

Design of the Questionnaire

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Data collection methods

- **Use of questionnaire**
- **Physical examination**
- **Biological specimen testing**
- **Various sources of records and data**
- **Field observation**
-

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A major challenge to epidemiologic research today is to assure the quality of the "raw data" which are generated for analysis in our studies. A serious potential hazard confronting us is that, as epidemiologists, we may become so enamored of increasingly sophisticated statistical techniques and data processing capabilities that we lose sight of the quality of the data themselves. As a result, the data become unreliable and the methods become untrustworthy. The quality of the data generated by these techniques is often poor.

Unfortunately, we have often paid too little attention to the quality of epidemiologic data, and particularly those obtained through interviews and questionnaires (31, p. 21).



(Gordis L, 1979)

Design and use of questionnaire

- **Good questionnaire**
 - Be acceptable to all participants
 - High response rates
 - Responses with maximal validity and reliability
- **Good questionnaire designer**
 - Language skills
 - Basic understanding of the cognitive processes of a person who responds to questionnaire items

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Properties of a well-designed questionnaire

- **Appropriate** – ask the right people, with the right questions, to get the right answers
- **Intelligible** - using a reading level that all respondents can understand
- **Unambiguous** - the researcher and all the respondents understanding the questions in the same way, regardless of their age, sex, ethnic, or social background

(Stone DH. Design a questionnaire. BMJ. 1993; 307: 1264-6)

Properties of a well-designed questionnaire

- **Omnicompetent** – capable of coping with all possible responses, the response choices should be mutually exclusive and exhaustive
- **Piloted** before use
- **Ethical** even with a single question

(Stone DH. Design a questionnaire. BMJ. 1993; 307: 1264-6)

Properties of a well-designed questionnaire

- The questionnaire designer needs to ensure that respondents.....
 - fully understand the questions
 - are not likely to refuse to answer, lie to the interviewer or try to conceal their attitudes
 - provide accurate, unbiased and complete information

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Step by step guide to questionnaire design

- Decide what data you need
- Select items for inclusion
 - Do a web and literature search for questions from other surveys ---
- Design individual questions
- Compose wording
- Design layout
- Think about coding
- Prepare first draft and pretest
- Pilot and evaluate
- Perform survey
- Start again

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(1) Decide what data you need

- Clearly define your objectives and hypotheses
 - What are the things you need to know from the respondent in order to meet the survey's objectives
 - Try to visualize what the results will look like

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Step by step guide to questionnaire design

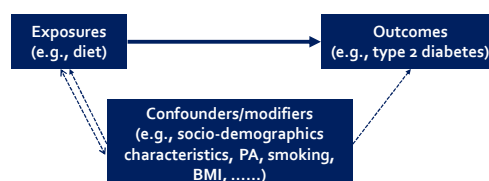
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(2) Select items for inclusion

- List survey question topics under each research question



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(3) Design individual questions

- **Types of information to be collected**
 - **Knowledge:** asks about what people know (believe), how well they understand something.
 - **Beliefs – attitudes – opinions:** refer to psychological states – the perceptions people hold, their thoughts, feelings, ideas, judgments, or ways of thinking.
 - **Behavior:** asks people what they have done in the past, do now, or plan to do in the future.
 - **Attributes:** asks about what people are, what people have, rather than what they do; e.g., personal or demographic characteristics
 - age, education, occupation, or income.

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(3) Design individual questions

- **Implications for distinction of information type**
 - Identify the ways the question can be phrased, the possible response options, and the methods that can be used to evaluate the validity of the answers
 - Present different writing problems
 - questions concerning **attitudes** tend to be more **difficult** to write
 - questions about **knowledge, behaviors** and **attributes** are more **straightforward**

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(3) Design individual questions

- **Response options – for questions about quantities**
 - Have the respondent **write the specific number or amount**
 - Advantage: precision and can always be collapsed in the analysis
 - Be not advisable to require the respondent to provide greater precision than he is capable of; otherwise, the respondent will make his/her own guess and then produces an unknown source of measurement error
 - Offer a limited number of response choices

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- How has smoking affected your health?
- What type of assistance do you think would most help you quit smoking?

- **Response options – open-ended**
 - **Advantages**
 - Helpful to explore things for which you don't yet have a hypothesis or theory, provide more "richness" or "depth" in your data (e.g., may help you explore "why" in more detail).
 - Easiest way to ask for information; allow respondents to provide their own answers, express their own thoughts
 - **Disadvantages**
 - Often reveal the issues which are most important to the respondent; may reveal findings which were not originally anticipated.
 - Respondents may not give a full answer simply because they may forget to mention important points; some respondents need prompting or reminding of the types of answer they could give.
 - Tend to produce varieties of answers, need to categorize and summarize them, and are more difficult to analyze.

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What type of assistance do you think would most help you quit smoking? (Please choose only one option)

- Medication
- Counseling
- Combination of medication and counseling
- More support from family and friends
- None of the above

• Response options – close-ended

- **Advantages**
 - Provide the respondent with an easy method of indicating his answer, prompt the respondent so that they have to rely less on memory in answering a question
 - Responses can be easily classified, making analysis very straightforward
- **Disadvantages**
 - Depend upon designer's knowing; response options must be exhaustive and also mutually exclusive in providing for the selection of a single response
 - Not allow the respondent the opportunity to give a different response to those suggested

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• Two-option responses

2. Do you remove the clippings from your lawn after mowing?

- 1 No
- 2 Yes

• One best answer

1. When does the word "nutrition" mean to you? (Circle one number.)

- 1 Getting enough vitamins
- 2 The food you eat and how your body uses it
- 3 Having to eat foods I don't like
- 4 Having good health

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• Rating scale

1. To what extent do you agree or disagree with the new zoning code? (Circle one.)

- 1 Strongly disagree
- 2 Mildly disagree
- 3 Neither agree or disagree
- 4 Mildly agree
- 5 Strongly agree

2. When purchasing new herd bulls, how important are the following traits in your selection process? (Circle one number for each selection trait.)

Selection trait	Of little importance					Highly important				
A. Performance	1	2	3	4	5	6	7	8	9	10
B. Conformation	1	2	3	4	5	6	7	8	9	10
C. Pedigree	1	2	3	4	5	6	7	8	9	10
D. Breed	1	2	3	4	5	6	7	8	9	10

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• Rating scale

• Use a scale of three, four, five or more categories: depends on the question, the amount of differentiation that is possible and desirable, and the respondents' capacity to answer.

- Five-point option series: best for measuring attitudes
- Four-point option series: useful for ratings (excellent, good, fair, poor)

• Use an even or odd number of response options:

- Odd number of categories provides a middle or neutral position for the respondent to select.
- Even number forces the respondent to take sides, which is appropriate when you want to know in what direction the people in the middle are leaning.

• Five categories are about the most you should use when listing words in the responses. Remember to keep the positive and negative options balances.

Very dissatisfied
 Somewhat dissatisfied
 Somewhat satisfied
 Very satisfied
 Strongly unfavorable
 Generally unfavorable
 Uncertain
 Generally favorable
 Strongly favorable
 Decreased
 Stayed the same
 Increased
 No help at all
 Slightly helpful
 Fairly helpful
 Very helpful
 Strongly disagree
 Disagree somewhat
 Uncertain
 Agree somewhat
 Strongly agree
 Poor
 Fair
 Good
 Excellent

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• Other, please specify

• Protect you against leaving out an important answer choices.

1. What do you consider the main responsibility of your county 4-H agent? (Circle one number.)

- 1 Work with people who request help
- 2 Work with 4-H members
- 3 Work with volunteer 4-H leaders
- 4 Plan and organize county youth events
- 5 Organize and expand new 4-H clubs
- 8 Other, please specify _____

2. Which of these community recreational facilities do you most frequently use? (Circle one number.)

- 1 Parks
- 2 Tennis courts
- 3 Swimming pools
- 4 Other _____

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• Items in a series

• Present the responses in a table when several questions use the same response category

2. How often do you eat the following meats? (Circle one number for each meat.)

	Never	Once a week	1-3 times a week	4-6 times a week	Daily
A. Beef	1	2	3	4	5
B. Lamb	1	2	3	4	5
C. Pork	1	2	3	4	5
D. Poultry	1	2	3	4	5
E. Fish	1	2	3	4	5

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• Multiple choices answers

• Don't make the list too long or the respondents may not consider each items

1. What steps have you taken to set up a business? (Check all that apply.)
- a. Improved product or skills
 - b. Defined product or service
 - c. Identified customers
 - d. Researched market potential
 - e. Filed business name
 - f. Established recordkeeping system
 - g. Applied for resale tax number
 - h. Other _____

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• Lists

• A list provides a series of answers. Respondents may choose one or more depending on the instructions.

1. Listed below are some adjectives which might be used to describe a person. Please indicate for each adjective, whether the adjective does or does not describe you. (Circle one number for each adjective.)

	Describes me	Does not describe me	Don't know
a. Ambitious	1	2	3
b. Happy	1	2	3
c. Idealistic	1	2	3
d. Outgoing	1	2	3

2. From the list provided, select THREE adjectives which best describe you. (Place the letter of the adjective on the lines provided.)

- 1. _____ a. Ambitious
- 2. _____ b. Happy
- 3. _____ c. Idealistic
- d. Outgoing

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• Ranking

1. What would you like to know more about? Select three responses from the list and rank them in order of 1, 2, 3.

- 1. ___ a. What to eat to look better
- 2. ___ b. How food affects you
- 3. ___ c. Weight control
- d. Health foods
- e. Physical conditioning through diet
- f. Vitamins

2. What would you like to know more about? Select three responses from the right hand column and rank them in order of first, second, and third choice.

- 1. ___ 1st choice a. What to eat to look better
- 2. ___ 2nd choice b. How food affects you
- 3. ___ 3rd choice c. Weight control
- d. Health foods
- e. Physical conditioning
- f. Vitamins

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(3) Design individual questions

- Don't ask a question unless it relates to the purpose of the study.
 - Eliminate all the “nice to know” items that aren't really essential.
 - Eliminate ambiguous questions.
- Think through what you will do with each piece of information. Do you expect to use frequencies, percentages, rankings, multivariate analysis, narrative remarks?
- Try to view them through your respondents' eyes. Will the question be seen as reasonable? Will it infringe on the respondent's privacy? Will the respondent be able and willing to answer the question?

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(4) Compose wording

- Considering two components in the data collection process:
 - Respondents: age, education, etc.
 - Interviewers: have to be able to read the questions smoothly, pronounce the words clearly and unambiguously

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Some suggestions

- Use simple wording.
 - Adapt wording to the vocabulary and reading skills of your respondents. Are any words confusing? Do any words have double meanings?
- Avoid the use of abbreviations, jargon, or foreign phrases.
 - “您最近一次测量的BMI/SBP/DBP是多少？”

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Some suggestions

- Use complete sentences.
 - Trying to keep questions simple and concise may result in questions that are cryptic and easily misunderstood.
- Avoid long questions.
 - Respondents' memories are limited and absorbing the meaning of long sentences can be difficult in listening to something they may not have much interest in, the respondents' minds are likely to wander, they may hear certain words but not others, or they may remember some parts of what is said but not all.

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Some suggestions

- Be specific, use clear wording.
 - “去年您是否经历过以下对您生活有重大影响的事件？”（调查日期：2015年3月）
 - “在过去的一年里，您家年收入约为多少？”
 - 定期，规律地，经常，通常情况，常住.....
- Prescribed definitions and explanations should be provided. This ensures that the questions are handled consistently.

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Some suggestions

- Include all necessary information.
 - In some cases, respondents may not know enough to adequately answer a question.
- “你认为慕课会对传统教育带来什么样的影响？”
- “慕课”是什么？
- Provide a statement summarizing it

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Some suggestions

- Avoid questions that may be too precise.
 - People's lives are usually not so orderly that they can recall exactly how many times they do something last year.

PICKS AND AMOUNTS	AVERAGE USE LAST YEAR				
	None or less than once	1-3 times	4-6 times	7-9 times	10 or more times
DRINKING					
Tea (cup)					
Coffee (cup)					
Coffee (milkshake, eg. Coffee mate)					
Crappooon					

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Some suggestions

- Phrase personal or potentially incriminating questions in less objectionable ways.
 - Must be clearly aware of the various customs, morals and traditions in the community being studied.
 - Ask respondents to select from among broad categories rather than specifying precise information. A series of questions may also be used to soften or overcome the objectionable nature of certain information.

How often your spouse/partner has had sex with you in the last 12 months? (Please check ONE box.)

- 1 = less than 10 times
- 2 = 11-20 times
- 3 = 21-30 times
- 4 = 31-40 times
- 5 = 41-50 times
- 6 = 51-60 times
- 7 = 61-70 times
- 8 = 71-80 times
- 9 = 81-90 times
- 10 = 91-100 times
- 11 = more than 100 times

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Some suggestions

- **Avoid questions that are too demanding and time consuming.**

“please rank the following 15 items in order of their importance to you”

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Some suggestions

- **Avoid making assumptions.**

“How many children do you have?”

“Do you prepare beef when you invite friends over to eat?”

“What did you dislike about the product you have just tried?”

- Make assumptions about the respondents – that they have children, invite friends over to eat, dislike the product
- A better set of question would start with the first question establishing the situation, followed by the question of interest.

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Some suggestions

- **Avoid bias in questions.**

– Biased questions influence people to respond in a way that does not accurately reflect their positions.

– A question can be biased in several ways:

- When it implies that the respondent should be engaged in a particular behavior.

我国现行“一孩”生育政策。你目前有几个孩子？

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Some suggestions

- **Avoid bias in questions.**

– A question can be biased in several ways:

- When the response categories are unequal or loaded in one direction.

你认为你目前的健康状况如何？

①一般 ②较好 ③非常好

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Some suggestions

- **Avoid bias in questions.**

– A question can be biased in several ways:

- When words with strong positive or negative emotional appeal are used.

E.g., “freedom”, “equality”, “boss”, “bureaucratic”, etc.

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Some suggestions

- **Avoid double-barreled questions.**

“你是否支持在学校和餐饮娱乐场所实行全面禁烟规定？（非常不支持/有点不支持/无所谓/有点支持/非常支持）”

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Some suggestions

- Use mutually exclusive categories. Make sure that only one answer is possible.
“How did you hear about the Extension seminar?” (only one choice allowed)

- from a friend
- from a relative
- from the newspaper
- at work
- from the county office
- at an Extension meeting

How to choose when heard from a friend at work?

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Some suggestions

- Make the response categories clear and logical.
 - Too often the answers are confusing, not in logical order or spaced so that numbers of figures are hard to interpret.

Poor spacing

1. 0 acres
2. 1-9 acres
3. 10-99 acres
4. 100-499 acres
5. 500-999 acres
6. 1,000 acres

Poor logic

1. 1,000 acres
2. 999-500 acres
3. 499-100 acres
4. 99-10 acres
5. 9-1 acres
6. 0 acres

Better

1. 0 acres
2. 1-99 acres
3. 100-999 acres
4. 1000-1499 acres
5. 1500-1999 acres
6. 2000-2499 acres
7. 2500 acres and over

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Some suggestions

- Avoid overlapping categories.

你每个月的生活费大约多少?

- ①500元以下
- ②500-1000元
- ③1000-1500元
- ④1500-2000元
- ⑤2000元以上

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Other questions which should be considered

- Are there any implied alternatives within the question?

- The presence or absence of an explicitly stated alternative can have dramatic effects on responses.

1. Would you buy pasta-in-a-jar if it were locally available? Yes/No
2. If pasta-in-a-jar and the cellophane pack you currently use were both available locally, would you:
 - Buy only the cellophane packed pasta?
 - Buy only the past-in-a-jar product?
 - Buy both products?



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(5) Design layout and presentation

- Ill-designed physical appearance of a questionnaire may have a significant effect upon both the quantity and quality of survey data obtained.
 - Give an impression of complexity and too big a time commitment.
 - Questionnaire with unnecessarily confusing layouts makes it more difficult for interviewers, or respondents in the case of self-completion questionnaires, to complete this task accurately.
- Self-administration questionnaires need to be simpler (short and without complicated branching), easy to fill out and appear well designed.

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(5) Design layout and presentation

- **Putting questions into a meaningful order and format.**
 - Begin with an introduction that includes the questionnaire's purpose, identifies its sources, explains how the information obtained will be used, and assures respondents of confidentiality. In mailed questionnaires, reinforce the points you made in the cover letter.

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(5) Design layout and presentation

- The first question should be easy and neutral, avoiding question difficult to understand, or beyond their knowledge and experience, or embarrassing in some way. Don't use open-ended or long questions with lengthy answer choices in the beginning of the questionnaire.
- Address important topics early.
- Put the global questions before the specific ones, in order to avoid framing effects.
- Place the boring questions about the respondent's demographic characteristics (age, sex, income level, etc.) at the end.
- Potentially sensitive questions should be left to the end.
- Always thank the respondent for devoting the time to complete the form.

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(5) Design layout and presentation

- Arrange questions so that they flow naturally. Keep questions on one subject grouped together.
- Try to use the same type of question and response throughout a series of questions on a particular topic.
- A numbered response should mean the same thing throughout the questionnaire. (e.g., if you begin with: 1 no, 2 yes; don't switch to: 1 yes, 2 no)
- Avoid making respondents turn a page in the middle of a question or between a question and answer.

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(5) Design layout and presentation

- **Use transitional statements to enhance continuity.**
 - To signal that a new topic is about to begin
 - To start new pages
 - To break up the monotony of a long series of questions

Next, we would like to ask you several questions about the organizations you belong to in your community.

Another important purpose of this survey is to learn how you feel about the work of service organizations in your community.

Finally, we would like to ask a few questions about you to help us interpret the results.

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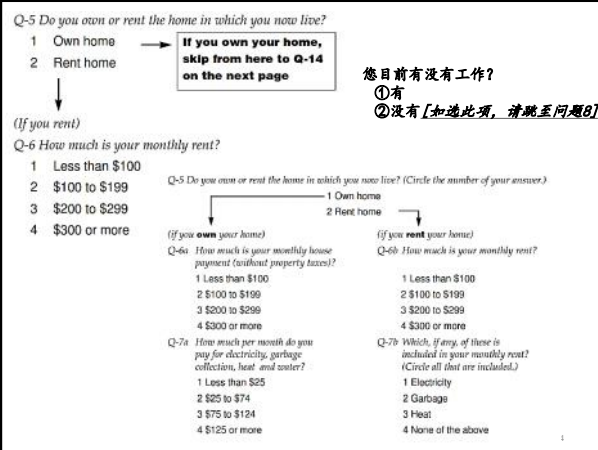
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(5) Design layout and presentation

- **Use filter or screen questions**
 - Some questions may not apply to all respondents. For these "screen questions," make it clear who should answer the question. Also be sure to give directions for those not expected to respond.
 - Use arrows to guide respondents from one question to the next
 - Indent all questions that may be screened
 - Use boxes to direct respondents past the question(s) they don't need to answer.

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(5) Design layout and presentation

- Space the categories so that it is easy to circle one response without touching an adjoining one.
- Ample writing space should be allowed to record open-ended answers, and to cater for differences in handwriting between interviewers.
- Arrange the categories vertically, rather than horizontally spread across the page. If you feel this format results in too much wasted spaces, you may wish to reorganize your questions.

35. 您家附近 1~6 层的普通住宅楼或公寓楼是否常见?
 ①没有 ②较少 ③有一些 ④很多 ⑤全部是

36. 您家附近 7~12 层的普通住宅楼或公寓楼是否常见?
 ①没有 ②较少 ③有一些 ④很多 ⑤全部是

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(5) Design layout and presentation

- Provide simple instructions of no more than two sentences describing how to answer questions. Include instructions in parentheses immediately following questions. It is better to repeat instructions too often than not enough.
 Circle the number of your choice; circle only one; check all that apply; please fill in the blank; please do not use decimals or fractions; etc.
- Interviewer instructions should be placed alongside the questions to which they pertain. Instructions on where the interviewers should probe for more information or how replies should be recorded are placed after the question.

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(5) Design layout and presentation

- Use a different typeface for question, response categories, and transitions or section headings. Be sure that the question is distinguishable from the instructions and the answers.

与交通出行相关的体力活动

下面的问题是向受访者询问出行相关的体力活动,包括上下车、购物、买菜、娱乐等不同类型的交通出行,请不要包括工作相关的步行。

8. 在过去的 7 天内,您有几天在出行的时候自己驾驶或乘坐机动车(包括共享单车、轿车、摩托车、公交车、地铁、出租车等)。
 □没有 (0 天) → [如选此项,请在后面写 10]

①1 天 ②2 天 ③3 天 ④4 天 ⑤5 天 ⑥6 天 ⑦7 天

9. 在这些几天中,您通常每天累积多长时间驾驶或骑行?每天 _____ 小时 _____ 分钟

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(5) Design layout and presentation

- Creative use of space and typeface
 - In order to reduce the number of pages of a questionnaire, there is a tendency to put too much information on a page. This is a counter-productive since it gives the questionnaire the appearance of being complicated.
 - Questionnaires that make use of blank space appear easier to use, enjoy higher response rates and contain fewer errors when completed.

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(6) Think about coding

- Pre-code as many items and response categories as possible to help tabulate and analyze data more quickly. When data is pre-coded, it can be entered directly from the questionnaire.

2. How often do you eat the following meats?
 (Circle one number for each meat.)

	Never	Once a week	1-3 times a week	4-6 times a week	Daily
A. Beef	1	2	3	4	5
B. Lamb	1	2	3	4	5
C. Pork	1	2	3	4	5
D. Poultry	1	2	3	4	5
E. Fish	1	2	3	4	5

96. 您完成的最高教育水平是:

- ①未上过小学 ②小学 ③初一 ④高中
- ⑤中专/技校 ⑥大专 ⑦大学 ⑧研究生

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(7) Prepare first draft and pretest

- Ask colleagues to review the questionnaire critically
 - if the wording and instructions are clear
 - if the questionnaire will accomplish the study objectives
- Select people as similar to your respondents as possible to pretest the questionnaire.
- Simulate the actual data collection procedure as closely as you can (e.g., mail survey, telephone or direct interview)

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(7) Prepare first draft and pretest

- The purpose of pretesting the questionnaire is to determine:
 - Whether the questions as they are worded will achieve the desired results
 - Whether the questions have been placed in the best order
 - Whether the questions are understood by all classes of respondent
 - Whether each close-ended question have an answer that applies to each respondent?

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(7) Prepare first draft and pretest

- The purpose of pretesting the questionnaire is to determine:
 - Whether additional or specifying questions are needed or whether some questions should be eliminated
 - Whether the instructions to interviewers are adequate
 - Whether the questionnaire create a positive impression – one that motivates people to answer it?
 - Assess the length of time an interview actually takes, in comparison to the planned length of the interview

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(7) Prepare first draft and pretest

- If a sufficient number of people have answered the questionnaire during pilot testing, preliminary quantitative studies can be performed.
 - Make sure that the questionnaire yields data that can be analyzed in the way that is needed.
 - Focus on the magnitude of non-response, on items where all (or nearly all) responses are in one category (indicating that the response options are not targeted at the population of interest), and on obvious response errors.

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Step by step guide to questionnaire design

- Decide what data you need
- Select items for inclusion
- Do a web and literature search for questions from other surveys ---
- Design individual questions
- Compose wording
- Design layout
- Think about coding
- Prepare first draft and pretest
- **Pilot and evaluate**
- Perform survey
- Start again

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(8) Pilot and evaluate

- **Select a small sample (not necessarily at random) of your target population and evaluate the responses.**
 - Validity
 - Reliability

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(9) Perform survey

- If you are using interviewers, ensure that they are properly selected, briefed, and trained.
- Institute quality control, check as many of the completed forms as you can personally and draw the interviewers' attention to the problems. At least one of the questions will turn out to be hopeless despite steps 1 to 8; this is par for the course and not worth losing sleep over.
- Take pains to achieve a high response rate, especially in postal surveys. If the response rate is poor and you are confident that your questionnaire is not to blame send out a reminder along with a second and even a third copy of the form. Avoid haranguing non-respondents but emphasize to them how important their cooperation is to the success of your extraordinarily important study. Flattery works.

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(10) Start again

Good research is usually the result of learning from mistakes. If time and resources (as well as personal motivation) permit replicate your study at least once. This will allow you to perform validation, to increase the sample size, and to fine tune your questionnaire to the point where you can be proud of it.

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Use well-constructed questions/questionnaires

- Duplication of effort will be reduced. Much of the time spent on developing questionnaires will be saved, improving the cost-effectiveness of epidemiological research.
- The quality and usefulness of information thus derived will be improved.
- Comparability, which is a prerequisite for meta-analyses and essential when trying to corroborate existing results, will be enhanced. Comparable information is also needed when we analyze results from different population. Descriptive epidemiology of this type has made important contributions in many areas of epidemiology.

(Olsen J. Epidemiology deserves better questionnaires. Int J Epidemiol. 1998; 27(6): 935)

Use well-constructed questions/questionnaires

- **Sources for standard questionnaires**
 - A typical strategy is to locate the most important studies for the given topic and then contact the authors.
 - Some Web sources are available.

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Sources for standard questionnaires

- <http://www.phenxtoolkit.org/>
- <http://www.p3gobservatory.org/questionnaire/list.htm>
- <http://discover.ukdataservice.ac.uk/variables>

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Cross-cultural issues

- Cross-cultural issues are of increasing importance in questionnaire research.
- Questions should be phrased in the respondents' native language and interviewers should never be asked to translate from a questionnaire written for a different language (Ref: <http://dgm.ucsf.edu/cadc/mm/translationguide.pdf>)
- Validity and reliability testing for the cross-cultural version of questionnaire
- It should be stressed that sometimes institutional or cultural differences can make it impossible to construct questionnaires that are exactly.

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Closing remarks

We epidemiologists ask questions very frequently as part of our research. The process demands significant time from respondents, and we have an ethical obligation to perform our work as well as possible. The results we report and on which health and policy decisions are made often rely heavily or totally on the answers respondents give to these questions. Therefore, we need to take great care in designing, standardizing, and critiquing these questions as a central part of the scientific process.

(Rosen T, Olsen J. Invited commentary: the art of making questionnaires better. Am J Epidemiol. 2006; 164: 1145-9)