

Demographic Concepts and Methods

Fertility practical

Period and Cohort Fertility in Fife and a council area of your choice 1991-2016

In this exercise you will calculate a series of period measures of fertility for **Fife and a council area of your choice: 1991 to 2016**:

- General Fertility Rates (GFRs)
 - Age-Specific Fertility Rates (ASFRs)
 - Total Fertility Rates (TFRs) (period and cohort)
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STEP 1: DOWNLOAD AND OPEN THE EXCEL WORKBOOK FROM THE SHARED COURSE FOLDER

Open the file. You will see it has 4 separate worksheets:

- **'live births'** contains data on births by age of mother
- **'Population-at-risk'** contains counts of females by age-group
- **'Period Fertility'** this is where you will calculate the period fertility measures
- **'Cohort fertility'** this is where you will calculate the cohort fertility measures

Data

In the interests of time we have downloaded the data and prepared this for analysis. However, the raw data can be accessed at the links below (and this information is regularly updated):

Live births: Table BT.6 at <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/births/births-time-series-data>

Populations at risk: Mid-year population estimates: Scotland and its council areas by single year of age and sex 1981 to 2016 available at: <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/mid-year-population-estimates/population-estimates-time-series-data>

STEP 2: CALCULATING PERIOD FERTILITY MEASURES

- Copy and paste the births data and population-at-risk data onto the relevant sections of the **'Period Fertility-worksheet'**

a) General fertility rates (GFRs)

- Sum the populations at risk so that you have a total number of women of child-bearing age for each year (Use Excel formulas to do this - ask a tutor if not sure!)
- Sum the age specific counts of live births for each year
- Calculate the GFRs $1000 * (\text{total births} / \text{total females aged 15-44})$ for each year

b) Age-specific fertility rates (ASFRs)

- For each year, divide births to women of each age-group by the number of women in that age-group.

c) Total fertility rates (TFRs)

- Sum the Age Specific Fertility Rates for each year and multiply the total by the number of years in each age-group (5).

Finally, try and produce graphs to show the trends in the GFR, ASFRs and TFR over the period 1991 to 2011.

What do your results show?

STEP 3: CALCULATING COHORT FERTILITY MEASURES

- Copy and paste the births data and population-at-risk data onto the relevant sections of the '**Cohort Fertility-worksheet**'
- Now use Excel formula to calculate the population at risk and number of births for the cohort aged 15 to 19 in 1991 as they move through the child bearing years. (Hint: in 1996 this cohort will be 20-24 and in 2001 they will be 25-29 – Excel file has formula tips)

a) (Cohort) Age-specific fertility rates (ASFRs)

- For each age, divide births to women who were aged 15 to 19 in 1991 by the number of women in that cohort at each age.

c) (Cohort) Total fertility rates (TFRs)

- Sum the Age Specific Fertility Rates for each year and multiply the total by the number of years in each age-group (5).

d) Compare the cohort and period TFR for 1991 for each of your council areas. What do your results show?

Extension: if you have spare time..... try calculating period TFRs for 2018. Note this will require you to download data from the links above.

Demographic Concepts and Methods

Mortality practical

Comparing Mortality in 2015 Scotland, Fife and one other council area of your choice

Exercises using 'Indirect' age standardisation

In this exercise you will calculate the following mortality measures for Scotland and two council areas of your choice:

- **Crude death rates for Scotland, Fife and the local area of your choice**
- **Indirectly Standardised Mortality Ratios (SMRs) for Fife and your chosen area (using Scotland as the 'standard')**
- **Indirectly standardised death rates for Fife and your chosen area**

**DOWNLOAD AND OPEN THE EXCEL FILE
MORTALITYPRACTICALWORKBOOK.XLS FROM THE COURSE FOLDER**

The data for this practical has been prepared in advance. It includes:

Data on population structure (2016)...

- Counts of the **population** for Scotland, broken down by **age and sex**
- Counts of the **population** for Council areas, broken down by **single year of age and sex**
- See table 2 at <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/mid-year-population-estimates/population-estimates-time-series-data>

Data on deaths (2016)

- Counts of **deaths** for Scotland, broken down by **age and sex**
- Counts of the overall number of **deaths** for Fife and your chosen area, by **sex**
- See table 5.02 <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/vital-events-reference-tables/2016/section-5-deaths>

STEP 2: CALCULATING THE MORTALITY MEASURES

1. CRUDE RATES

- a) Scotland – in the 'Scotland 2016' worksheet, sum the total of populations (male and female separately) and sum the total of deaths (male and female separately). Then divide total deaths by total population *1000 (male and

female separately) to get the crude death rates per 1,000 (i.e. separate crude rates for males and females).

- b) In the 'Fife + Other Area' worksheet copy the appropriate data on population and deaths from the 'Council Area data' worksheet – calculate crude death rates for men and women for Fife and your chosen area ie total deaths / total population * 1000)

2. STANDARDISED MORTALITY RATIOS (SMRs)

- a) calculate age specific death rates (ASDRs) for Scotland (which we will use as the 'standard' for calculating our SMRs. To do this go to 'Scotland 2016' worksheet and divide deaths by population for each age group (males and females separately)
- b) copy the ASDRs for Scotland you have just calculated and paste into the relevant column in the 'Fife + Other Area' worksheet
- c) calculate expected deaths in Fife and your chosen area using these ASDRs
- d) sum the total of expected deaths
- e) calculate the SMRs for Fife and your chosen area by dividing the total 'observed' deaths by the total 'expected' deaths (from d)

3. INDIRECTLY STANDARDISED DEATH RATES

- a) copy the crude death rates you calculated for Scotland into the relevant cells in the 'Fife + Other Area' Worksheet
- b) calculate indirectly Standardised Death Rates for Fife and your chosen area by multiplying the crude death rate for Scotland by the SMR for Fife and your chosen area respectively (do for males and females separately)

For reflection:

Check you understand the meaning and correct interpretation of each of the measures you have calculated.

- ***Are the differences between crude and standardised rates as you'd expect?***
 - ***What do the SMRs tell you about the relative differences in mortality between Fife and your chosen area and Scotland as a whole?***
 - ***Use the 'age-sex pyramids' worksheet to understand how local age structures contribute to the differences in results across areas (depending on the mortality measure used: crude rates versus SMRs)***
 - ***If you have time try extending your analysis to 2018!***
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Demographic Concepts and Methods

Migration practical

Making sense of migration statistics: measuring migration flows in and out of and within the Scotland.

In this week's practical we will measure migration in three ways.

1. **International migration into and out of the UK (1991/2-2015/6)** (Data source: National Records of Scotland Migration estimates).
2. **An indirect measure of net migration (internal and international migration combined) for Council areas of Scotland** (Data source: 2001 and 2011 Censuses; Vital Registrations for births and deaths).
3. **Migration for districts of Council areas of Scotland, 2010-2011** (Data source: 2011 Census)

DOWNLOAD AND OPEN THE EXCEL FILE MIGRATION PRACTICALWORKBOOK.XLS FROM THE COURSE FOLDER

Task 1: Is Scotland gaining or losing population through migration?

(Data source: National Records of Scotland migration estimates)

- ➔ Go to: <https://www.nrscotland.gov.uk/files//statistics/migration/flows/apr-19/mig-to-from-scotland-tab1.xlsx>
- ➔ Go to the sheet 'Net 1951-'
- ➔ We only need the **net migration estimates from 1991/2 to 2017/8**
- ➔ Copy the estimate for **1991/2 to 2017/8** for net migration - total (Rows 46-73, Column B), net migration – rest of UK (Rows 46-73, Column C), net migration – overseas (Rows 46-73, Column D) and paste the data into your TASK 1 worksheet (within the Migration Practical Workbook)
- ➔ Produce a chart plotting net migration (total, overseas and UK) over time
- ➔ Use the data to complete the following table:

Table 1: International migration, 1991-2017/8

	Year
Year with highest total net migration	
Year with highest net migration (rest of UK)	
Year with highest net migration (Overseas)	

- ➔ Consider: Is the Scotland gaining or losing population through international migration? How has this changed since 1991?

Task 2: Are the Council areas of Scotland experiencing net gains or losses from migration (international and internal combined)?

(Data source: Reverse Accounting using 2001 and 2011 Census and data for births and deaths 2001-2011)

In this task you will use reverse accounting to indirectly estimate net migration for Council areas of Scotland.

Go to the second worksheet 'TASK 2'. Here 2001 and 2011 population is provided from the 2001. The table also includes data for births and deaths in the period.

- ➔ Use the demographic balancing equation to calculate net migration 2001-2011 in Column F.
- ➔ Consider:
 - Which Council area has grown the most in absolute size as a result of migration?
 - What is the most likely source of error in these net migration estimates?

Task 3: Are the districts of Council areas of Scotland experiencing net gains or losses from internal migration?

(Data source: 2011 Census)

In this task you will use Census 2011 data to calculate net migration for Council areas of Scotland.

First, let's get a sense of what migration data is provided in Census area tables.

- ➔ Go to the Census 2011 Table Finder on the Nomis website: http://www.nomisweb.co.uk/census/2011/data_finder.
- ➔ Check the box next to 'Migration' on the left hand list of topics. The list of available 2011 Census tables on migration is given at the right.
- ➔ On the options for the geographical scale of the table above the list of tables, click in the circle next to 'Local Authority' (District).
- ➔ Click on the table for 'Migration' (UKMIG008). In the options box at the left hand side, under the text 'Download the entire table for all areas' select 'local authorities: district/unitary' from the drop-down menu. Click 'Download'. Open the file using Excel. You will see a lot of numbers! Look at the column titles to get a sense of how migration is categorised in census data.
- ➔ The data have been tidied up for you and are provided in the 'TASK 3' sheet.

Now, let's examine what the data tell us about migration for Scottish Council areas

- ➔ In column D calculate non-migrants (those who lived at the same address one year ago) as a percent of the 2011 population. Use your results to enter areas with the highest % in the Table 3 below.

Table 3: Non-migrants in Scottish Council areas (2010-2011)

District	Percent non-migrants

- ➔ In columns I, J, and K, calculate within-district movers (I), in-migrants from the UK (J) and in-migrants from outside the UK (K) as a percent of all migrants in each district.
- ➔ Consider:
 - What is the most common type of migration (within-district, from elsewhere in UK, from outside UK)? Is this consistent for all Scottish council areas?
 - What might explain the relatively high proportion of migrants in East Renfrewshire and East Dunbartonshire who have come from elsewhere in the UK? Where do you think a lot of them will have moved from?
 - Which districts have the highest proportions of immigrants?
- ➔ In column M, calculate the total in-migration to each district.
- ➔ Use this, together with the figures for 'moved out of district' (column L) to calculate net migration in column N.
- ➔ Consider:
 - Which district has grown the most in absolute size as a result of migration?
 - How do your results compare to those you obtained from the indirect estimates in Task 3?
 - What do you think are the reasons that some districts in Scottish Council areas are losing population as a result of migration (net out-migration) and some districts are gaining population (net in-migration) as a result of migration?

Demographic Concepts and Methods

Population Projection practical (Cohort Component Method)

Introductory information

This exercise involves running a simple cohort projection for Fife or a council area of your choice. The projection is run from 2016 and initially involves projecting the population forward to 2021. A second projection is then made from 2021 to 2026, incorporating different assumptions about future components of change (births deaths and migration).

INSTRUCTIONS

STEP 1. Open the file Population projection practical.xls. from the course folder that is saved to your computer.

This file includes all the data required to make your projection. Worksheets include:

- Projections base data – formatted data on components of change for each council area
- PROJECTION CALCULATIONS – where you run the projection
- FERTILITY – where the fertility input for 'Projection Calculations' is derived
- MORTALITY – where the mortality input for 'Projection Calculations' is derived
- MIGRATION – where the migration input for 'Projection Calculations' is derived
- PROJECTION OUTCOMES – where the results of the projection are pasted.
- VARIATIONS IN RATES – alternative rates to use in projections

STEP 2. Calculate births born over the period of the projection

Copy the 5 year birth rate for your area from the 'Projections base data' worksheet to the Fertility worksheet.

In the FERTILITY worksheet – calculate the number of male and female births in the cells indicated (these will automatically be inserted in the 2011 'new born' cells of the PROJECTION CALCULATIONS worksheet).

STEP 3. Age on the 2016 population to provide the 'Initial Population' for the 2021 projection.

First, copy (or better) use formula to transfer the 2016 population for your area from the 'Projections base data' worksheet to the 'PROJECTION CALCULATIONS' worksheet (cells C7 to C24 for males and C30 to C47 for females). **NOTE YOU WILL NEED TO SUM THE Aged under 1 year and Aged 0 to 4 populations in the 'Projections Base data' worksheet to give the population aged 0 to 4 in the Projection Calculations' worksheet.**

Now in the PROJECTION CALCULATIONS worksheet use excel formula to 'age on' the 2016 Start population (male and female) to provide the 'initial population' for 2021. Note that the newborns you derived in step 1 will become the 0-4 year olds in 2021. Note that the final age group (age 85+) in 2021 is derived by adding together the two groups (age 80-84) and (age 85+) from 2016)

STEP 4. Derive the number of deaths by age between 2016 and 2021.

Copy the 5 year death rates for your area from the 'Projections base data' worksheet to the 'Mortality' worksheet.

The deaths by age group data has been transferred to the appropriate columns using formula. Remember deaths to new borns 2016-2021 will impact on the 0-4 age group in 2021, deaths to those aged 0-4 at start of period will impact on 5-9 total in 2021 etc – for the oldest 85+ group the formula adds together deaths for those 80-85 and 85+ at start of period.

STEP 5 Derive net migration between 2016 and 2021

Copy the 5 year migration rates for your area from the 'Projections base data' worksheet to the 'Migration' worksheet.

The migration components within the 'Projection calculations' sheet is calculated for you using Excel formula by adding the in/out migrants to the appropriate columns of the Projection calculations worksheet (following the same approach used for mortality)

STEP 6 Calculate the 2021 'End Population'

Finally derive the 'End Population' in the Projection calculations worksheet by subtracting deaths, adding in-migrants and subtracting out-migrants.

STEP 7 copy over the 2021 End Projection into the PROJECTION OUTCOMES worksheet

Paste the End population into the relevant column of the PROJECTION OUTCOMES Worksheet (for 2016) – use 'paste special, values' to do this

EXTENSION.....**STEP 8 Run a new projection for the period 2021-2026**

Simply paste the End population calculated for 2021 into the Start population on the PROJECTION CALCULATIONS worksheet. Before running the projection try changing the assumptions used e.g. you might use a different set of Age Specific Fertility Rates on the assumption that fertility rates may increase somewhat after 2021. Or maybe you anticipate a change in migration behaviour – various options are provided in the worksheet 'VARIATIONS IN RATES')

STEP 9 copy over the 2026 End Projection into the PROJECTION OUTCOMES worksheet

FINALLY... consider the change in population size and structure over the period of the projections 2011 -2021. You could try generating population pyramids (use the population pyramid worksheet)

N.B. You could go on repeating the above procedure to build up a projection further into the future (i.e. taking the 'End population' from one 5 year projection and pasting it into the 'Start population' for the next projection period, modifying assumptions for fertility, mortality and migration as required) However, it is evident that the further you project into the future, the less likely it is that your projections will serve as accurate predictions of the future population