistent when formatting surveys. It can be difficult to evaluate visual design of surveys using traditional methods, such as cognitive interviewing, because these methods cannot assess what respondents attend to when answering survey questions. An alternative method is eye tracking. This method provides an objective measure of what respondents fixate on, how long they fixate on it, and the order in which they look at the information presented when reading.

To determine the optimal placement of instructions and definitions on NASS surveys, NASS collaborated with researchers at the Bureau of Labor Statistics to conduct an eye tracking study. Participants were presented common formats that are used on NASS surveys: Single-banked instructions, double-banked instructions, definitions preceding survey questions, definitions following survey questions, and definitions embedded within a matrix.

The purpose of the current study was to examine the feasibility of using eye tracking to assess the optimal placement of this information and to answer three research questions: 1) Are respondents more likely to attend to the include and exclude statements when they are presented single- or double-banked? 2) Are respondents more likely to attend to definitions when they precede the survey question or when they follow the survey question? 3) Do respondents attend to definitions that follow a survey question when the question is embedded within a matrix?

Due to limitations of the eye tracking equipment, the definition within the matrix could not be evaluated. However, the other formats were evaluated. Participants were more likely to attend to survey instructions, and to attend to them longer, when they were presented single-banked versus double-banked. Participants were more likely to attend to definitions when they were presented before the survey question versus when they were presented after, and they attended to definitions presented before the survey question longer. The results from this research demonstrate that eye tracking is a useful tool that could be incorporated into NASS's pretesting research. It also provided compelling findings regarding the optimal placement of instructions and definitions on NASS surveys.

RECOMMENDATIONS

1. Continue using eye tracking to evaluate questionnaire design
2. Use eye tracking to evaluate communication strategies used during data collection
3. Use eye tracking in conjunction with other questionnaire evaluation methods, such as cognitive testing
4. Single-bank include and exclude statements
5. Place definitions before the survey question to which they pertain

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Optimal Placement of Instructions and Definitions in Survey Questionnaires

Heather Ridolfo and David Biagas Jr¹

Abstract

Establishment surveys often ask about complex constructs that require instructions and definitions. However, respondents do not always fully read survey questions and are less inclined to read auxiliary information, such as instructions. The visual design on the questionnaire can impact what respondents attend to when completing a questionnaire. The National Agricultural Statistics Service (NASS) conducted a study designed to assess the optimal placement of question instructions and definitions to increase the likelihood that they are seen by respondents. Using Tobii eye tracking software, NASS examined which question formats respondents were most likely to attend to when responding to a survey: single-banked instructions, double-banked instructions, definitions preceding survey questions, definitions following survey questions, and definitions within a matrix.

1. INTRODUCTION

Establishment surveys often measure complex constructs, such as a business's organizational structure, size, characteristics of production premises, production, financial expenditures, and the labor force among others (Christianson and Tortora 1995). Respondents may not conceptualize the constructs in the same way as survey designers and/or may not store information in the format requested by the survey designer (Willimack and Snijkers 2013). Questions in establishment surveys are often not full questions but instead keywords reflecting the construct being measured (Haraldsen 2013; Morrison et al., 2010). Adding to the complexity of the response task, these keywords are often presented in matrices, which increase the cognitive burden placed on respondents (Dillman et al. 2014; Tourangeau et al. 2000).

To address comprehension issues that may arise due to the complexity of constructs being measured and the formatting of the questionnaire, definitions and instructions are often provided. These instructions and definitions are sometimes placed in auxiliary materials, such as an instruction booklet or help screens; however, this is not recommended as respondents often do not look for auxiliary information when answering survey questions (Conrad et al. 2006; Couper et al. 1997), even if this information is necessary for answering the survey question (Sloan and Ott 2016). The more effort respondents need to expend to locate instructions (e.g., single click vs. two clicks or clicking and scrolling in web surveys), the less likely they are to access them (Conrad et al. 2006).

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Instead, survey methodologists recommend placing instructions and definitions on the questionnaire and as close to the survey question for which they pertain as possible (Couper 2008; Dillman et al. 2014). Although this recommendation is often followed, the placement of instructions and definitions within the questionnaire can vary considerably. Instructions and definitions can be found before a survey question or a set of survey questions, between a survey question and response options, after a survey question, and sometimes within a question matrix (Haraldsen 2013).

The limited research examining the optimal placement of instructions and definitions has found that survey instructions and definitions that precede the survey question are more likely to be attended to by respondents. Christian and Dillman (2004) found the placement of skip instructions before or after the response options, which indicated to respondents they should skip the current question if it was not applicable impacted adherence to the instruction. That is, respondents were more likely to answer “no” to a question that did not apply to them, rather than skip the non-applicable question if the skip instruction followed the response options. The placement of the instructions after the response options also confused respondents, causing them to apply the skip instruction to the following question instead of the current question. In addition, Redline (2011) found that clarifying inclusion criteria were more likely to be attended to when they were placed before the survey question versus after.

The formatting of the instructions and definitions may also have an impact on respondents’ adherence to them (Dillman et al. 2014). Respondents are more apt to read instructions when they are presented as a bulleted list rather than in paragraph form (Morrison et al. 2010). However, when lists of instructions are long, survey designers may double- or triple-bank them to save space. Romano and Chen (2011) found that double-banking long lists of instructions is preferred by respondents and respondents were more likely to attend to instructions at the end of the list when the instructions were double-banked compared to when they were presented in a long list that required scrolling. In contrast, Healey and colleagues (2005) found no difference in the selection of response options when the options were presented single-banked versus double-banked. Research on the presentation of single versus triple-banked response options found respondents are more likely to select responses presented in the top row and less likely to select responses in the second row when response options are presented triple-banked versus a single column (Christian and Dillman 2004).

Methodologists at the National Agricultural Statistics Service (NASS) often struggle with determining the optimal placement and formatting of instructions and definitions. As a result, there are inconsistencies in the placement and formatting of instructions and definitions on NASS surveys. When conducting cognitive interview studies, methodologists are often asked by survey administrators to probe respondents to see if they read question instructions and definitions. However, cognitive interviewing is not an ideal method for determining this as respondents are not very good at identifying what they have read and have not read (Schall and Bergstrom 2013; Guan et al. 2006; Albert and Tedesco 2010). In fact, in cognitive testing at NASS, respondents will often say they read instructions and definitions, but upon further probing it is determined that they did not read these instructions or definitions or if they did, they did not adhere to them (Ridolfo and Ott 2021a; Ridolfo and Ott 2021b).

Although unable to assess comprehension, eye tracking provides an objective measure of what respondents look at when completing a survey questionnaire. Using eye tracking equipment, researchers can determine what information respondents fixated on, how long they fixated on it, and the order in which they looked at the information presented. It is possible that respondents may fixate on text such as a definition but not read it; however, the more time respondents spend fixating on a definition, the more it impacts their responses (Galesic et al. 2008).

The purpose of the current study is to explore whether eye tracking would be an effective method in determining the optimal placement of question instructions and definitions to increase the likelihood that they are seen by most respondents. The evaluation focused on the five most common formats used on NASS surveys:

- 1) Single-banked instructions
- 2) Double-banked instructions
- 3) Definitions preceding survey questions
- 4) Definitions following survey questions
- 5) Definitions following a survey question embedded within a matrix

This research sought to answer three research questions: 1) Are respondents more likely to attend to the include and exclude statements when they are presented single- or double-banked? 2) Are respondents more likely to attend to definitions when they precede the survey question or when they follow the survey question? 3) Do respondent attend to instructions that follow a survey question when the question is embedded within a matrix? The following report details the results of this research and provides recommendations for future surveys and research.

2. METHODOLOGY

This project was conducted in collaboration with research conducted by the Office of Survey Methods Research (OSMR) at the Bureau of Labor Statistics (BLS) (Fox 2019).

2.1 Sample

Forty participants were recruited from BLS's OSMR participant's database. Participants who wear glasses were excluded from the study. Prior to the eye tracking, all participants must be calibrated to the eye tracking equipment in order to ensure their eye movements can be tracked. A number of issues can interfere with tracking including age of the participant, use of glasses or contacts, droopy eyelids, mascara, body movements, the level of light in the room, and the position of the eye tracker (Bojko 2013). Four participants could not be calibrated to the eye tracker and were excluded from the study. The capture rate for the remaining participants was reviewed after data collection.

$$\text{Capture rate} = \frac{\text{number of eye tracking samples with usable gaze data that were correctly identified}}{\text{number of attempts}} .$$

Participants whose capture rates fell below 80 percent were removed from the analysis. There are no set standards for determining optimal capture rates; however, researchers tend to set thresholds between 70 and 90 percent (Bojko 2013). Fourteen participants were retained for the

analysis of the placement of instructions and 15 for the analysis of the placement of definitions.

2.2 Survey Questionnaire

Because the OSMR participant database contains persons sampled from the general population, question topics that could be answered by any member of the public were selected. These questions come from different household surveys (i.e., the National Health Interview Survey and the General Social Survey) and in some cases were modified for the study purposes. In addition, the study asked questions with formatting similar to formats used in NASS surveys. Topics included health behaviors and conditions, and transportation expenses.

The survey questions were programmed into a web survey using SurveyMonkey (see appendix). Two versions of the survey were created to randomize the order in which respondents were administered the question formats. In Survey 1, respondents were to receive the question with the definition after the question as the first question on the screen, and the question with a definition before the survey question as the second question on the screen. In Survey 2, the participants were to receive the question with the definition before the question as the first question on the screen, and the question with a definition after the question as the second question as on the screen. However, the survey questions were re-ordered to limit the amount of scrolling. Unfortunately, in the process of re-ordering the questions, the conditions were mistakenly altered. As a result, in Survey 2 the condition with the definition before the survey question was presented as the second question on the screen instead of as the first question on the screen (see table 1). Participants were randomly assigned to one of the surveys.

Table 1. Questionnaire Versions	
Survey 1	Survey 2
<ul style="list-style-type: none">- Definition after question<ul style="list-style-type: none">- First question on page- Definition before question<ul style="list-style-type: none">- Second question page- Definition inside matrix- Double-banked instructions	<ul style="list-style-type: none">- Definition before question<ul style="list-style-type: none">- Second question on page- Definition after question<ul style="list-style-type: none">- Second question on page- Definition inside matrix- Single-banked instructions

2.3 Eye Tracking Procedures

Eye tracking was conducted using Tobii eye tracker. Before beginning the study, each participant received an overview of the task, signed informed consent forms, and then calibrated to the eye tracker. Participants completed two web surveys that were part of BLS research and then completed one of the NASS web surveys. The Tobii eye tracker monitored their eye movements across the three studies. The current study focuses on the NASS study only.

2.4 Analytic Strategy

Median fixation duration and median fixation counts were the measures used to answer the research questions. Findings were presented using gaze plots and heat maps. To analyze the data,

areas of interest (AOI) were first identified. AOIs are areas of the instrument that are being studied. Using the Tobii software, the AOIs were marked, including margins for offset due to precision errors in the tracking (Bojko 2013).

Median fixation duration was calculated for each AOI. Typically, the average fixation duration, which is the sum of durations of fixations divided by the total number of fixations, are used in eye tracking research (Bojko 2013); however, the study used median fixation durations to counteract the effect of outliers, which could have an undue influence on the results especially given the small sample size.

Median fixation counts were calculated for each AOI. More fixations on the AOIs indicate more attention given to that area (Poole et al. 2004).

Gaze plots are visual representations of the data that show a respondent's fixations, represented by dots and saccades (eye movements between fixations), which are represented by lines connecting the dots. Dots are numbered to indicate the order in which the fixations occurred. Dot size represents the fixation duration. Larger dots represent longer fixations, which can indicate deeper cognitive processing. This can be indicative of reading behavior but if the duration lasts longer than the average reading times it can indicate processing difficulty (Bojko 2013). When presenting gaze plots, Bojko (2013) recommends identifying a participant with a typical gaze plot that represents the sample. To do this, we identified participants with the median number of fixations and fixation durations on each AOI and typical order of fixations and selected the participant with a gaze plot that best represented the sample.

Heat maps are another data visualization tool used to display the number of fixations, the absolute gaze duration, or the relative gaze duration (Bojko 2013). The values of eye tracking measures are displayed as colors, where red represents the highest values, followed by yellow, and green. Relative gaze duration shows the accumulated time respondents spent attending to the stimuli relative to the total time each participant was exposed to the stimuli (Bojko 2013). Relative fixation duration is used instead of absolute duration to reduce bias introduced if one participant spends a particularly long time on an AOI. Heat maps can be produced for each respondent or aggregated across participants. In this study, relative duration was used instead of absolute duration and heat maps were limited to 10 seconds, and aggregated across participants.

3. RESULTS

3.1 Data Quality Issues and Design Flaws

During analysis, it was discovered that the AOI for the condition where the definition was placed after the question, within a matrix could not be adequately tracked. In eye tracking research, the AOI must be large enough to capture eye movements (Poole and Ball 2005; Holmqvist et al. 2011). In the matrix experiment, the space between the rows and the text within each row was too small to adequately detect eye movement between the AOIs. This condition was subsequently dropped from the analysis.

As mentioned above, the survey was reformatted in SurveyMonkey before the start of the study

to ensure that the participants would not need to scroll, which can cause interference with the eye tracking. The reformatting of the survey inadvertently affected the experimental design as it reordered the survey questions. Subsequently, the condition where the definition was presented before the question appeared as the second question on the screen in Survey 2, instead of being presented as the first question on the screen. Therefore, the condition where the definition appears after the survey question and the survey question is the first question on the screen was dropped from the analysis.

3.2 Placement of Instructions

Table 2 shows the median fixation duration and median fixation count for the exclude statements when the instructions were single-banked versus double-banked. Participants attended to the exclude statements more frequently and for longer duration when the instructions were single-banked versus when they were double-banked.

Table 2. Exclude Statements Fixation Duration and Fixation Count		
	Median Fixation Duration (seconds)	Median Fixation Count
Single-Banked (n=7)	0.73	5.00
Double-Banked (n=7)	0.50	2.00

These findings were illustrated in the gaze plots across participants. A typical path by an average participant is displayed in Figures 1 and 2. When the instructions were single-banked, participants typically read through the surveys question and then proceeded to read down through the include and exclude statements before selecting their response.

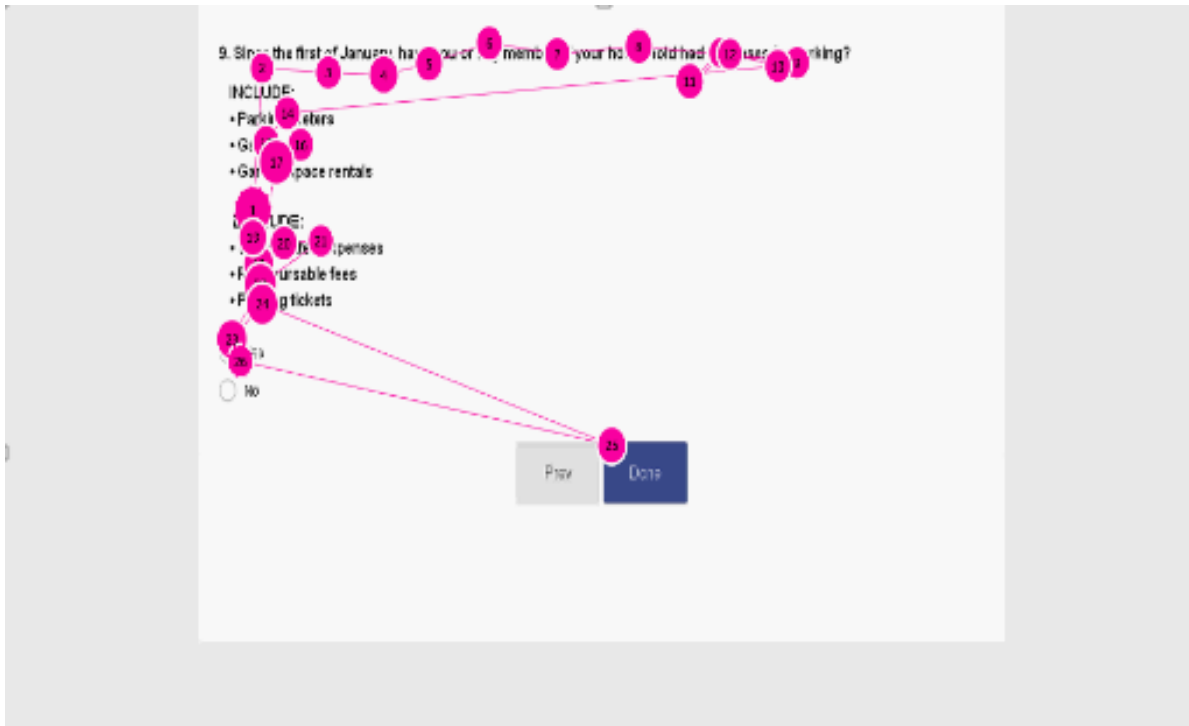


Figure 1. Average Gaze Plot for Single-Banked Include/Exclude Statements

When the instructions were double-banked, the participants typically read through the survey question and then read through the include statements, only glancing at the exclude statements, or sometimes not at all, before selecting their response (Figure 2).



Figure 2. Average Gaze Plot for Double-Banked Include/Exclude Statements

This pattern was further illustrated using heat maps. Using the aggregate fixations on the AOIs, we found the same pattern to be true (see Figures 3 and 4).



Figure 3. Heat Map for Single-Banked Include/Exclude Statements



Figure 4. Heat Map for Double-Banked Include/Exclude Statements

3.3 Placement of Definitions

Participants were more likely to attend to definitions when they were placed before the survey question versus when they were placed after the survey question (Table 3).

Table 3. Definition Median Fixation Duration and Fixation Counts		
	Median Fixation Duration (Seconds)	Median Fixation Count
Definition Before (n=10)	4.68	24.5
Definition After (n=5)	1.8	14

This finding is illustrated in Figure 5, which displays the gaze plot of one participant who was

Conversely, when the definition followed the survey question, participants were observed reading through the survey question, glancing at the definition or skipping it entirely before answering the survey question (Figure 6).

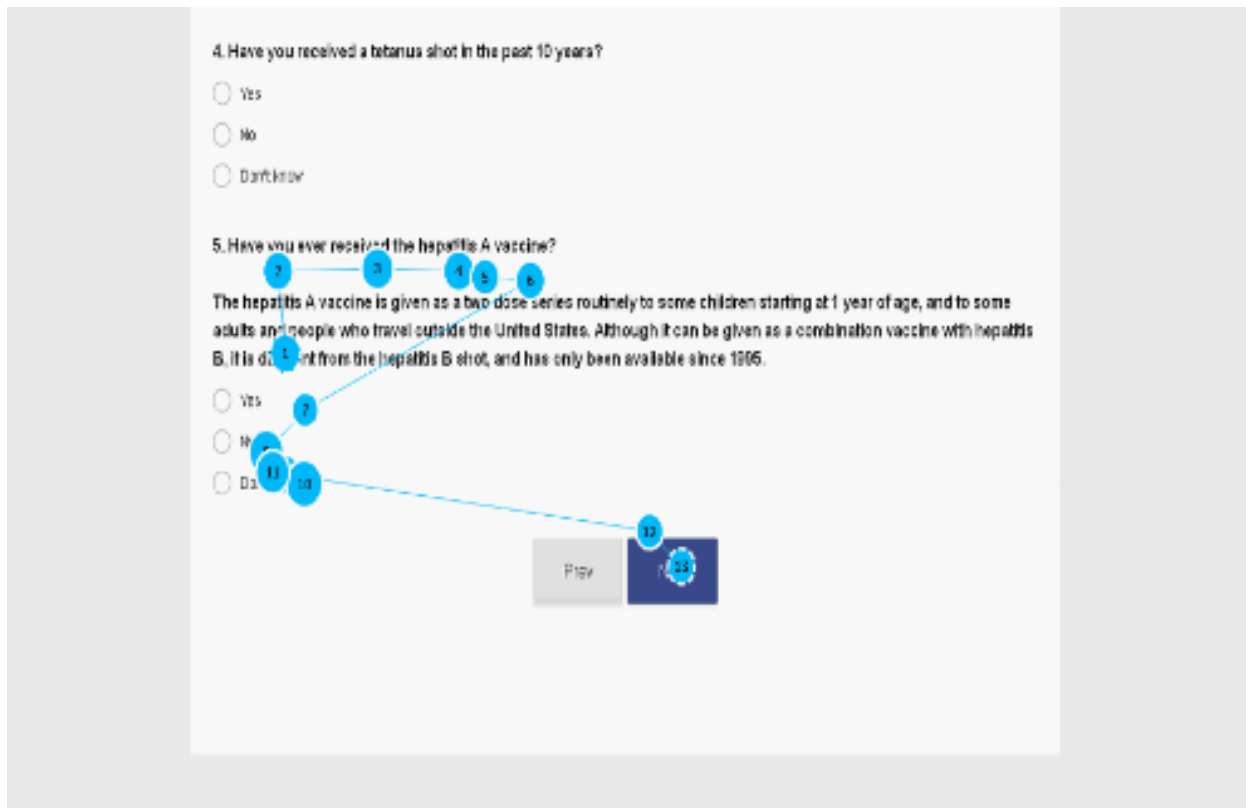


Figure 6. Average Gaze Plot for Definitions after Question

4. CONCLUSION AND RECOMMENDATIONS

Two clear patterns emerged from this study. Respondents are more likely to attend to the full set of include and exclude statements when the statements are single-banked compared to when they are double-banked. Definitions are more likely to be attended to when they precede the survey question compared to when they follow the survey question.

Eye tracking is a useful tool for understanding what respondents look at; however, eye tracking alone cannot determine whether respondents read the information, understood the information, or used the information to formulate their response. It would be useful to use eye tracking in conjunction with other methods such as cognitive testing and usability testing to determine which information respondents are attending to or not, and when they attend to it, the duration of their attention, and their understanding of the information.

This study had other limitations. First, many participants tracked poorly and as a result their data had to be dropped from the analysis. Some participants tracked poorly across all tests and others who tracked at a sufficient rate overall, tracked poorly on particular sections of the test.

When participants did track well, there were still issues with precision in the eye tracker. Some question formats tracked better than others and thus it was easier to decipher where participants were looking. For example, eye movements could not be adequately tracked between surveys questions, definitions, and response options when participants were looking at a matrix. In the condition cases where the definition followed a question within a matrix, the eye tracker could

not decipher whether the participants were looking at that instruction or the question below it. This issue could be resolved by adding more space between questions within the matrix. However, the matrix would then not appear as it does in production surveys.

Questions also had to be reordered to eliminate the need for scrolling during the eye tracking, which impacted the experimental design. Subsequently, one condition was dropped from the analysis. The content of questions also varied along with the formatting (placement of the definitions). It is possible that this may have had an impact on attentiveness. However, the questions that contained single- and double-banked instructions were identical in wording.

The purpose of this research was to explore the feasibility of using eye tracking to evaluate questionnaire design that is not easy to assess in other traditional methods, such as cognitive testing. Despite the limitations of the research, the results from this study are compelling. It would be beneficial to conduct this research again, correcting for the methodological limitations. The findings could be further supplemented by adding cognitive probing to assess respondents' response process. In addition, eye tracking could be used to evaluate communications used during data collection, such as advance letters, emails, and envelope designs. Based on these results, the following recommendations are made:

1. Continue using eye tracking to evaluate questionnaire design
2. Use eye tracking to evaluate communication strategies used during data collection
3. Use eye tracking in conjunction with other questionnaire evaluation methods, such as cognitive testing
4. Single-bank include and exclude statements
5. Place definitions before the survey question to which they pertain

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APPENDIX. Questionnaires Used during Testing

The following questions will ask about your behaviors related to your health and your use of transportation.

1. During the past 12 months, have you talked with a health care professional about your health?

☐ Yes

☐ No

2. Have you ever received the hepatitis A vaccine?

The hepatitis A vaccine is given as a two dose series routinely to some children starting at 1 year of age, and to some adults and people who travel outside the United States. Although it can be given as a combination vaccine with hepatitis B, it is different from the hepatitis B shot, and has only been available since 1995.

- ☐ Yes
- ☐ No
- ☐ Don't know

3. Have you received a tetanus shot in the past 10 years?

- ☐ Yes
- ☐ No
- ☐ Don't know

4. Have you ever had chickenpox?

☐ Yes

☐ No

5. Shingles is an outbreak of a rash or blisters on the skin that may be associated with severe pain. This is generally on one side of the body or face. Shingles is caused by the chickenpox virus. A vaccine for shingles has been available since May 2006.

Have you ever had the Zoster or Shingles vaccine, also called Zostavax?

☐ Yes

☐ No

6. Have you ever received an HPV shot or vaccine?

☐ Yes

☐ No

7. We would now like to ask you about your use of tobacco products.

	Yes	No
Have you ever smoked cigarettes?	<input type="radio"/>	<input type="radio"/>
Have you smoked at least 100 cigarettes in your entire life?	<input type="radio"/>	<input type="radio"/>
Have you ever smoked cigars regularly? (Yes means more than 1 cigar a week for one year at any time in your life)	<input type="radio"/>	<input type="radio"/>
Have you ever used smokeless tobacco products at least 20 times in your entire life?	<input type="radio"/>	<input type="radio"/>

Next, we would like to ask about your use of transportation.

8. Do you or anyone in your household use mass transportation services such as bus, subway, or train?
Include all commuter services.

☐ Yes

☐ No

9. Since the first of January, have you or any member of your household had expenses for parking?

INCLUDE:

- Parking meters
- Garage fees
- Garage/space rentals

EXCLUDE:

- Work related expenses
- Reimbursable fees
- Parking tickets

☐ Yes

☐ No

The following questions will ask about your behaviors related to your health and your use of transportation.

1. Have you ever had chickenpox?

☐ Yes

☐ No

2. Shingles is an outbreak of a rash or blisters on the skin that may be associated with severe pain. This is generally on one side of the body or face. Shingles is caused by the chickenpox virus. A vaccine for shingles has been available since May 2006.

Have you ever had the Zoster or Shingles vaccine, also called Zostavax?

☐ Yes

☐ No

3. Have you ever received an HPV shot or vaccine?

☐ Yes

☐ No

4. Have you received a tetanus shot in the past 10 years?

- ☐ Yes
- ☐ No
- ☐ Don't know

5. Have you ever received the hepatitis A vaccine?

The hepatitis A vaccine is given as a two dose series routinely to some children starting at 1 year of age, and to some adults and people who travel outside the United States. Although it can be given as a combination vaccine with hepatitis B, it is different from the hepatitis B shot, and has only been available since 1995.

- ☐ Yes
- ☐ No
- ☐ Don't know

6. During the past 12 months, have you talked with a health care professional about your health?

☐ Yes

☐ No

7. We would now like to ask you about your use of tobacco products.

	Yes	No
Have you ever smoked cigarettes?	<input type="radio"/>	<input type="radio"/>
Have you smoked at least 100 cigarettes in your entire life?	<input type="radio"/>	<input type="radio"/>
Have you ever smoked cigars regularly? (Yes means more than 1 cigar a week for one year at any time in your life)	<input type="radio"/>	<input type="radio"/>
Have you ever used smokeless tobacco products at least 20 times in your entire life?	<input type="radio"/>	<input type="radio"/>

Next, we would like to ask about your use of transportation.

8. Do you or anyone in your household use mass transportation services such as bus, subway, or train?
Include all commuter services.

☐ Yes

☐ No

9. Since the first of January, have you or any member of your household had expenses for parking?

INCLUDE:

- Parking meters
- Garage fees
- Garage/space rentals

EXCLUDE:

- Work related expenses
- Reimbursable fees
- Parking tickets

☐ Yes

☐ No