

OUTBREAK: STRATEGIC PLANNING

These activities are designed for 60-minute lessons. You may need to adapt the materials for use in longer or shorter lessons.

INTRODUCTION

In this activity pupils must decide which categories of people in a town should be given a vaccine when there is a limited budget. They are guided in the use of a spreadsheet as a tool for solving this type of problem.

This activity is mainly ICT based. It has been designed for use with pupils in an ICT suite although it could be adapted for use in a maths classroom equipped with a data projector and whiteboard. It is suggested that pupils work together in pairs or small groups to encourage appropriate levels of participation and discussion.

The activity contains 3 options offering varying degrees of challenge. Different pupil pairs or groups within a class can work at different options. Alternatively, you may prefer to ensure each group has a mix of pupils. This will help to create appropriate conditions for peer support.

This activity differs from those found elsewhere in the Outbreak case study in that the map room codes are not automatically allocated. Instead, you will need to allocate a code to each group based on how well you think they performed (see below).

Each option has an example spreadsheet demonstrating the formulae that can be used:

Option 1: Pupils are given two vaccines to administer. The vaccines have different levels of efficacy and different costs. Pupils are taken stage by stage through the completion of the spreadsheet. This option is for pupils working at **level 4 of the National Curriculum**.

Option 2: Here there are three different vaccines that can be given. Pupils have to choose which formulae go where on the spreadsheet. The creation of graphs from the spreadsheet is included. This option is for pupils working at **level 5 of the National Curriculum**.

Option 3: Again there are three vaccines but only a few spreadsheet formulae are given. Graph creation is included. Pupils are encouraged to extend the spreadsheet to take account of an additional variable. They are also invited to consider different ways that the formulae can be expressed. This option is for pupils working at **level 6 of the National Curriculum**.

LEARNING OBJECTIVES

Option 1

By the end of the lesson pupils will:

- find simple percentages of large whole numbers;
- relate pencil-and-paper methods of calculation to spreadsheet formulae.

Option 2

By the end of the lesson pupils will:

- find percentages of large whole numbers;
- relate pencil-and-paper methods of calculation to spreadsheet formulae;
- identify and create spreadsheet formulae;
- draw graphs within the spreadsheet.

Option 3

By the end of the lesson pupils will

- relate pencil-and-paper methods of calculation to spreadsheet formulae;
- create spreadsheet formulae using more than one variable;
- use a variety of spreadsheet techniques, such as replicating and inserting columns;
- draw graphs within the spreadsheet.

LEARNING OUTCOMES

Option 1

Most pupils will:

- Use given information to solve a problem. Find percentages of large whole number quantities. Identify the correct spreadsheet formula to use, replicate both down columns and across rows of a spreadsheet.

Option 2

Most pupils will:

- Use given information to solve a problem and appreciate the effects of the decisions they make in trying to keep within a budget. Find percentages of large whole number quantities. Identify and create spreadsheet formulae, replicate both down columns and across rows and draw graphs using the Chart Wizard.

Option 3

Most pupils will:

- Use given information to solve a problem and appreciate the effects of the decisions they make in attempting to keep within a budget. Create spreadsheet formulae, replicate both down columns and across rows, insert columns and draw graphs using the Chart Wizard. Extend the problem to take account of an additional variable.

NATIONAL CURRICULUM OBJECTIVES

Ma2 Number and algebra

Using and applying number and algebra

- 1) Pupils should be taught to:
 - a) explore connections in mathematics to develop flexible approaches to increasingly demanding problems; select appropriate strategies to use for numerical or algebraic problems
 - d) select efficient techniques for numerical calculation and algebraic manipulation
 - j) show step-by-step deduction in solving a problem; explain and justify how they arrived at a conclusion.

Numbers and the number system

- 2) Pupils should be taught to:
 - e) understand that 'percentage' means 'number of parts per 100' and use this to compare proportions.

Links to the revised Programme of Study for introduction in 2008 include:

1 Key concepts

Competence

- a) Applying suitable mathematics accurately within the classroom and beyond.
- b) Communicating mathematics effectively.

Critical understanding

- a) Knowing that mathematics is essentially abstract and can be used to model, interpret or represent situations.
- b) Recognising the limitations and scope of a model or representation.

2 Key processes**Representing**

Pupils should be able to:

- a) identify the mathematical aspects of a situation or problem.

Analysing

Pupils should be able to:

- a).make connections within mathematics
- f) explore the effects of varying values and look for invariance and covariance
- h) work logically towards results and solutions, recognising the impact of constraints and assumptions
- i) appreciate that there are a number of different techniques that can be used to analyse a situation
- l) calculate accurately, selecting mental methods or calculating devices as appropriate
- n) use accurate notation, including correct syntax when using ICT.

Interpreting and evaluating

Pupils should be able to:

- a) form convincing arguments based on findings and make general statements
- b) consider the assumptions made and the appropriateness and accuracy of results and conclusions

Communicating and reflecting

Pupils should be able to:

- a) communicate findings effectively
- b) engage in mathematical discussion of results

3 Range and content**Number and algebra**

The study of mathematics should include:

- b) rules of arithmetic applied to calculations and manipulations with rational numbers
- e) algebra as generalised arithmetic.

4 Curriculum opportunities

The curriculum should provide opportunities for pupils to:

- a) develop confidence in an increasing range of methods and techniques
- d) work on problems that arise in other subjects and in contexts beyond the school
- f) work collaboratively as well as independently in a range of contexts
- g) become familiar with a range of resources, including ICT, so that they can select appropriately.

LESSON PREPARATION

- Familiarise yourself with the on-screen task in order to identify the key points that your pupils will need to address before they attempt the task.
- Arrange for access to computers for the lesson. Pupils should be able to work in pairs or small groups at a computer.
- You will also need access to a whiteboard or a projector and screen for the example spreadsheets.
- You may wish to create a certificate of achievement to award to pupils that perform well in the activity.

Vocabulary

Percentage, calculate, graph, data.

Materials required

- Microsoft Excel
- Whiteboard or projector and screen
- Sufficient number of computers.

Prior knowledge and skills

- Pupils should be able to calculate a percentage of a quantity and be familiar with writing the calculation of, for example, 12% of 250 as $\frac{12}{100} \times 250$
- Before attempting option 3, pupils should have some experience of using a spreadsheet

LESSON DETAILS**Starter****Option 1 and Option 2**

- Revise the calculation of percentages of a quantity by asking pupils to find, for example:
 - 50% of 180 = 90
 - 25% of 80 = 20
 - 10% of 60 = 6
 - 10% of 65 = 6.5
 - 5% of 65 = 3.25
- These are examples of percentages that can be calculated mentally. Go on to ask pupils to find, e.g. 9% of 150 = 13.5. Ask 'How will you write a calculation to find this?'
- Set a few further examples where written methods are required, such as:
 - 7% of 450 = 31.5
 - 11% of 6200 = 682
 - 48% of 345 000 = 165 600
- Emphasise that the method of finding p% of q is $\frac{p}{100} \times q$

Option 3

- Draw this table on the board and explain that it is part of a spreadsheet.

Population 345 000	A	B	C
1	Male	52%	
2	Female	48%	
3	Children under 16	18%	

- Ask the following questions:
 - How many males in the population? 179400
 - How many children? 62100
 - About how many female children are there? 29808
 - What formula should go in C1? $=52/100 * 345\ 000$
- Check that pupils know that all spreadsheet formulae begin with =, and that / means divide and * means multiply
- What formulae go in C2 and C3?
 - $= 48/100*345000$
 - $=18/100*345000$
- Write these formulae into the relevant cells

Main

Option 1

1. As a whole class, explain that the purpose of the activity is to decide which members of a certain population in London should be given which vaccine.
2. Discuss with pupils the various categories the population could be divided into, e.g.
 - Males
 - Females
 - School Children
 - Parents
 - Emergency service workers
 - Shop assistants
3. Ask them to think of other categories. Which people should be given the more effective vaccine?
4. Ask pupils to consider the implications of their decisions. For example, if refuse collectors are given the less effective vaccine, then more of them will become ill, rubbish will not be collected, rats will proliferate and there will be more disease.
5. Project the **Example** spreadsheet onto the screen. Explain that for this town with a population of 420,400 there is a budget of £3,000,000 and that the categories of people have been chosen for them.
 - Ask them to calculate 8% of 420,400 to find the number of medical personnel in the town
 - Show that this calculation can be done by the computer by entering the formula $=8/100*420400$ into cell D6.
 - Follow the step-by-step instructions given on the screen to complete the spreadsheet. If possible, allow individual members of the class to perform these steps. At each stage ask pupils what the effect of the instruction has been.

- Emphasise the fact that the formula does not have to contain a particular number but that the name of the cell containing the number is used. This allows the formula to change as a column is replicated. Click on any cell in column D or E for example and look at the formula displayed in the formula bar.
- Change some of the numbers in column E and note the effect on the rest of the figures.
- Ask pupils to work out the formula for cell H18 ($=F16 + H16$).
- Ask them for the formula for H24 ($= E16 + G16$).
- This is given as a check. They should have 420, 400, the total population.

Pupil activity

- With pupils working in pairs or small groups at a computer, ask them to open the **Intro** sheet. This sets the parameters for their task.
- Then ask pupils to look at the **Planning** sheet. Get pupils to use the formulae from the example spreadsheet to help them to fill this one. The structure of the formulae will be the same but the new population and vaccine costs must be used.
- They must decide on the numbers for column E for themselves.
- If they are over budget, or very much below budget, the numbers in column E will need to be changed.
- Once the spreadsheet has been satisfactorily filled it can be printed.

Option 2

As a whole class, follow steps 1-5 as described for Option 1 above.

- Follow the on-screen instructions to complete the spreadsheet. If possible, allow individual members of the class to perform these steps. At each stage ask pupils what the effect of the instruction has been.
- Emphasise the fact that the formula does not have to contain a particular number, but that the name of the cell containing the number is used. This allows the formula to change as a column is replicated. Click on any cell in column D or F for examples and look at the formula displayed in the formula bar.
- Change some of the numbers in columns E and G and note the effect on the rest of the figures.
- Ask pupils to work out the formula for cell J19 ($=F17+H17+J17$).
- Ask them for the formula for J23 ($= E17+J14+I14$).
- This is given as a check. They should have 420,400 the total population.

Pupil activity

- With pupils working in pairs or small groups at a computer, ask them to open the **Intro** sheet. This sets the parameters for their task.
- Then ask pupils to look at the **Planning** sheet. Get pupils to use the formulae from the example spreadsheet to help them to fill this one. The structure of the formulae will be the same but the new population and vaccine costs must be used.
- They must decide on the numbers for columns E and G for themselves.
- If they are over budget, or very much below budget, the numbers in columns E and G will need to be changed.
- Ask pupils to calculate the number of people protected, using the success rates given on the Intro sheet then to find the percentage of the population protected. Allow pupils to use either a spreadsheet formula, or a pencil and paper method

Graph drawing

- To select the column of categories, click on cell B7, hold down the left mouse button and drag to cell B16.
- Select the other columns by holding down Ctrl before repeating the above procedure.

- Allow pupils to find the Chart Wizard by letting the cursor hover over the icons on the tool bar.
- Let them explore the options given in the Chart Wizard, emphasising that the final graph must be clear and show all necessary information.
- Once the spreadsheet has been satisfactorily filled in it can be printed.

Option 3

As a whole class, follow steps 1-5 as described for Option 1 above.

- How could you find the total number vaccinated in each section?
- Follow the instructions on the screen to complete the spreadsheet

The formulae required are

C3	=B3/100*420450
E3	=D3*7
G3	=F3*3.35
H3	=420450-D3-F3
I3	=H3*1.5
C14	=SUM(C3:C12)
G17	=E14+G14+I14
G18	=D14+F14+H14

- To round the figures in column C, complete the following steps:
 - Highlight column C
 - Go to **Format** menu
 - Select **Cells**
 - Select the **Number** tab, then **Number** in **Category** list
 - Set **Decimal Places** to zero

Pupil activity

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- Then ask pupils to look at the **Planning** sheet. Get pupils to use the formulae from the example spreadsheet to help them to fill this one. The structure of the formulae will be the same but the new population and vaccine costs must be used.
- They must decide on the numbers for columns E and G for themselves.
- If they are over budget, or very much below budget, the numbers in columns E and G will need to be changed.
- Ask pupils to calculate the number of people protected, using the success rates given on the Intro sheet then to find the percentage of the population protected.
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Graph drawing

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- Let them explore the options given in the Chart Wizard, emphasising that the final graph must be clear and show all necessary information.
- Once the spreadsheet has been satisfactorily filled in it can be printed.

Plenary**All options**

- Ask questions, such as:
 - Who managed to stay within budget?
 - What category of people got vaccine A? Why?
 - What category of people got vaccine B? Why?
 - What difficulties did you have in deciding who to give vaccine A to?
- Discuss the dilemma faced by Health Authorities in similar circumstances.

Homework**All options**

Ask pupils to write a report for the Health Authority explaining the decisions they have made.

For example,

- They may say they gave priority to farmers because everyone will need the food they produce.
- Or, they may have chosen to give farmers vaccine B as they live in rural areas and will not come into much contact with people carrying the infection.

Their report should include a printout of their spreadsheet.

MAP ROOM FEEDBACK

- For this activity you will need to manually give your pupils the codes to use within the map room. The code you give on each occasion should be based on how well you think the pupil or pupils completed the task.
- The codes you can use are as follows:
 - Option 1 - Progress 1: kbfb
 - Option 1 - Progress 2: jbjp
 - Option 1 - Progress 3: jdqz
 - Option 1 - Progress 4: mdth

 - Option 2 - Progress 1: jhfr
 - Option 2 - Progress 2: jhmz
 - Option 2 - Progress 3: jgqd
 - Option 2 - Progress 4: mgrj

 - Option 3 - Progress 1: mjgy
 - Option 3 - Progress 2: kkjb
 - Option 3 - Progress 3: mkqn
 - Option 3 - Progress 4: jmsh

Please note that these codes are case sensitive and should be entered by pupils in the lower case form as shown above.

Progress values are on a sliding-scale from 1: unable to complete the activity /demonstrated poor spreadsheet skills to 4: completed the activity/demonstrated excellent spreadsheet skills and presented their decisions to the class.

TECHNICAL SUPPORT

Throughout all the activities and support notes you will be asked to open various files in Flash, Microsoft Excel or in Adobe PDF. To use these, you will need to have the minimum specification installed. This recommendations list can be found below.

The latest **Adobe Flash Player** (previously know as the Macromedia Flash Player) can be downloaded free from the Adobe website. Support and Help can also be found on this site:

http://www.adobe.com/shockwave/download/download.cgi?P1_Prod_Version=ShockwaveFlash

You will need to have purchased and installed **Microsoft Excel**. It is usually installed with Microsoft Office. You can find help and support on using Microsoft Excel (Versions 2007, 2003, 2002, 2000) on the Microsoft website for Excel. You can also find methods of purchasing or upgrading your Excel here:

<http://office.microsoft.com/en-us/excel/FX100646951033.aspx>

You will be using a version of **Adobe Reader** or Distiller to view these Teacher Notes. If you would like help or to download a newer version, you can find information at Adobe's website:

<http://www.adobe.com/products/reader/>

Minimum Machine and Software Specifications

PC

P3 800MHz; 128MB RAM; Windows 2000

Screen resolution 1024x768

Browser: Microsoft Internet Explorer 5.5; Firefox 1; Netscape 7; or Opera 7

Microsoft Excel 2000

Macromedia Flash Player 7

Adobe Reader 7

Mac

G3 500MHz; 128MB RAM; OS X 10.2

Browser: Safari 1; Firefox 1; Netscape 7; or Opera 6.2

Screen resolution 1024x768

Macromedia Flash Player 7

Adobe Reader 7