

# No Smoking?



## Task sheet

A college principal is planning to carry out a survey amongst students to find out how much support there would be for a ban on smoking on all college property.

**Design a questionnaire** to find out:

- information about students' smoking habits
- whether there would be support for a total smoking ban on all college property
- whether there would be support for a more limited smoking ban  
eg smoking banned in all buildings but not on college grounds outside buildings

**Describe how you would carry out such a survey**

- How would you distribute the questionnaire to all students?
- How would you encourage students to respond?
- Describe any problems there are likely to be.

The principal suggests that it is only necessary to consult a representative sample of the students.

**Describe how you would select a representative sample of 500 students.**

- What characteristics of the student population do you think are relevant in this situation?
- How would you select the representative sample?



# Sampling

## Some Definitions

## Information sheet

- Population** all the members of the group being considered
- Census** a survey involving all members of the population
- Sample** a sub-group of the population
- Random sample** a sample taken in such a way that every member of the population has an equal chance of being included
- Representative sample** a sample that reflects the population in the proportion of individuals that have particular characteristics relevant to the investigation (eg age, gender)
- Biased sample** a sample that is not representative

### **Finding a representative sample (stratified sample)**

- Decide what characteristics of the population are likely to have some bearing on the investigation (eg age, gender, ethnicity, income).
- Determine how many of the population lie in each of the sub-groups defined by these characteristics.
- Divide the sample in the same proportion.
- Use random sampling to select individuals from each sub-group.

### **Using random numbers to select a sample**

- List and number each member of the group.
- Decide how many random digits you need to use to enable all members of the group to have an equal chance of being selected.
- Find random numbers from a calculator, computer or tables.
- Use as many of the digits as you need, treating them as whole numbers.
- If a random number is higher than the largest number in your list, simply ignore it and try again. Also ignore any repeat values that occur.

### **Practical considerations**

- What will it cost?
- How long will it take?
- How convenient will it be (for both researchers and members of the sample)?
- What is the response rate likely to be?

### **Designing a Questionnaire**

- Think carefully about what you want to find out.
- Questions should be short, simple and easy to understand and easy to answer.
- Avoid ambiguous, leading or personal questions.
- Think about how you will analyse the results.



# Sampling

## Worksheet

- 1 Show how you would use random numbers to select a random sample of 20 items from a population of 750.
- 2 A GP would like to select a random sample of her patients to include in a survey to find out how satisfied patients are with the service they receive from her practice. Describe how she could select a random sample and what decisions and problems may be involved.
- 3 A botanist wants to study the distribution of plants in a random sample of 10 square metres of land from a rectangular site that is 30 metres long and 20 metres wide. How could he use random numbers to select a sample?
- 4 How would you select a representative sample to carry out a survey in the following cases?
  - a) A sample of 500 students from a college to answer questions about canteen facilities.
  - b) A sample of 1000 people from a city to answer questions about car parking.
  - c) A sample of 5000 people from a region to answer questions about a plan for a new international airport in the region.
  - d) A sample of 20 000 people from England to answer questions about regional devolution.
- 5 A survey is to be carried out in a town to find out what parents of children under five think of the provision of nursery schools in the town. Describe two possible ways of selecting a sample of 400 such parents and list the advantages and disadvantages of these methods.
- 6 The table below gives the number of part-time and full-time employees in different sectors of the UK economy.

Number of Employees (000s)	Male		Female	
	Full-time	Part-time	Full-time	Part-time
Manufacturing	2295	80	617	192
Construction	1062	25	138	65
Service Industries	7692	1956	5894	5981
Other	267	31	82	35

Source: Labour Market Trends October 2005 from [www.statistics.gov.uk](http://www.statistics.gov.uk)

A representative sample of 5000 workers is to be selected to receive a questionnaire by post about health and safety at work.

- a) Calculate how many workers from each sub-group are required.
- b) What other characteristics of the workforce are likely to be relevant in this situation?
- c) What problems are likely to arise in the gathering of information by this method?



<b>Teacher Notes</b>
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**Unit** Advanced Level, Using and applying statistics

**Notes on the resources**

After giving some definitions of terms used in sampling, the Powerpoint presentation goes on to show how a representative sample can be found. Note that the use made of random numbers to select a random sample is simple and easy to understand but not very efficient in that a large proportion of the random numbers may have to be discarded in some groups. There are other more efficient methods that you may like to introduce if time permits. For example, the integer part of  $(n \times \text{random decimal} + 1)$  where  $n$  is the population size will give a position in the population. The randomness of the positions given by this method depends on the number of digits used in the random decimal – the more digits used in the random decimal, the better.

Another slide lists some of the main points to consider when designing a questionnaire and the following slide gives some of the other considerations to bear in mind when planning a survey. The final slide gives a list of frequently used survey methods.

This presentation can be used to generate discussion when the topic of sampling is introduced or it could be adapted to provide a summary of the main points for revision.

The main points covered in the Powerpoint presentation are also given on the information sheet on page 2. The ‘No Smoking?’ sheet on page 1 could be used in full or the Word version adapted for use with individual students or in whole class or group discussions. This is also true of the worksheet on page 3.

There are many possible answers to the questions on the worksheet. Some of these are given below:

**Worksheet Answers**

- Use 3 digit random numbers, discarding any above 750 and any repeats.
- Many possibilities eg need to decide what age boundaries to use, whether to contact single people or households, patients may not give honest answers to questions asked by their GP etc.
- Area =  $600 \text{ m}^2$ . These could be numbered and 10 square metres selected using 2 digit random numbers, discarding any above 600. Could also divide into smaller squares or use coordinates.
- Relevant characteristics for sub-groups may include age, ethnicity, gender, mode of attendance.
  - c), d) Populations could be divided into sub-groups according to where they live, income, age etc.
- Many possibilities. Perhaps the best would be to use a list of parents with children under five that may be available to officials through the local Health Authority. They could then be divided into sub-groups according to where they live (this may also give a reasonably representative sample as regards income and ethnic ity) and a sample selected in proportion using random numbers.
- Total number of employees = 26 412 thousand  
Numbers in each sub-group in the sample are given below :

Number of Employees (000s)	Male		Female	
	Full-time	Part-time	Full-time	Part-time
Manufacturing	434	15	117	36
Construction	201	5	26	12
Service Industries	1456	370	1116	1132
Other	51	6	16	7

- Many possibilities eg age, experience, type of work within the industry etc.
- Many possibilities eg finding names and addresses of employees, poor return rate etc.

