Update 02-2014

# Fertility in London
# 2001 and 2011

February 2014

## Key findings

- Mean age at childbearing has risen in all boroughs and borough groups between 2001 and 2011 - the result of falling fertility at younger ages and increasing fertility at older ages.

- In 28 boroughs the mean age at childbearing is over 30 years (compared to only 12 boroughs in 2001) and in Greater London rose from 29.7 to 31.0 years between 2001 and 2011.

- Kensington & Chelsea had the highest mean age at childbearing in 2011 at 33.7 years and Barking & Dagenham the lowest at 29.0 years.

- Between 2001 and 2011, the total fertility rate (TFR) for Greater London rose from 1.63 to 1.83.

- Outer London boroughs saw the largest rises in fertility rates, with an overall rise in TFR from 1.66 to 2.00.

- Four boroughs, all in inner London, saw a decline in their TFR over the ten-year period.

- In 2001 Greater London exhibited a bi-modal fertility rate distribution, with peaks in the early twenties and thirties. By 2011 this had become a single mode distribution with a peak in the early thirties.

## Introduction

The GLA's Intelligence Unit obtains data from the Office for National Statistics (ONS) on births by age of mother for London local authorities. This data is used by the Intelligence Unit to calculate Age Specific Fertility Rates (ASFR) for use within its demographic models. Before use, age specific fertility rates for each authority are smoothed by fitting curves to the raw estimates data.

This Intelligence Unit *Update* presents a comparison of smoothed fertility rates from 2001 and 2011.

The results presented here are:

- Age-specific fertility rates (ASFR);
- Total fertility rates (TFR);
- Mean age at childbearing (MAC);
- Mean age of mothers giving birth (2001 and 2011); and
- The difference between these figures in 2001 and 2011.

A glossary of terms can be found at the end of this *Update*.

## Methodology

The data used to calculate the fertility rates are:

- Population by single years of age of woman, 15 to 49 years, for mid-2001 and mid-2011 from the ONS mid-year estimates; and
- Births by single years of age of mother:
    - 15 to 49 years, for calendar years 2000 to 2002;
    - 15 to 45+ for calendar year 2011.
    This data is provided under license by the Office for National Statistics.

Within this *Update*, data for City of London and Hackney have been combined.

Births to women aged below 15 are added to the number at age 15. For the 2011 data, the 45+ age category was redistributed across ages 45 to 50.

To smooth each set of fertility rates, double-peak Hadwiger expression were fitted to the raw data. The parameters of the expressions are found by performing a least squares fit to the raw data. The double-peak Hadwiger (see Chandola *et al*., 1999[1]) is given by the expression:

Where:

$$f(x) = am\left(\frac{b_1}{c_1}\right)\left(\frac{c_1}{x}\right)^{3/2}\exp\left\{-b_1^2\left(\frac{c_1}{x}+\frac{x}{c_1}-2\right)\right\} + (1-m)\left(\frac{b_2}{c_2}\right)\left(\frac{c_2}{x}\right)^{3/2}\exp\left\{-b_2^2\left(\frac{c_2}{x}+\frac{x}{c_2}-2\right)\right\}$$

$x$ is age of the mother at birth

$(x)$ is the fertility rate at age x $f$

$m$ is a mixture parameter that determines the relative sizes of the two component distributions

$a, b_1, c_1, b_2, c_2$ are other model parameters related to total fertility and the level and trend of the mean ages of fertility in the two component distributions.

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[1] Chandola, T., Coleman, D.A., Horns, R.W. (1999) Recent European fertility patterns: fitting curves to 'distorted' distributions. *Population Studies*, 53, 3:317-329.

# Results

Table 1 gives the mean age of mother at childbearing, mean age of mothers giving birth that year, and the TFR for each London borough, Greater London and borough groups for 2001 and 2011.

**Mean age at childbearing (MAC)**
Figure 1 shows the mean age at childbearing (MAC) for London boroughs in 2011. Three boroughs (Kensington & Chelsea, Camden, and Richmond upon Thames) had a MAC that was over 33 years. These three boroughs formed part of a south-west corridor, along with their neighbouring boroughs, which had the highest MAC in London (age 32 and over).

Inner London boroughs generally had a higher MAC than outer London boroughs. The eastern boroughs of outer London had the lowest MAC at under 30 years.

**Figure 1: Mean age at childbearing, 2011**
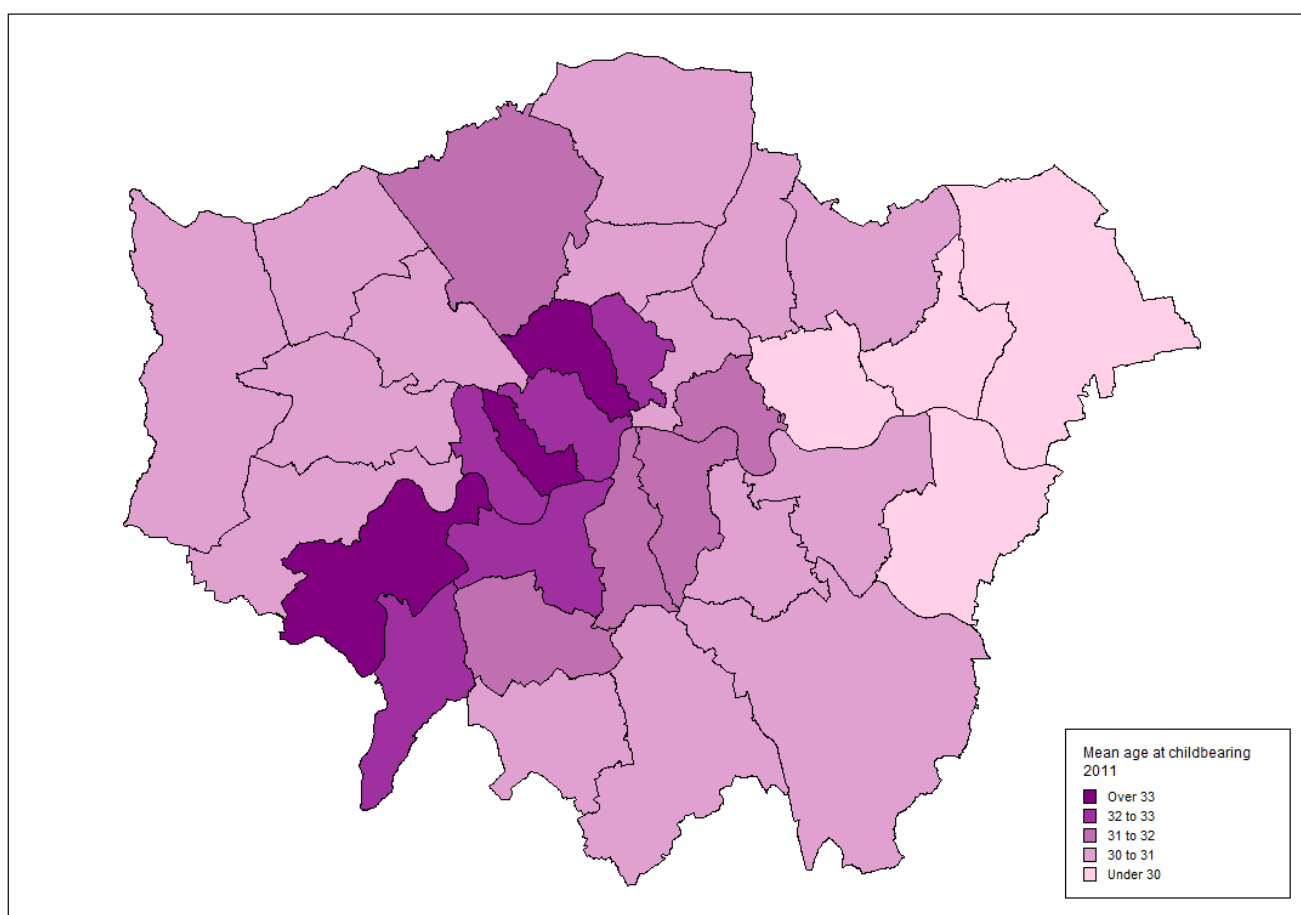


*Source: GLA, 2014*

The MAC went up in all areas (Figure 2). In 2001 twelve boroughs had a MAC that was over 30 years; by 2011 this had risen to 28 boroughs. This shows that on average woman are having children later in life.

For Greater London, the mean age at childbearing went up from 29.7 years in 2001 to 31.0 years in 2011; a rise of 1.3 years. The biggest change in the MAC occurred in inner London boroughs - Tower Hamlets saw an increase of 3.0 years to 31.5 years in 2011. Camden, Lambeth and Southwark all saw the mean age at childbearing also rise by more than two years.

Richmond upon Thames had the highest MAC in 2001 of 32.3 years.  By 2011, despite a rise in Richmond upon Thames's mean age at childbearing to 33.1 years, both Camden and Kensington & Chelsea had higher mean ages (33.2 and 33.7 years respectively).

**Figure 2: Increase in mean age at childbearing (years), 2001 to 2011**
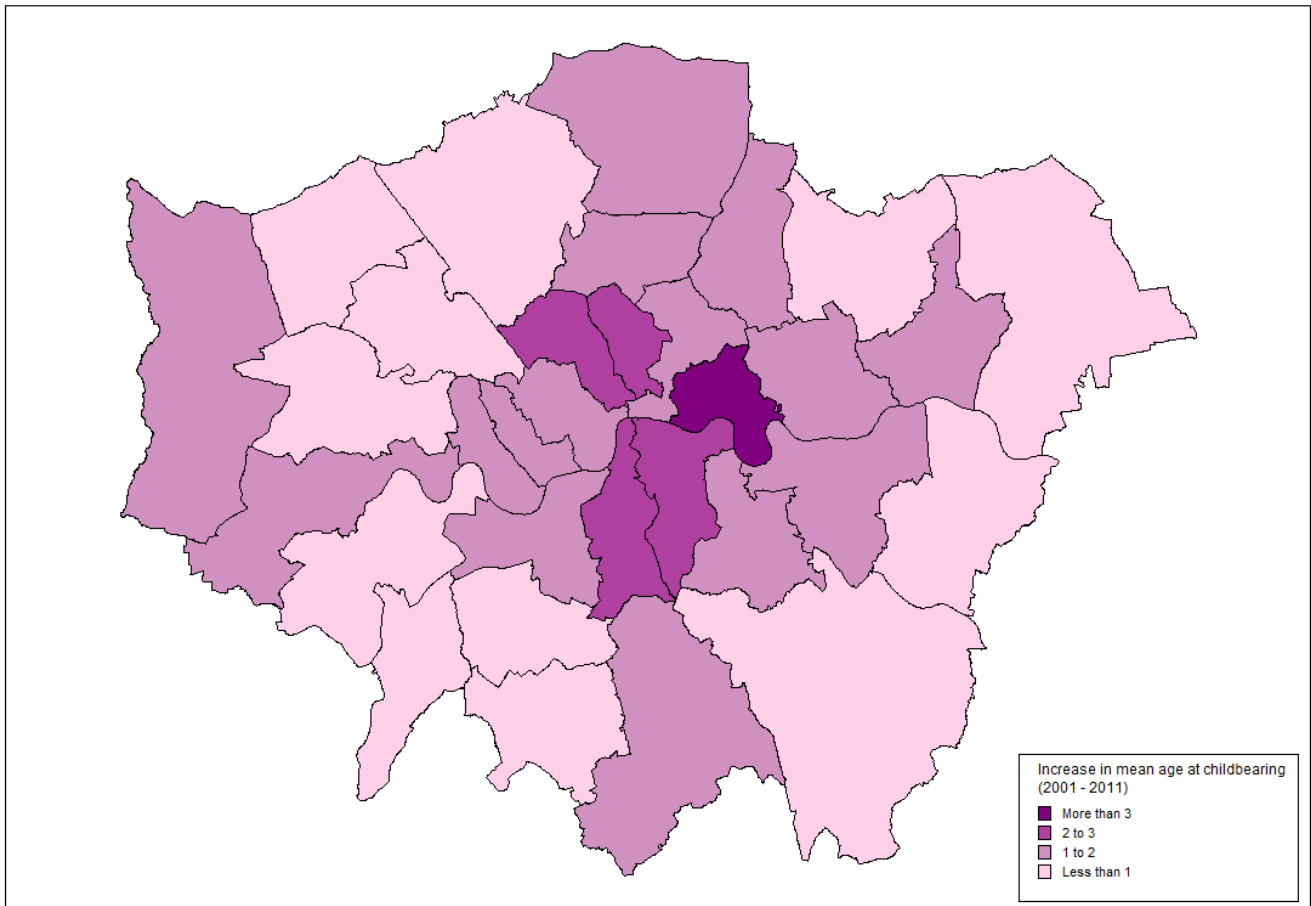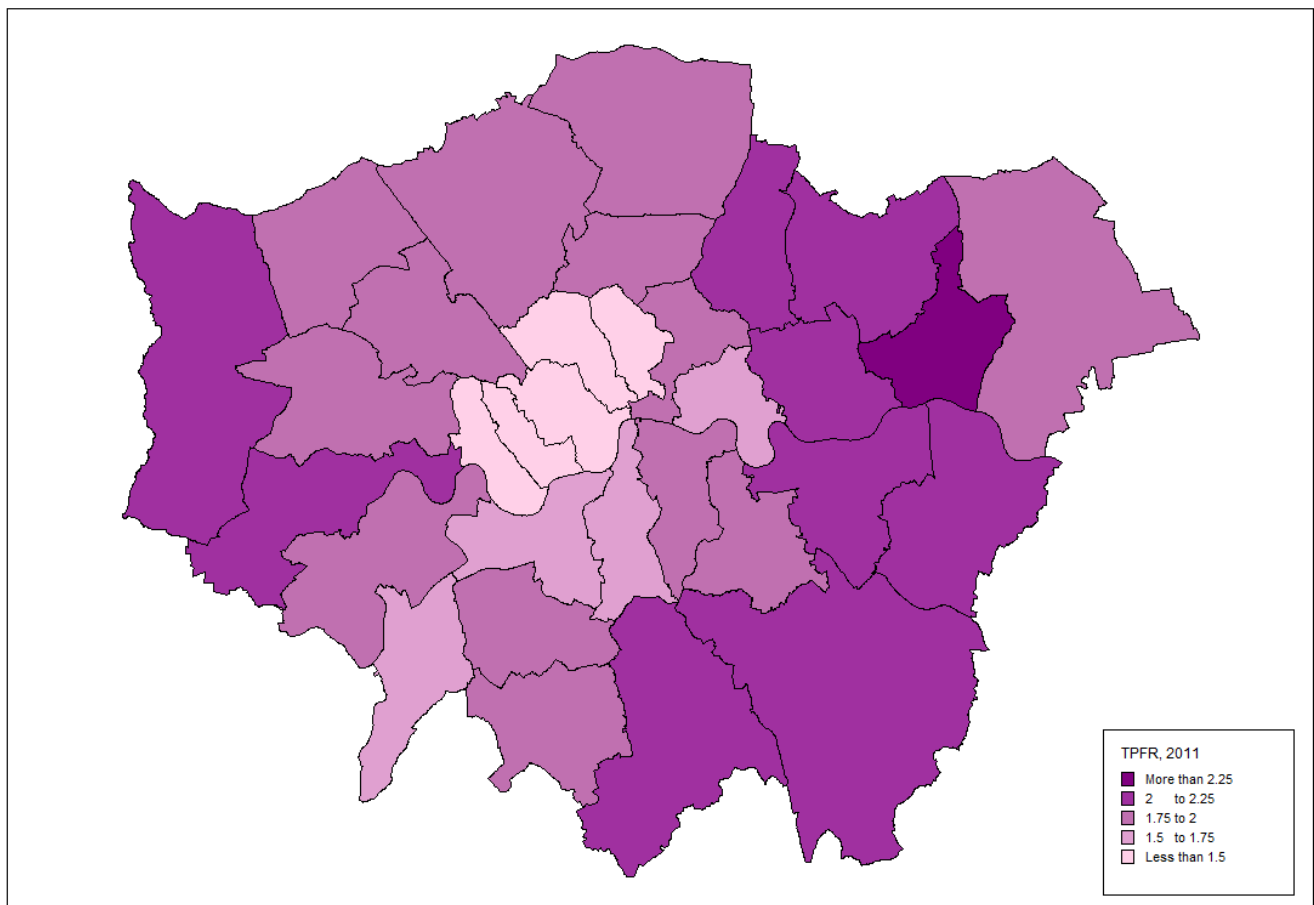


*Source: GLA, 2014*

Outer London boroughs experienced less of a rise in the mean age at childbearing than inner London boroughs; 0.9 years to inner London's 1.8 years.  Of the outer London boroughs Harrow had the lowest increase in the MAC of only 0.2 years.

**Total fertility rate (TFR)**

Figure 3 shows the TFR for all London boroughs in 2011. Greater London had a TFR of 1.83 in 2011 which is lower than the England & Wales figure of 1.93[2] for the same year. Replacement fertility (the level of fertility required to ensure a population continues to replace itself in size) for the UK is estimted to be 2.1.

Inner London had a lower TFR in 2011 than Outer London; 1.65 compared to 2.0. Barking & Dagenham had the highest TFR at 2.43 with Islington having the lowest at 1.41. Figure 3 shows that outer London boroughs in the east and south-east of London had the highest TFRs.

**Figure 3: Total fertility rate, 2011**



*Source: GLA, 2014*

The TFR for Greater London rose from 1.63 to 1.83 between 2001 and 2011 (Figure 4). The largest rise in TFR between 2001 and 2011 has occurred mainly in Outer London (0.35 increase compared to a 0.03 increase for Inner London). Some eastern Inner London boroughs have seen a drop in the TFR over the same period.

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[2] ONS, June 2013

**Figure 4: Change in total fertility rate, 2001-2011**
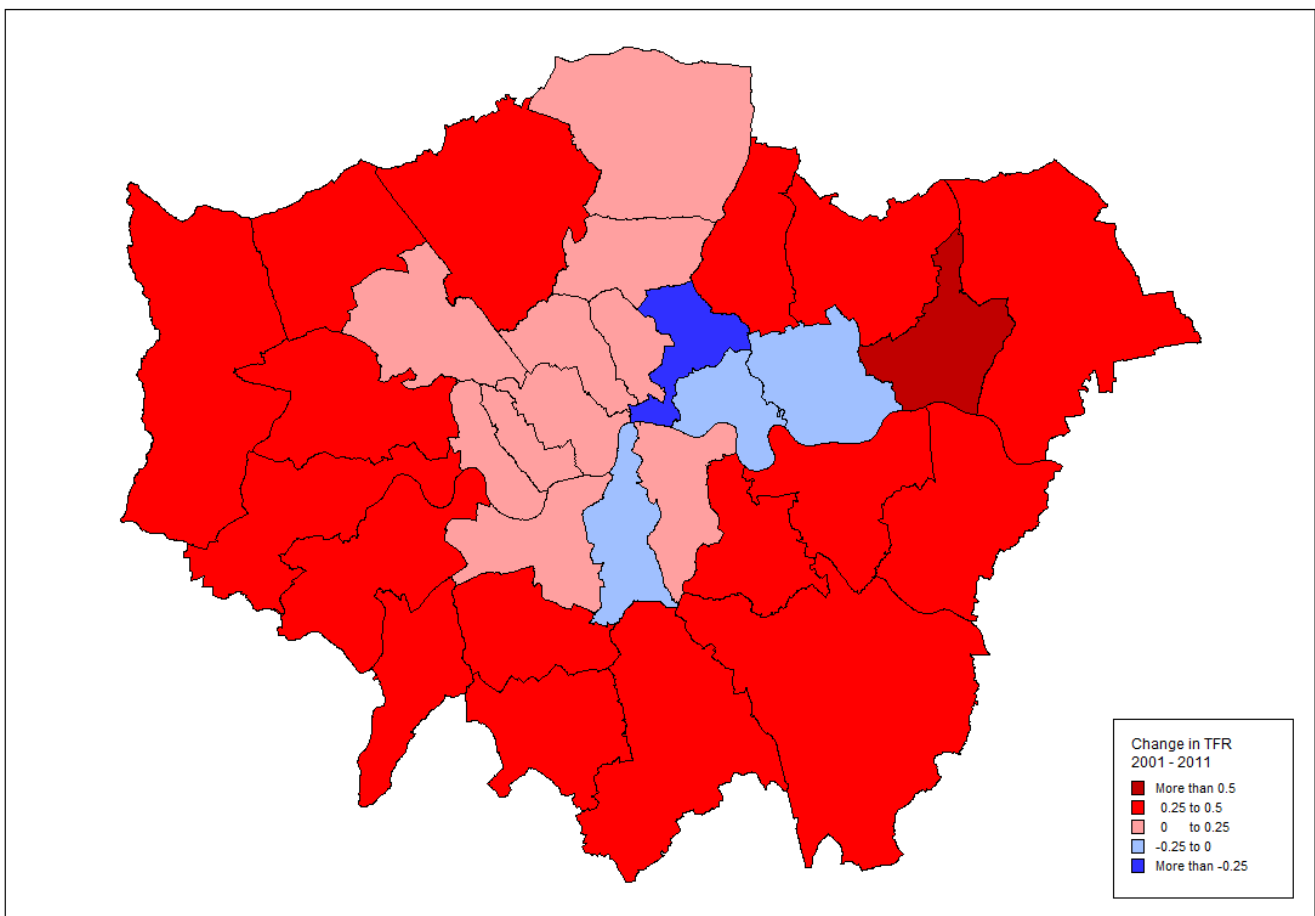


*Source: GLA, 2014*

The majority of boroughs saw a rise in TFR and only four boroughs, all of which are in Inner London, saw a fall (Figure 4). In 2001, Newham had the highest TFR at 2.25. By 2011 this had fallen to 2.18 and Newham had been overtaken by Barking & Dagenham as the borough with the highest TFR (2.43 in 2011). Ten boroughs had TFRs of over 2.0 in 2011 compared with only two boroughs in 2001.

The City of London and Hackney saw the largest drop in TFR between 2001 and 2011 of 0.31 followed by Tower Hamlets with a 0.25 fall.

## Table 1: London boroughs and borough groups, 2001 and 2011

| | 2001 | | | 2011 | | | Difference | | |
|---|---|---|---|---|---|---|---|---|---|
| | MAC | Mean | TFR | MAC | Mean | TFR | MAC | Mean | TFR |
| Camden | 30.90 | 30.67 | 1.36 | 33.20 | 32.52 | 1.43 | 2.29 | 1.85 | 0.07 |
| Kensington & Chelsea | 32.11 | 32.35 | 1.32 | 33.71 | 33.64 | 1.45 | 1.60 | 1.29 | 0.13 |
| Westminster | 31.26 | 31.04 | 1.28 | 32.67 | 32.44 | 1.42 | 1.41 | 1.40 | 0.14 |
| City of London and Hackney | 28.90 | 29.44 | 2.06 | 30.62 | 30.55 | 1.76 | 1.72 | 1.11 | -0.31 |
| Hammersmith & Fulham | 31.02 | 31.36 | 1.43 | 32.89 | 32.66 | 1.45 | 1.87 | 1.30 | 0.01 |
| Haringey | 29.70 | 30.29 | 1.78 | 30.87 | 31.17 | 1.79 | 1.17 | 0.88 | 0.01 |
| Islington | 30.18 | 30.53 | 1.41 | 32.20 | 31.63 | 1.41 | 2.01 | 1.09 | 0.01 |
| Lambeth | 29.33 | 30.24 | 1.65 | 31.43 | 31.51 | 1.58 | 2.10 | 1.27 | -0.08 |
| Lewisham | 29.36 | 30.22 | 1.65 | 30.64 | 30.97 | 1.94 | 1.28 | 0.75 | 0.29 |
| Newham | 28.34 | 28.37 | 2.25 | 29.96 | 29.47 | 2.18 | 1.62 | 1.10 | -0.07 |
| Southwark | 29.68 | 30.25 | 1.70 | 31.69 | 31.35 | 1.75 | 2.01 | 1.10 | 0.05 |
| Tower Hamlets | 28.50 | 27.78 | 1.83 | 31.51 | 30.32 | 1.58 | 3.00 | 2.53 | -0.25 |
| Wandsworth | 31.33 | 31.57 | 1.41 | 32.93 | 32.71 | 1.59 | 1.60 | 1.14 | 0.19 |
| Barking & Dagenham | 27.38 | 27.92 | 1.85 | 29.04 | 29.35 | 2.43 | 1.66 | 1.44 | 0.58 |
| Barnet | 30.66 | 31.00 | 1.56 | 31.29 | 31.41 | 1.88 | 0.62 | 0.41 | 0.32 |
| Bexley | 28.94 | 29.80 | 1.73 | 29.89 | 30.02 | 2.09 | 0.95 | 0.21 | 0.37 |
| Brent | 29.69 | 29.97 | 1.68 | 30.48 | 30.38 | 1.90 | 0.78 | 0.41 | 0.22 |
| Bromley | 30.10 | 31.13 | 1.60 | 30.70 | 31.46 | 2.02 | 0.60 | 0.33 | 0.42 |
| Croydon | 28.88 | 29.87 | 1.69 | 30.01 | 30.32 | 2.07 | 1.13 | 0.45 | 0.38 |
| Ealing | 29.96 | 30.42 | 1.63 | 30.78 | 30.93 | 1.96 | 0.82 | 0.51 | 0.33 |
| Enfield | 29.43 | 30.02 | 1.76 | 30.48 | 30.54 | 1.99 | 1.05 | 0.52 | 0.24 |
| Greenwich | 28.83 | 29.30 | 1.77 | 30.02 | 30.25 | 2.08 | 1.19 | 0.94 | 0.31 |
| Harrow | 30.42 | 30.91 | 1.58 | 30.65 | 30.76 | 1.89 | 0.23 | -0.15 | 0.31 |
| Havering | 29.14 | 29.89 | 1.60 | 30.00 | 30.09 | 1.92 | 0.86 | 0.20 | 0.32 |
| Hillingdon | 29.21 | 29.76 | 1.67 | 30.34 | 30.26 | 2.05 | 1.14 | 0.50 | 0.38 |
| Hounslow | 29.24 | 29.69 | 1.70 | 30.44 | 30.56 | 2.02 | 1.20 | 0.88 | 0.32 |
| Kingston upon Thames | 31.22 | 31.49 | 1.45 | 32.07 | 32.13 | 1.74 | 0.85 | 0.63 | 0.29 |
| Merton | 30.39 | 31.14 | 1.55 | 31.15 | 31.63 | 1.97 | 0.77 | 0.49 | 0.42 |
| Redbridge | 29.57 | 30.04 | 1.73 | 30.26 | 30.39 | 2.05 | 0.69 | 0.35 | 0.32 |
| Richmond upon Thames | 32.32 | 33.05 | 1.55 | 33.05 | 33.84 | 1.89 | 0.73 | 0.79 | 0.34 |
| Sutton | 29.40 | 30.36 | 1.53 | 30.20 | 30.79 | 1.99 | 0.80 | 0.43 | 0.46 |
| Waltham Forest | 28.97 | 29.66 | 1.83 | 30.38 | 30.38 | 2.13 | 1.41 | 0.72 | 0.29 |
| *Central Boroughs* | *31.33* | *31.27* | *1.32* | *33.15* | *32.78* | *1.43* | *1.82* | *1.51* | *0.10* |
| *Rest of Inner Boroughs* | *29.53* | *29.91* | *1.70* | *31.39* | *31.12* | *1.70* | *1.86* | *1.22* | *0.00* |
| *Inner Boroughs* | *29.83* | *30.13* | *1.62* | *31.67* | *31.38* | *1.65* | *1.84* | *1.25* | *0.03* |
| *Outer Boroughs* | *29.61* | *30.24* | *1.66* | *30.53* | *30.74* | *2.00* | *0.92* | *0.50* | *0.35* |
| **Greater London** | **29.70** | **30.20** | **1.63** | **31.00** | **31.00** | **1.83** | **1.30** | **0.81** | **0.20** |

Figure 5 plots the change in TFR between 2001 and 2011 against the change in MAC over the same period for all boroughs and borough groups.  This highlights strong correlation between increasing MAC and decreasing TFR.

The two biggest outliers from the observed trend are Barking & Dagenham, and the City of London and Hackney.  Based on the trend, Barking & Dagenham's increase in TFR is higher than expected when compared to its increase in MAC; a rise in TFR of 0.46 from an expected figure of 0.12 to 0.58.

The City of London and Hackney's decrease in TFR is greater than expected given the change in MAC.  Their TFR of -0.31 is -0.21 lower than the level of 0.1 assumed by the trend.

## Figure 5: Change in TFR and MAC, 2001 to 2011
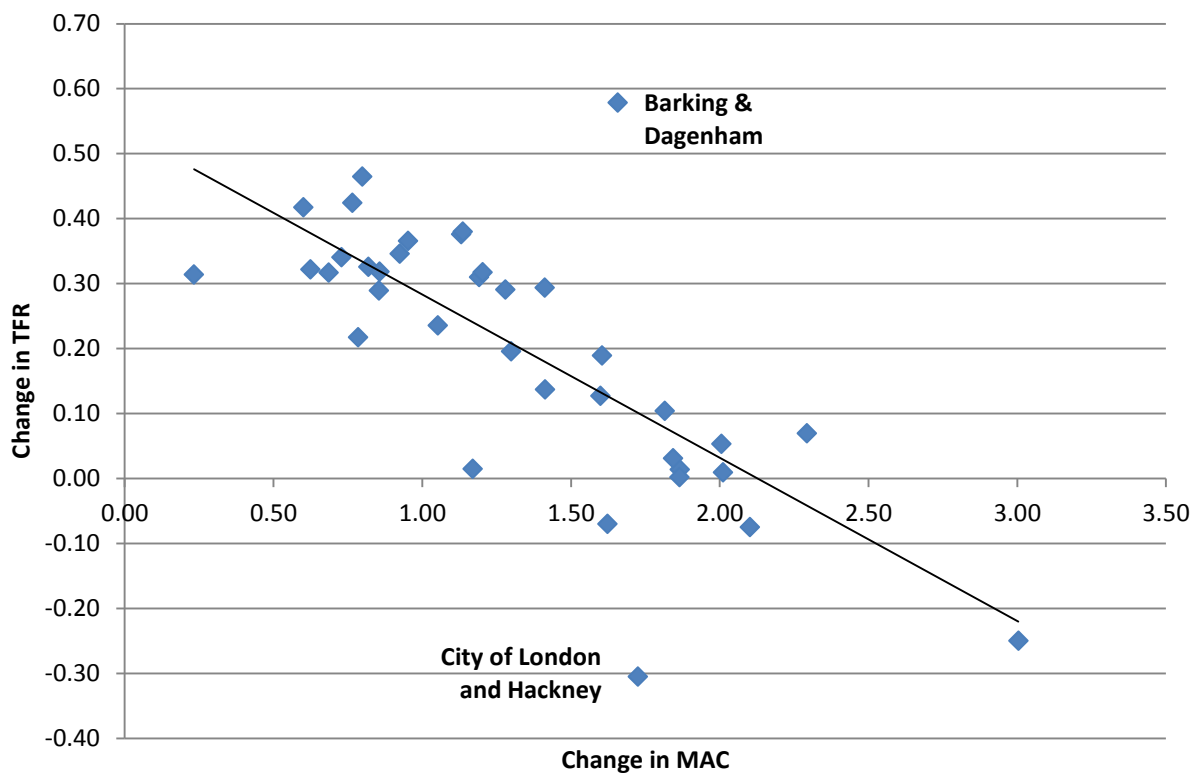
## Fertility rate curves

Figure 6 shows the proportional change in fertility by age in Greater London between 2001 and 2011.  The pattern is similar across the borough groups.  Fertility in the younger ages has fallen while there has been a rise in fertility across all other ages – notably for those in their late thirties/early forties.

**Figure 6: Proportional change in fertility by age, Greater London, 2001-2011**
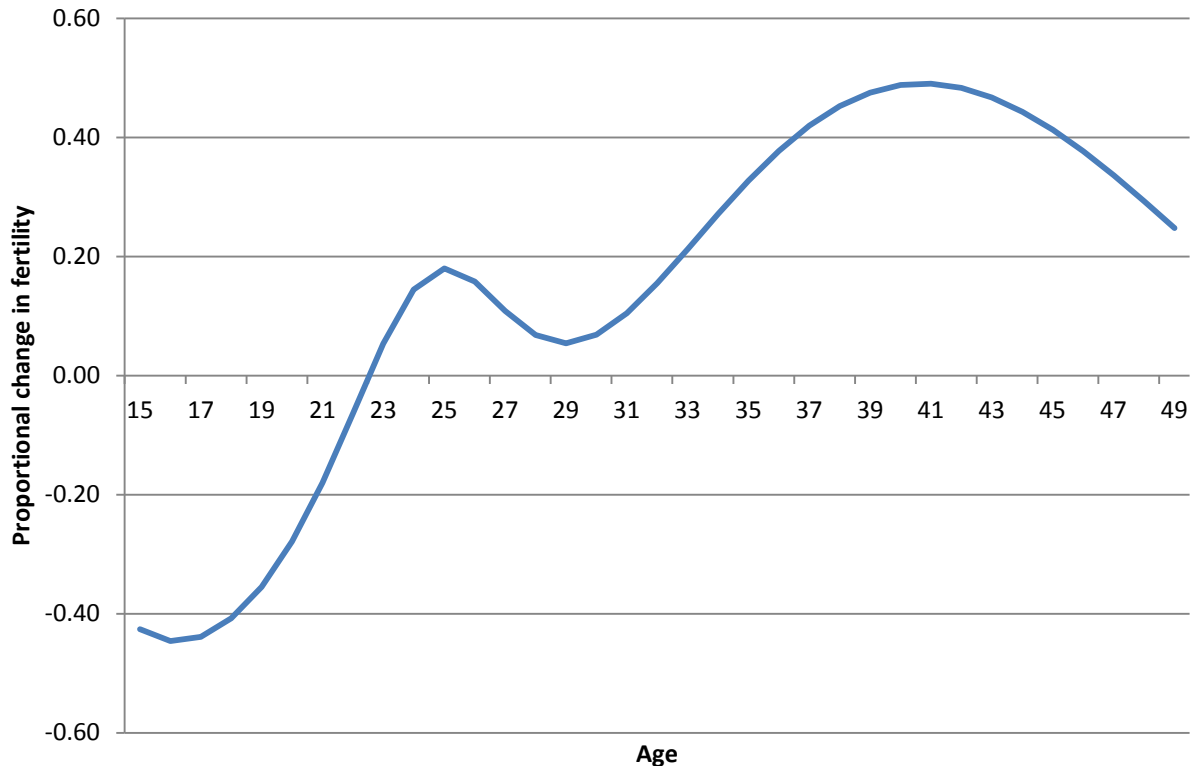


Figures 7-43 contain fertility rate curves for all boroughs and borough groups comparing 2001 and 2011. Figure 7 shows the fertility curves for Greater London.  In 2001 the curve had a bimodal distribution peaking at age 22 and again, ten years later, at age 32, equating to fertility rates of 0.06 and 0.10 respectively.  By 2011 this had changed to a single, shouldered, peak at age 33 of 0.11.

This highlights that women in Greater London are having children later (loss of the earlier peak at age 22 and shift of the higher peak to age 32) and that they are having more children at an older age (increase in fertility rates at these ages from less than 0.10 to nearly 0.12).

This pattern is apparent in the borough groups (Figures 8-11) and across many London boroughs.

## Figure 7: Greater London
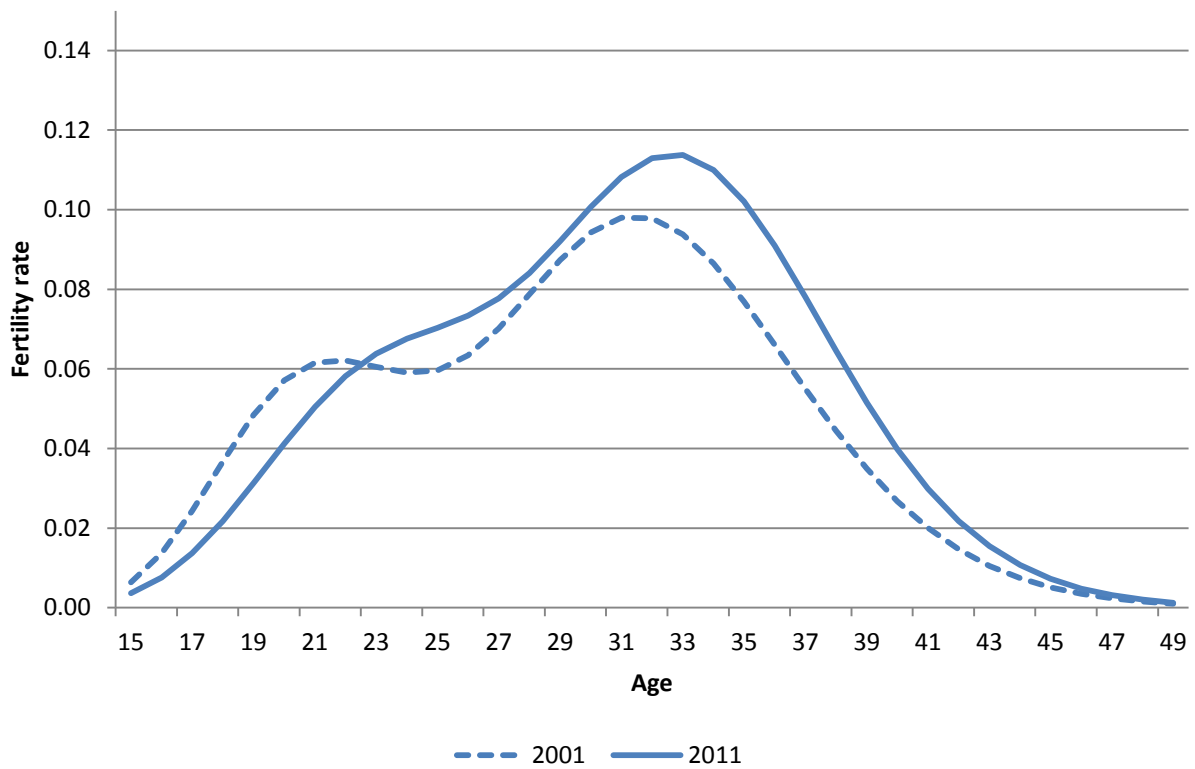


## Figure 8: Central boroughs
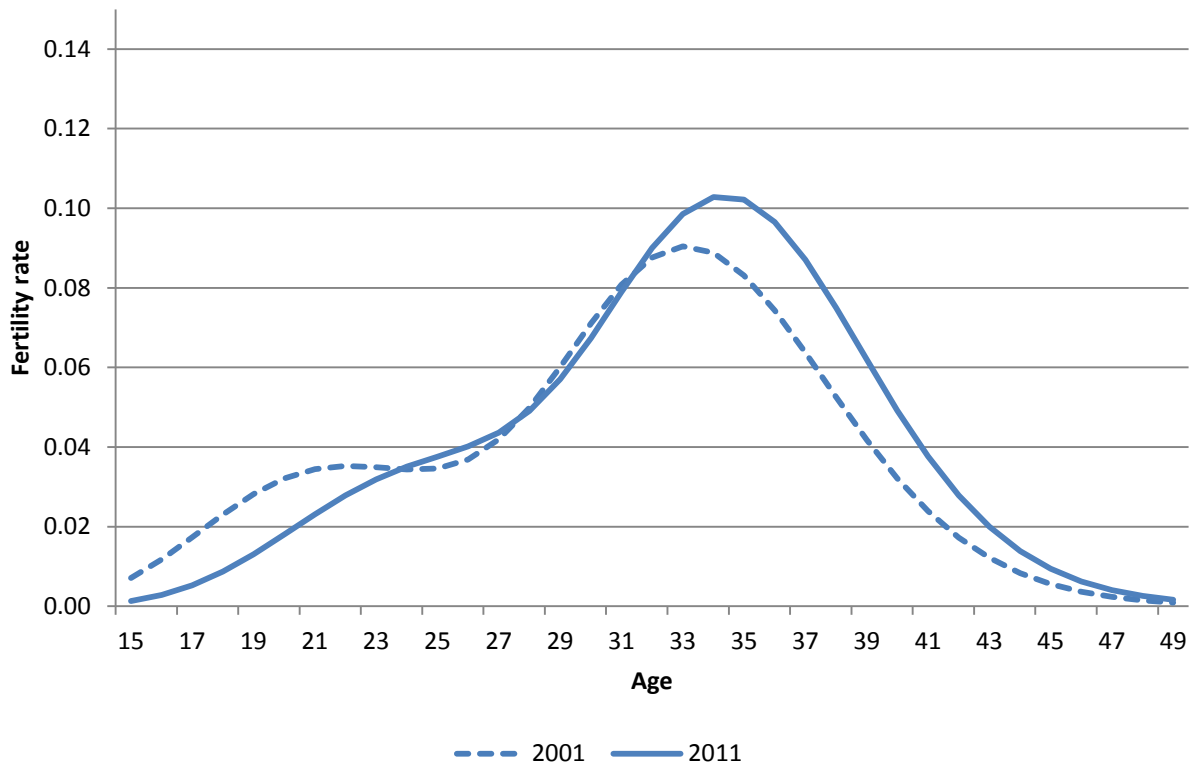
**Figure 9: Rest of Inner London**
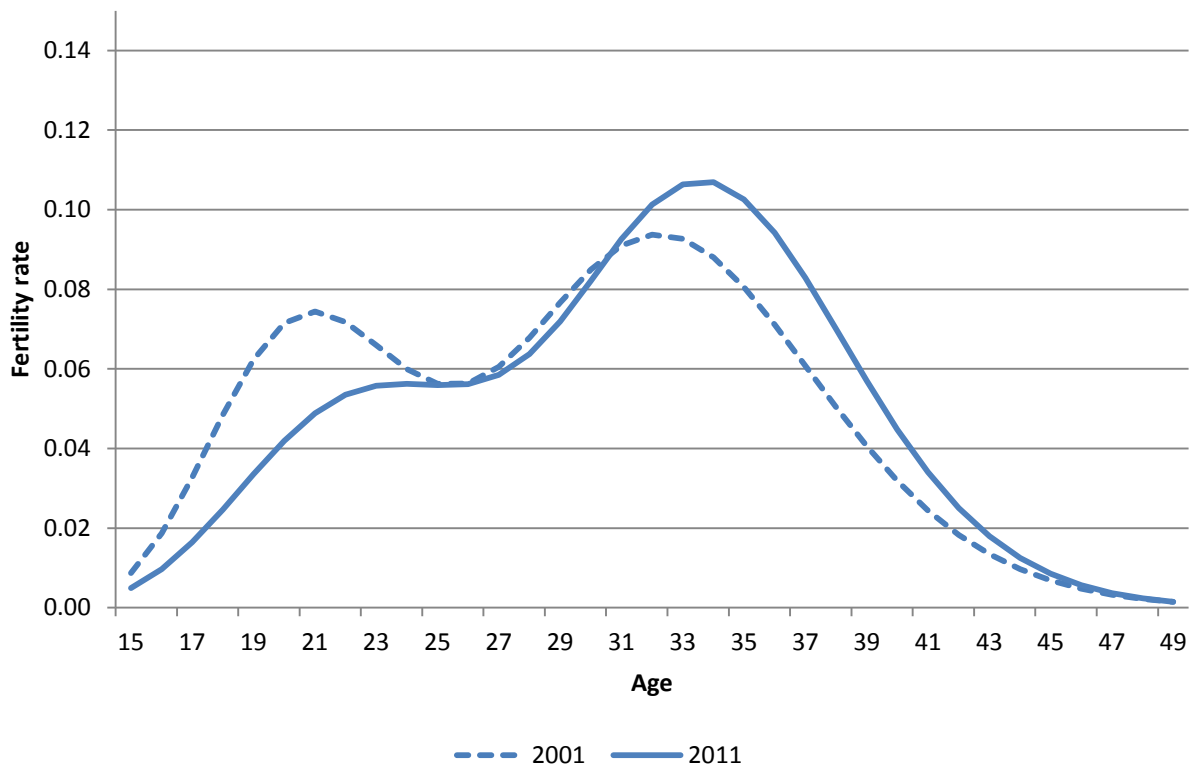


**Figure 10: Inner London**
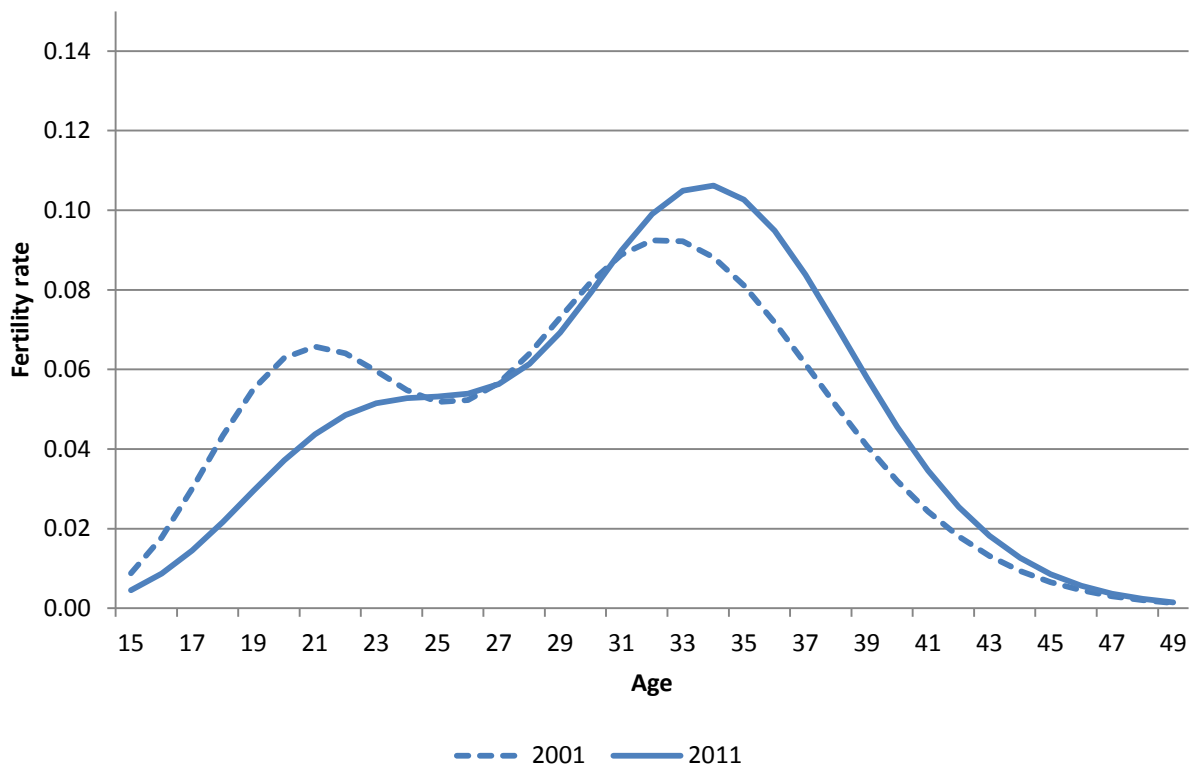
## Figure 11: Outer London
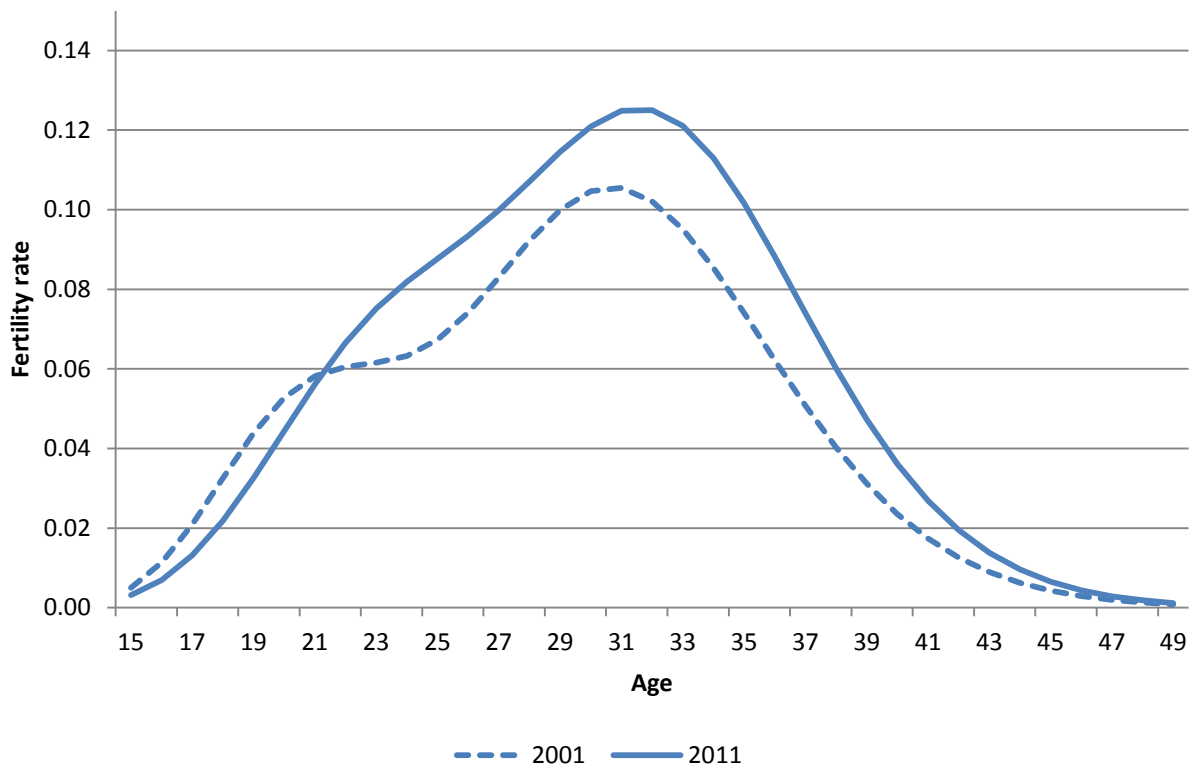


## Figure 12: Camden
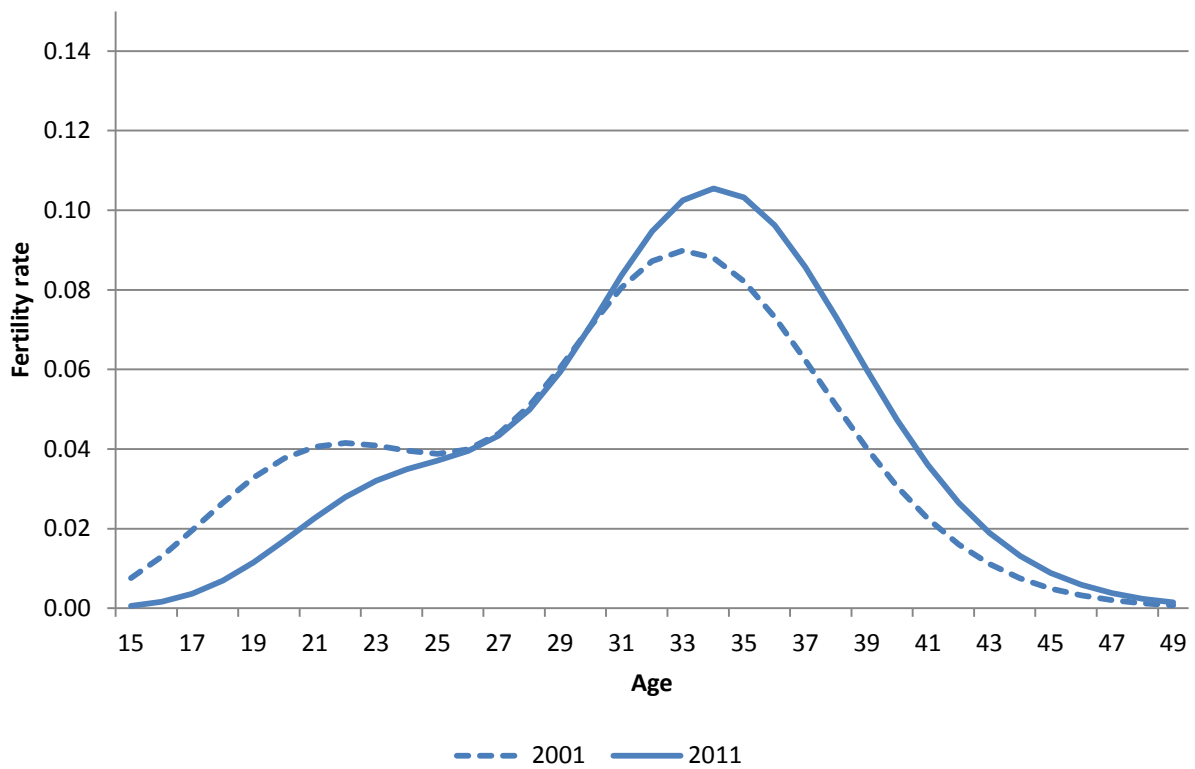
## Figure 13: Kensington & Chelsea



- - - 2001 —— 2011
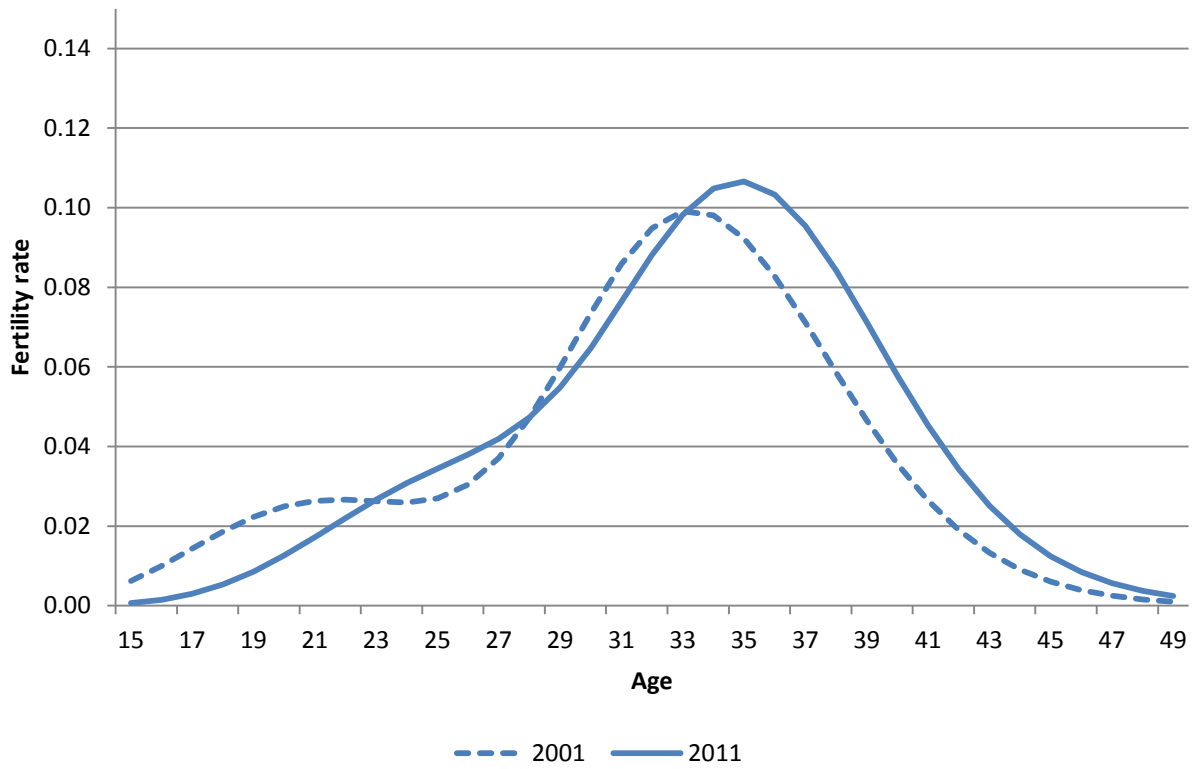
## Figure 14: Westminster



- - - 2001 —— 2011
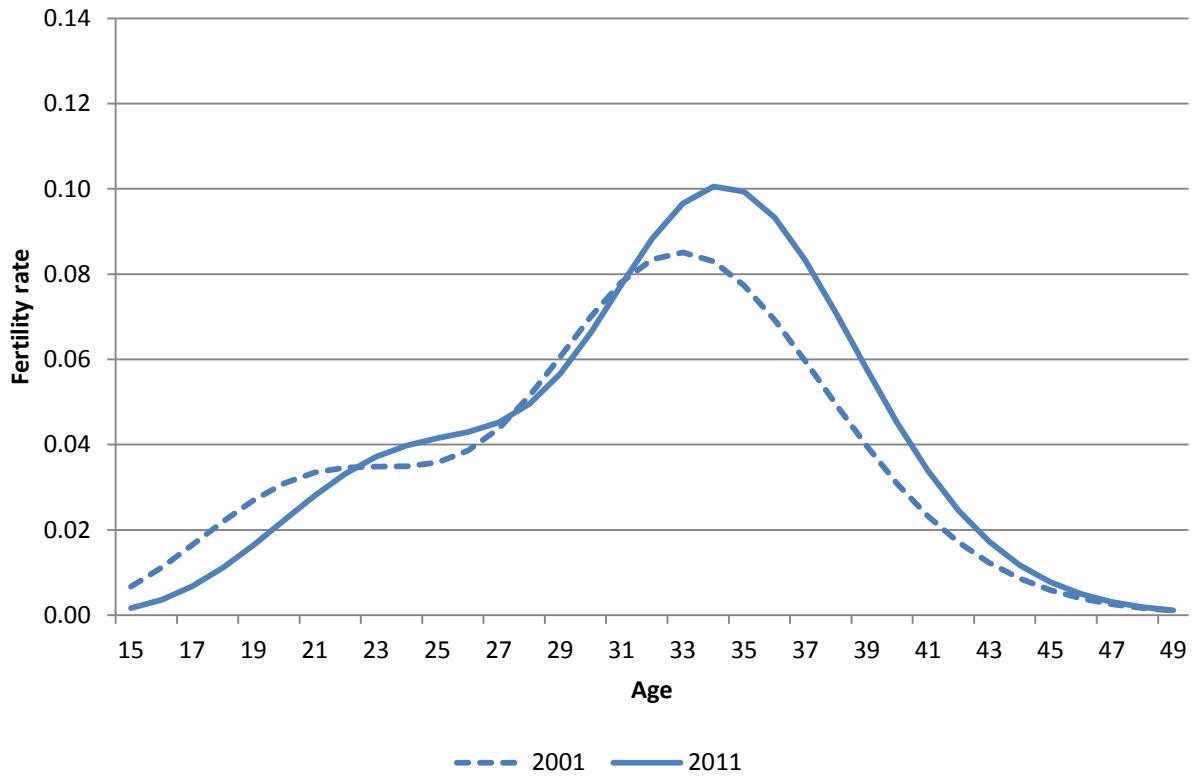
**Figure 15: City of London and Hackney**
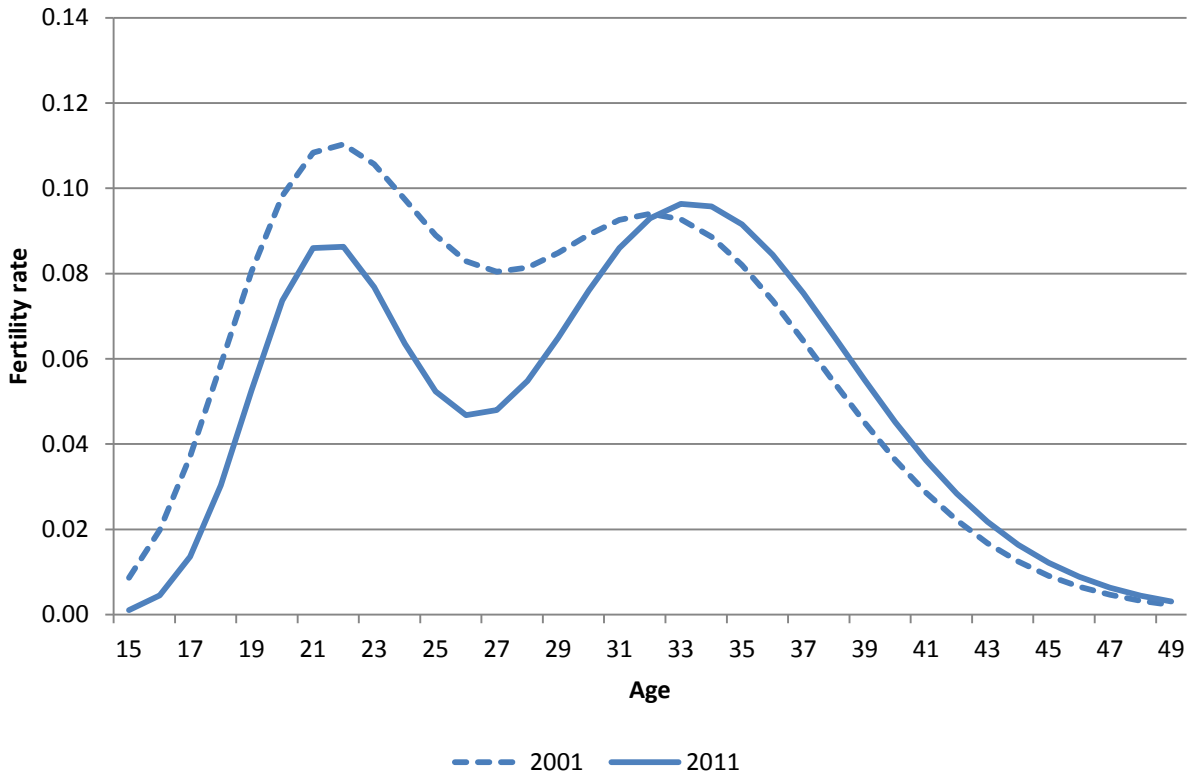


**Figure 16: Hammersmith & Fulham**
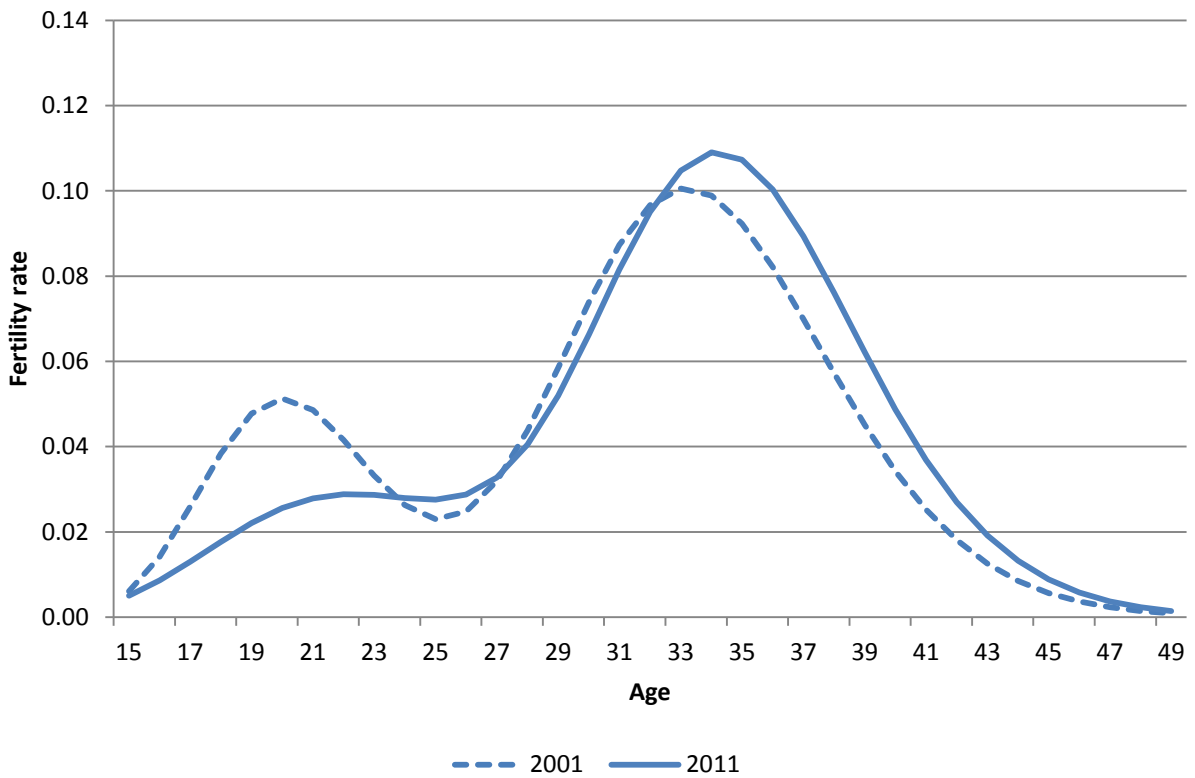
## Figure 17: Haringey
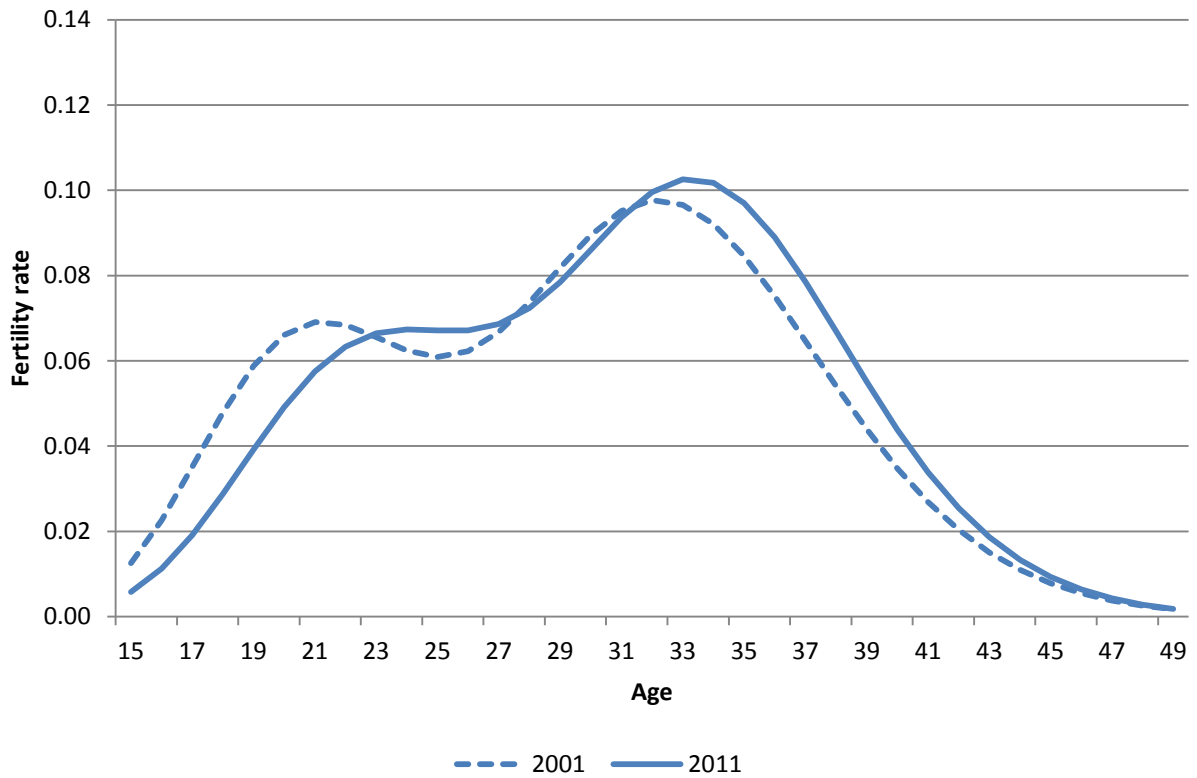


## Figure 18: Islington
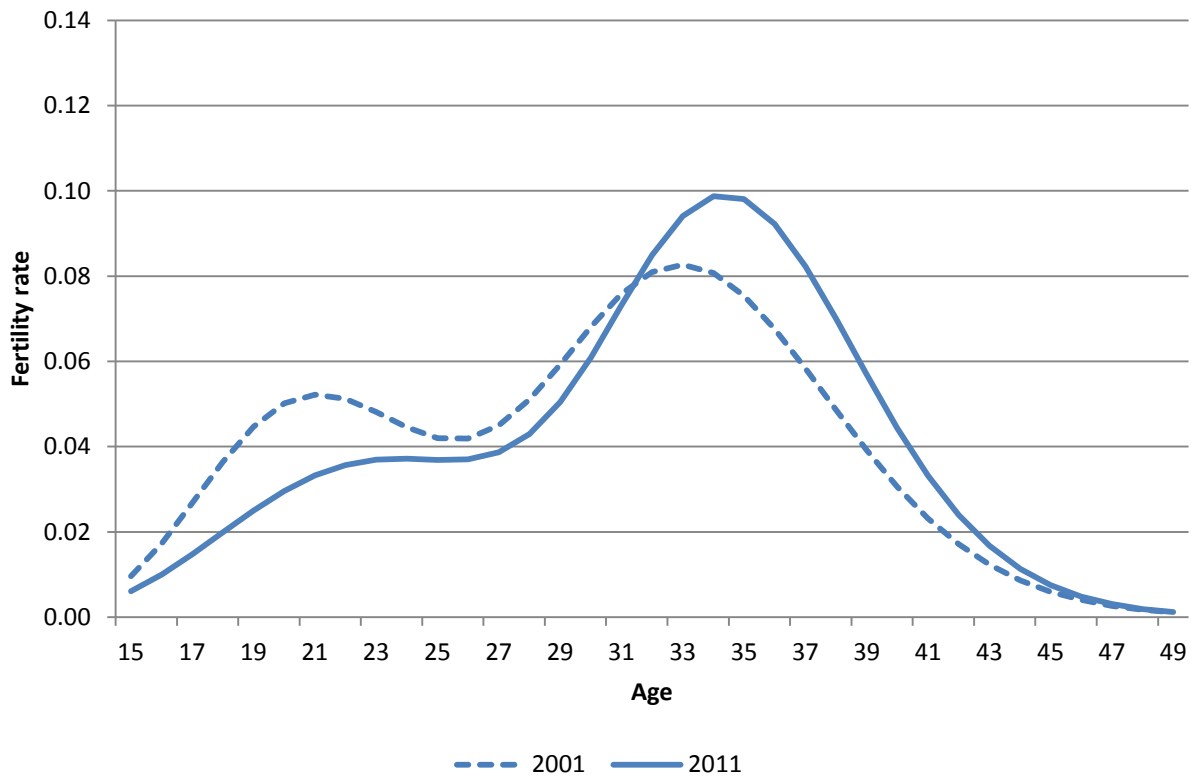
**Figure 19: Lambeth**
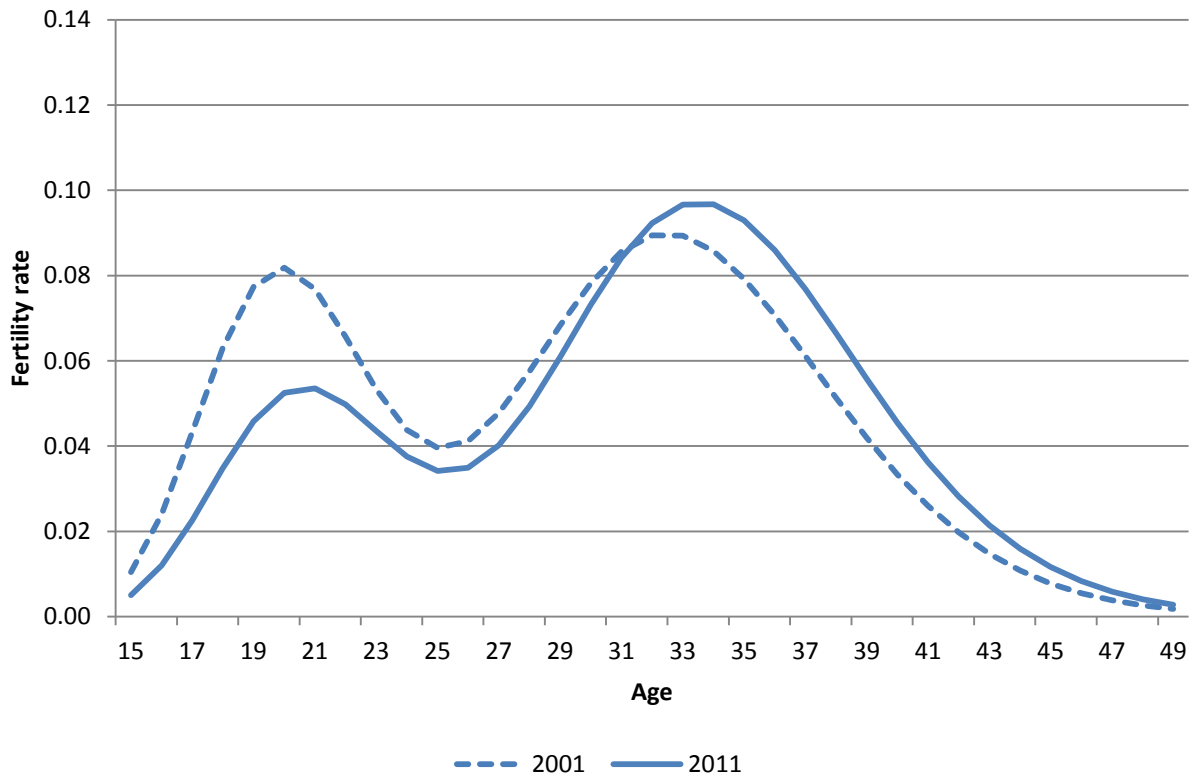


**Figure 20: Lewisham**
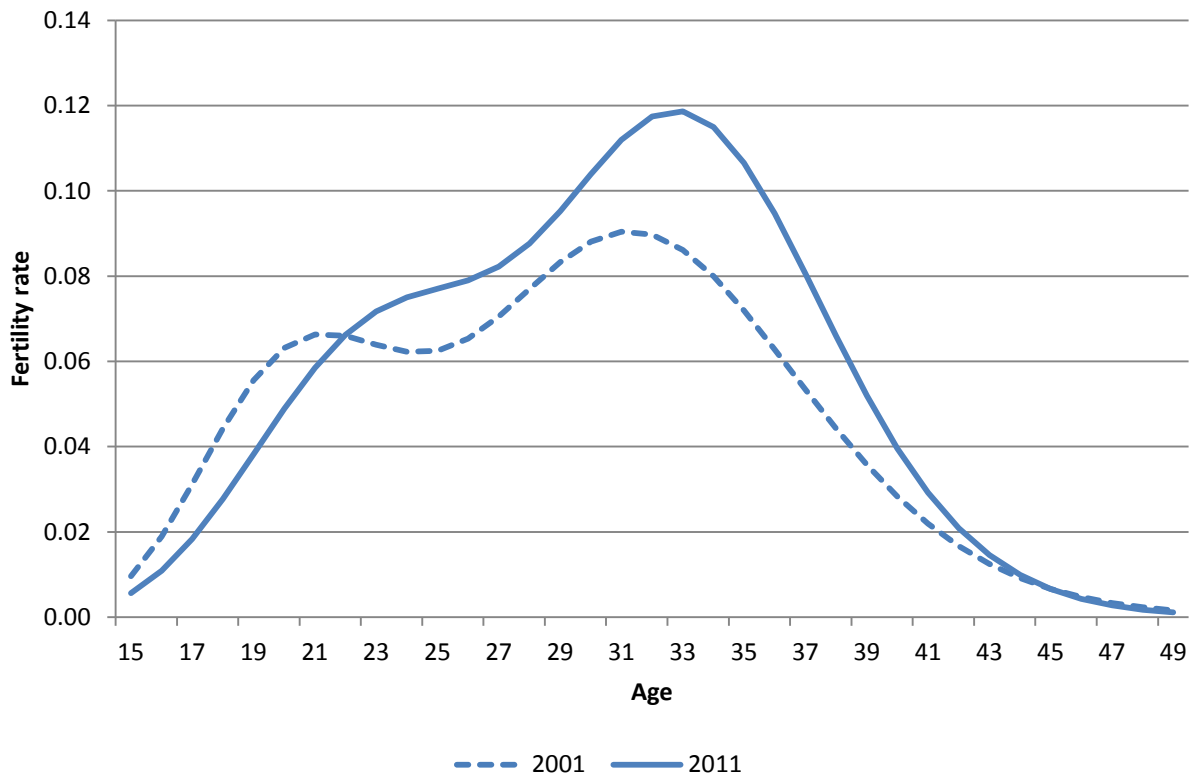
**Figure 21: Newham**
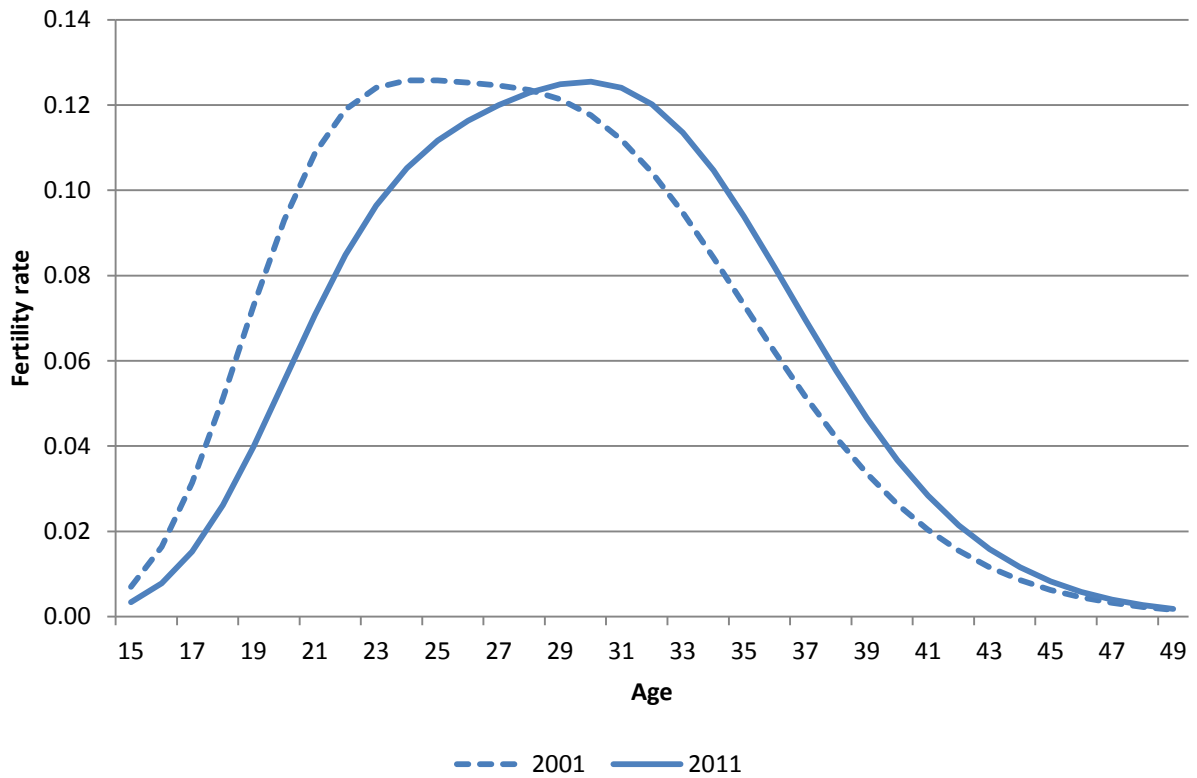


**Figure 22: Southwark**
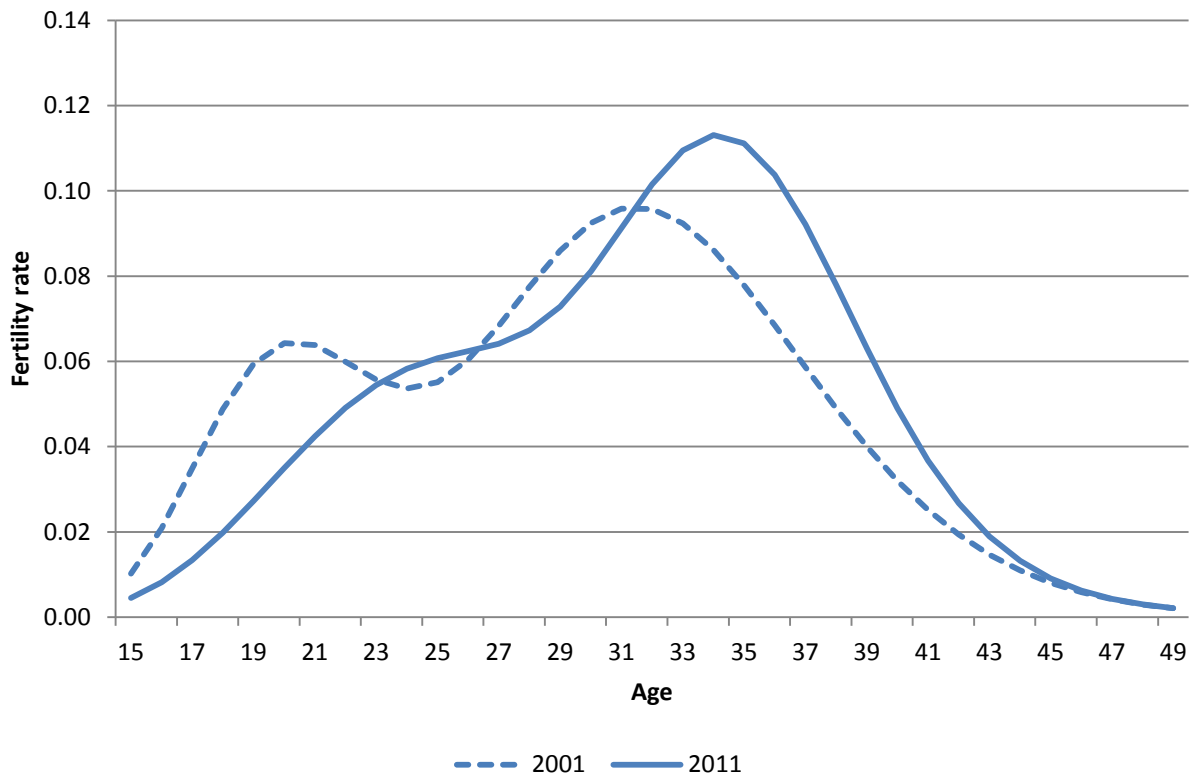
## Figure 23: Tower Hamlets
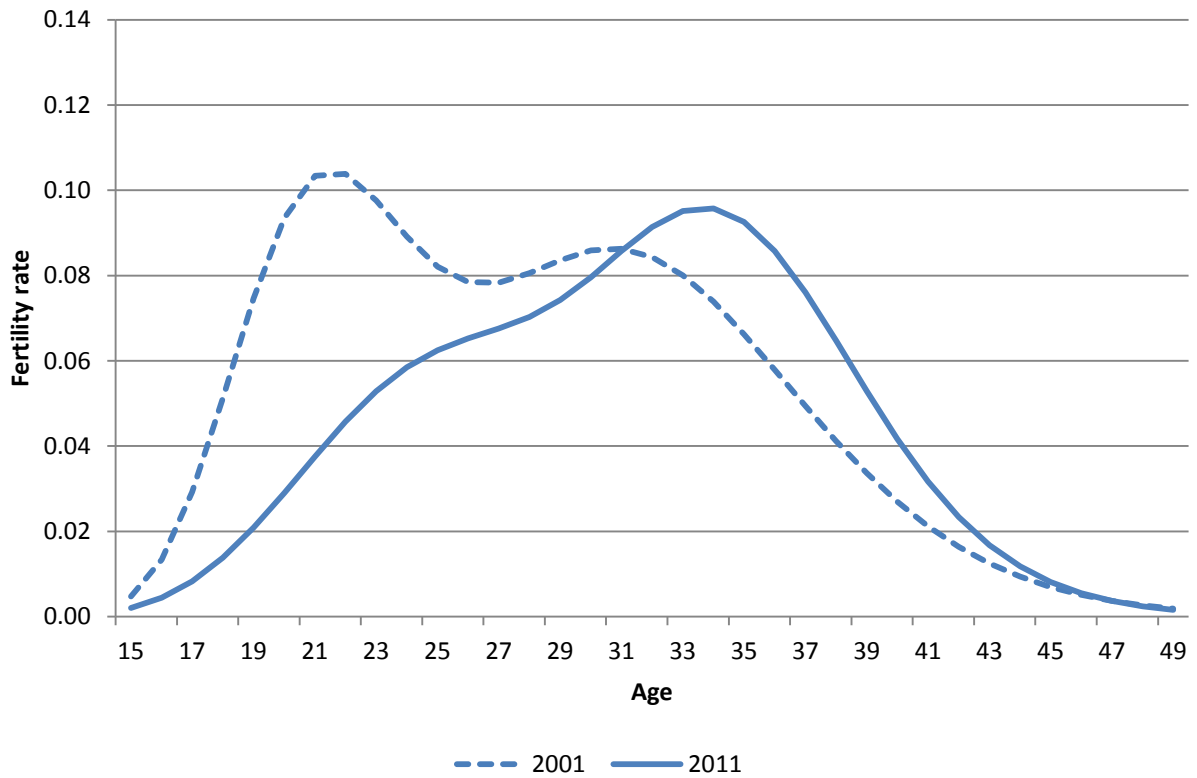


## Figure 24: Wandsworth
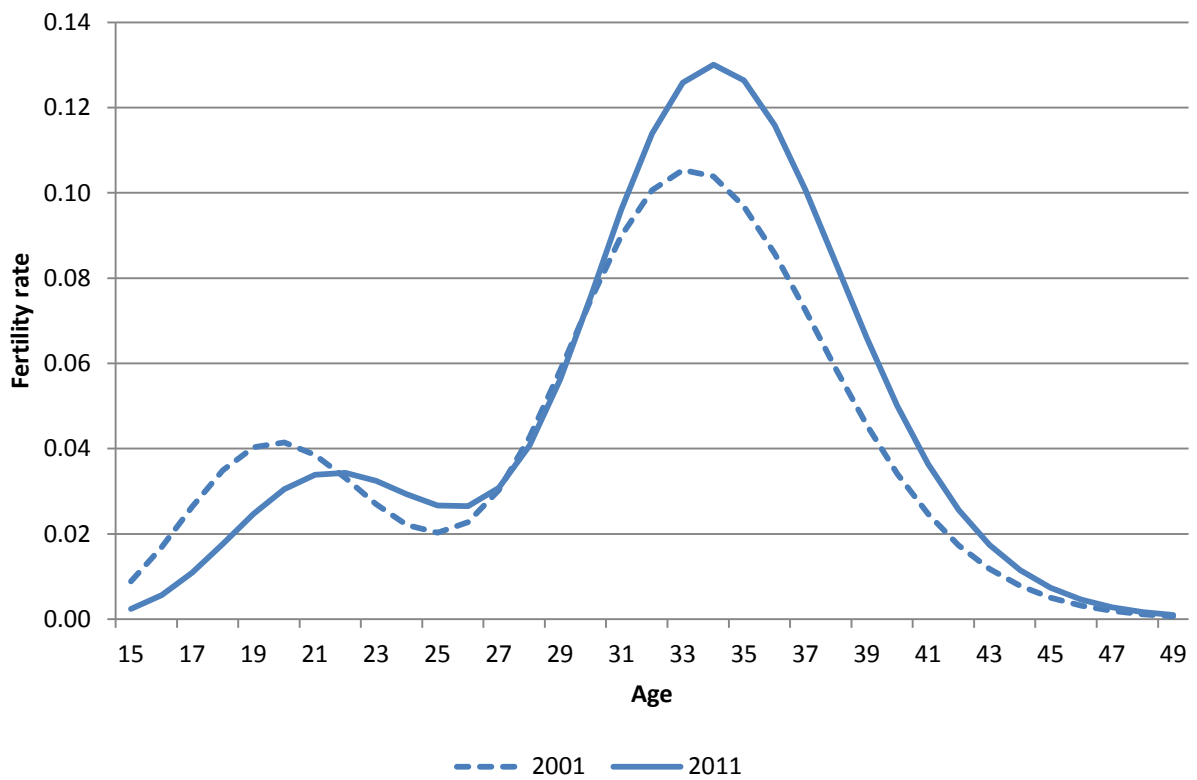
## Figure 25: Barking & Dagenham



- - - 2001 —— 2011

## Figure 26: Barnet



- - - 2001 —— 2011
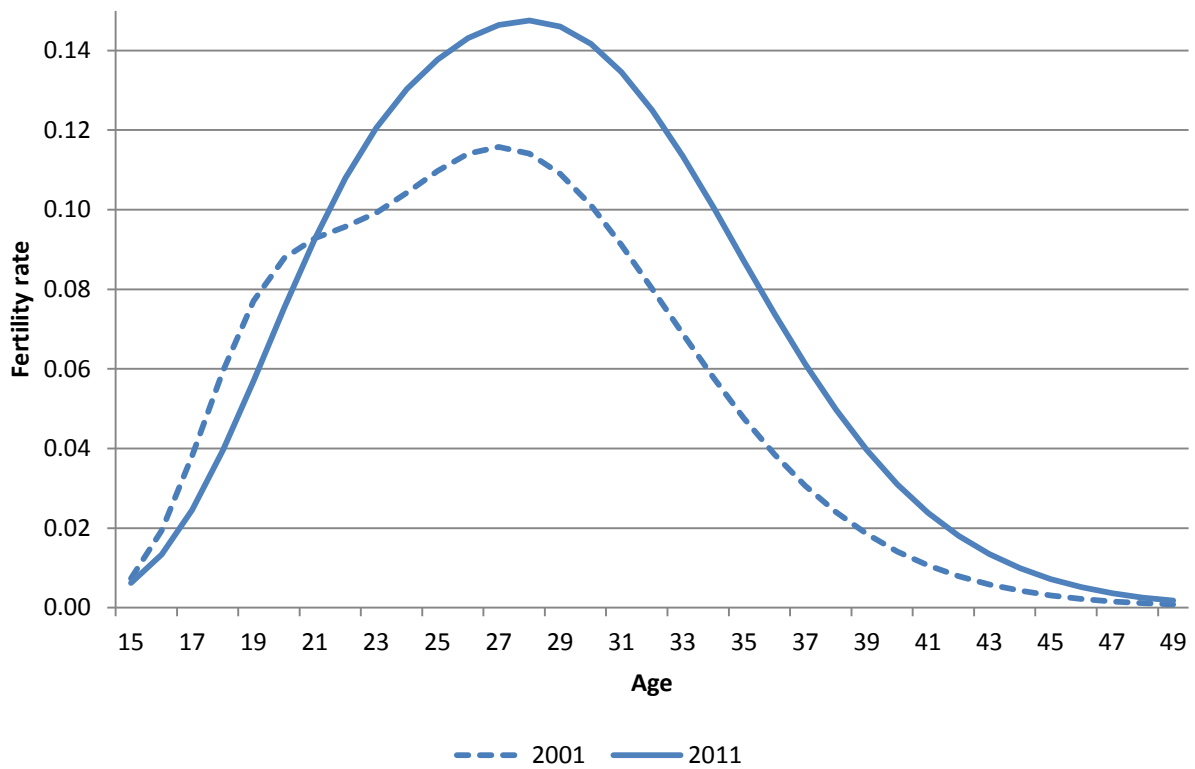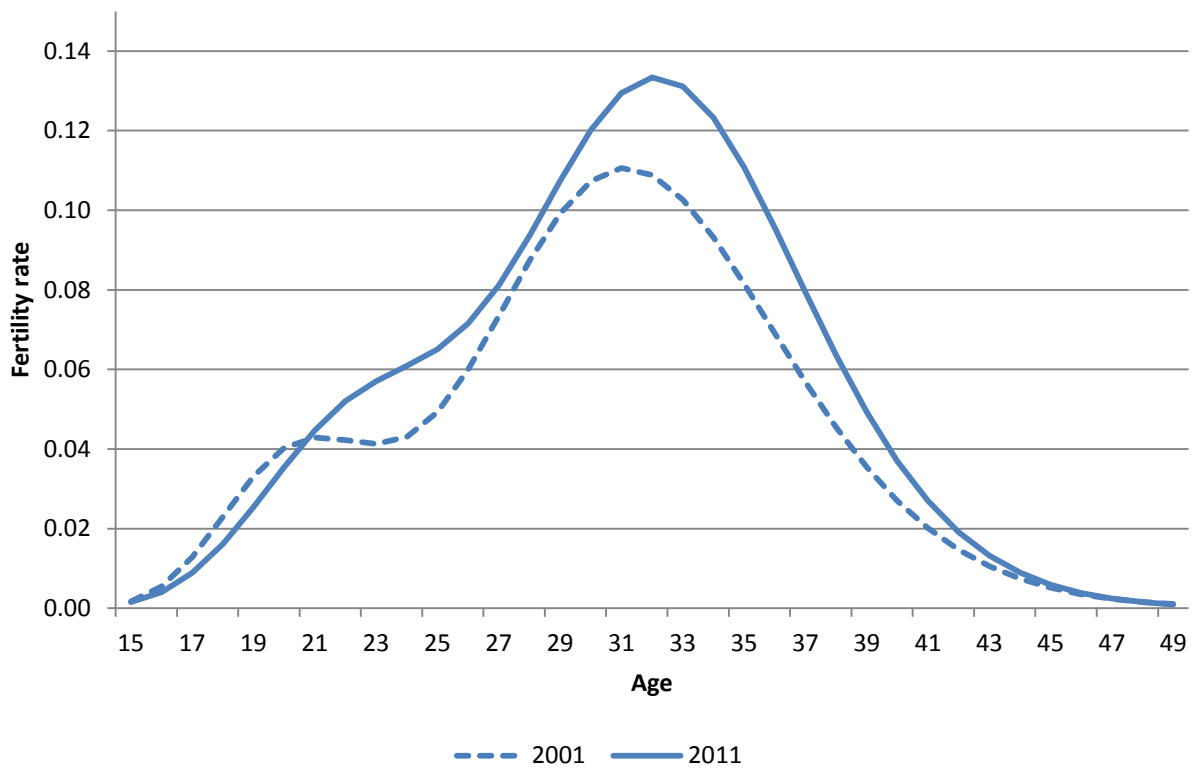
## Figure 27: Bexley
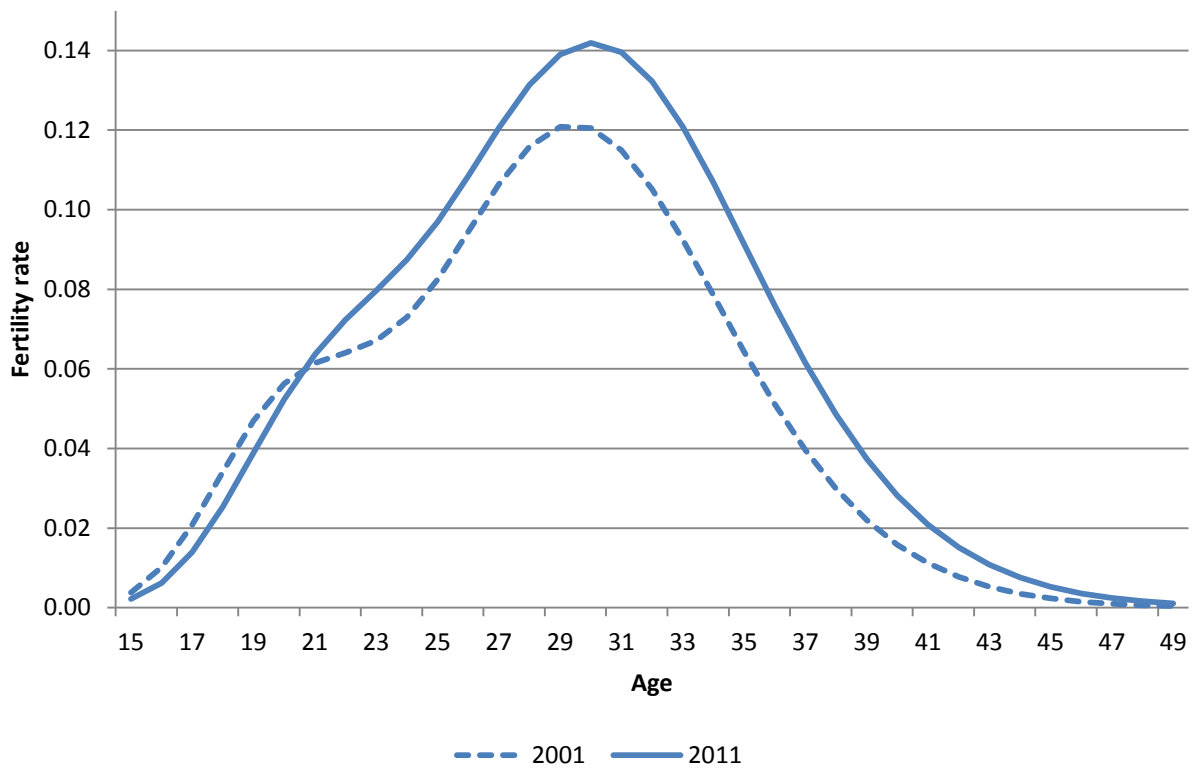


## Figure 28: Brent
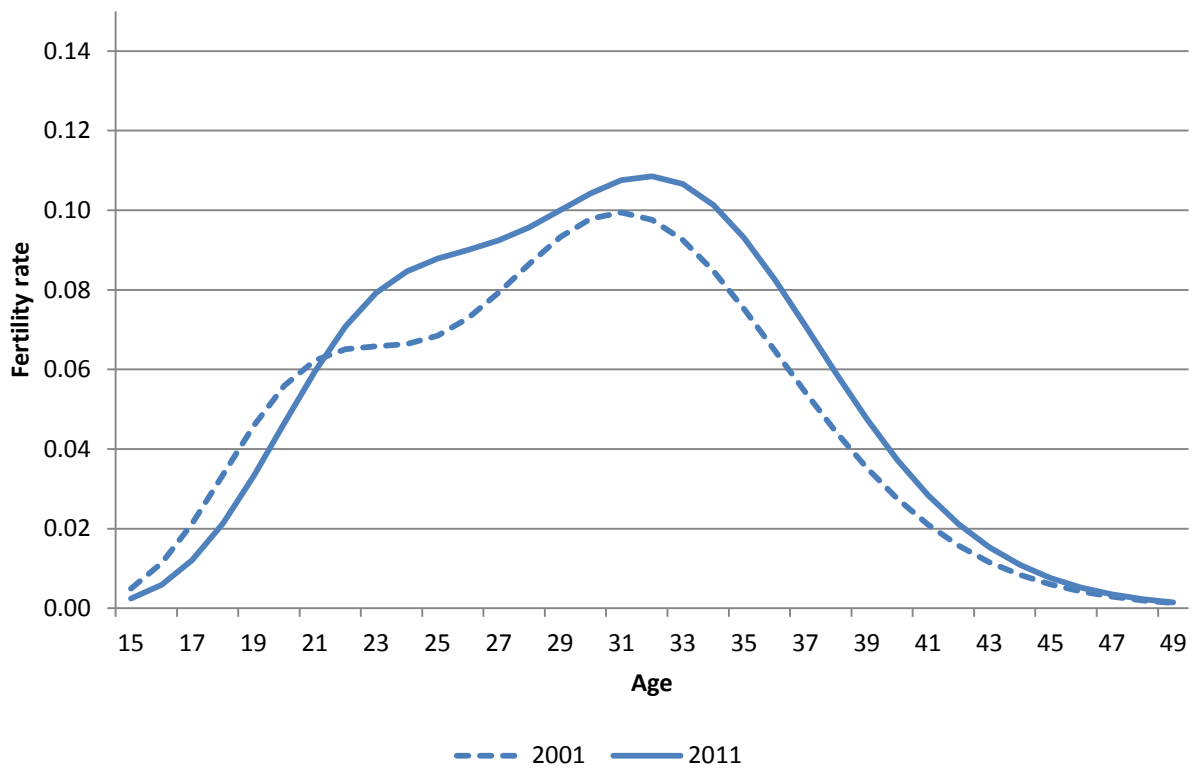
## Figure 29: Bromley
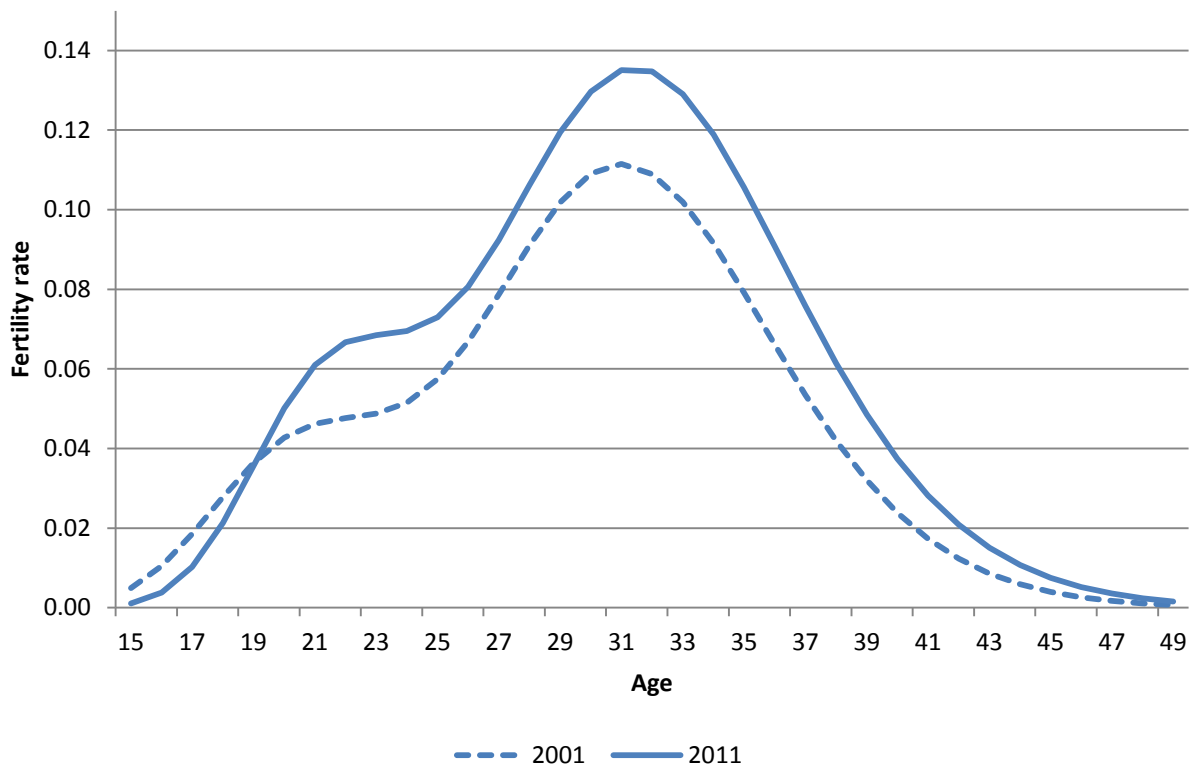


## Figure 30: Croydon
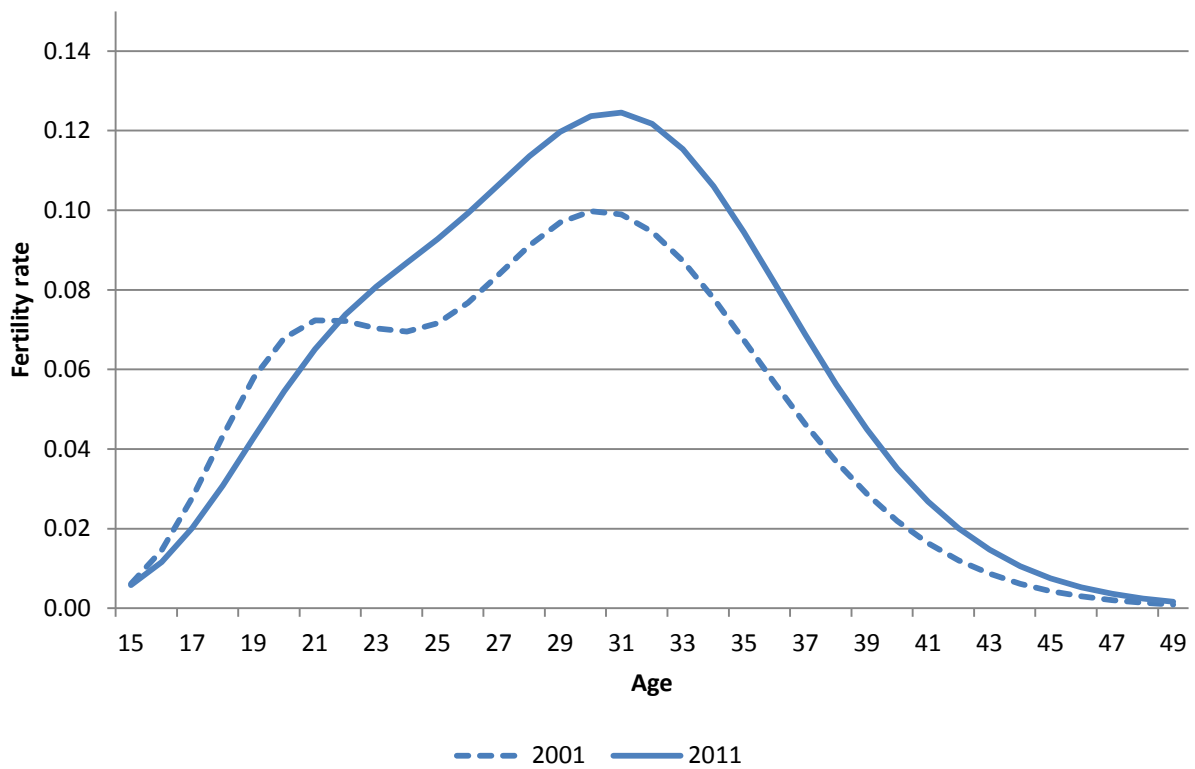
## Figure 31: Ealing
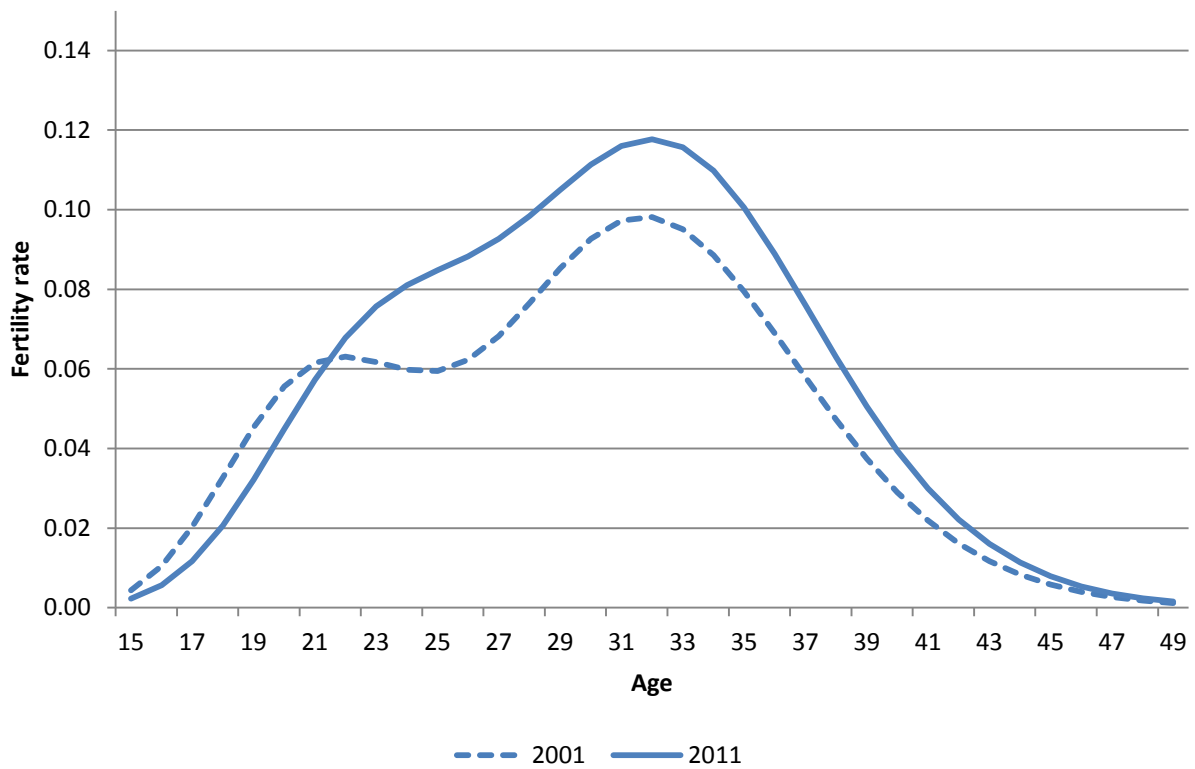


## Figure 32: Enfield
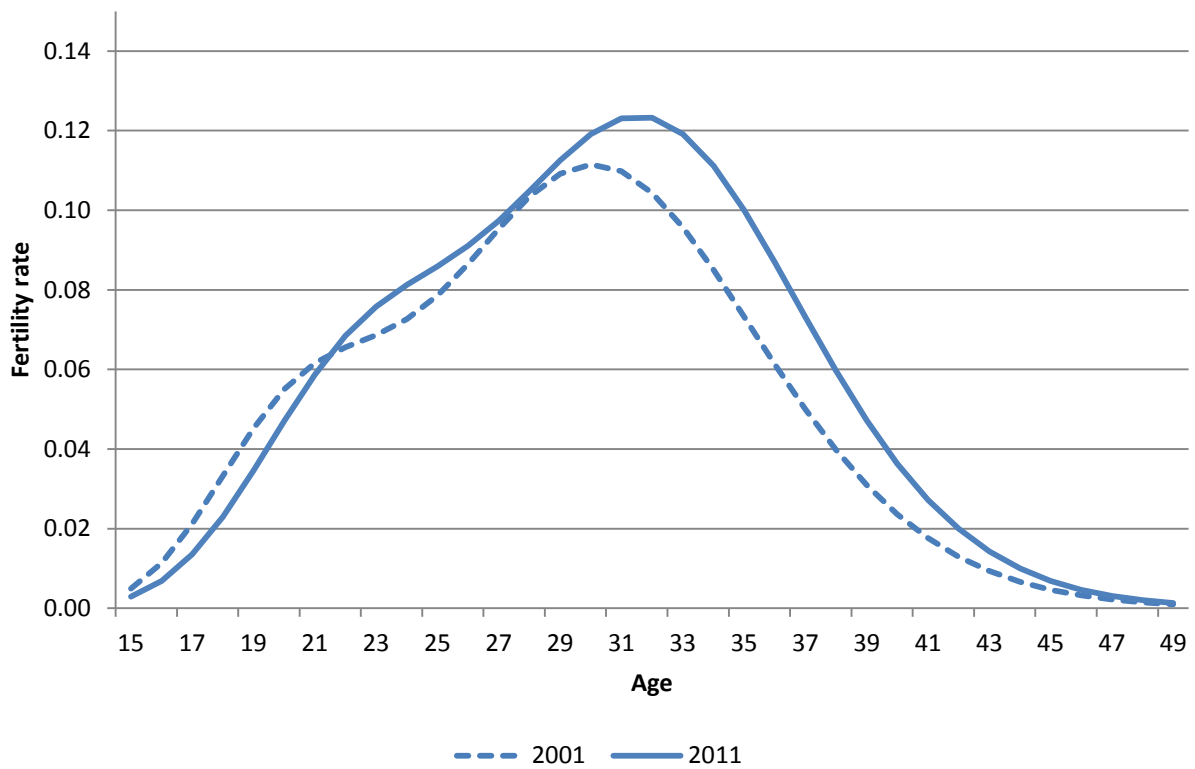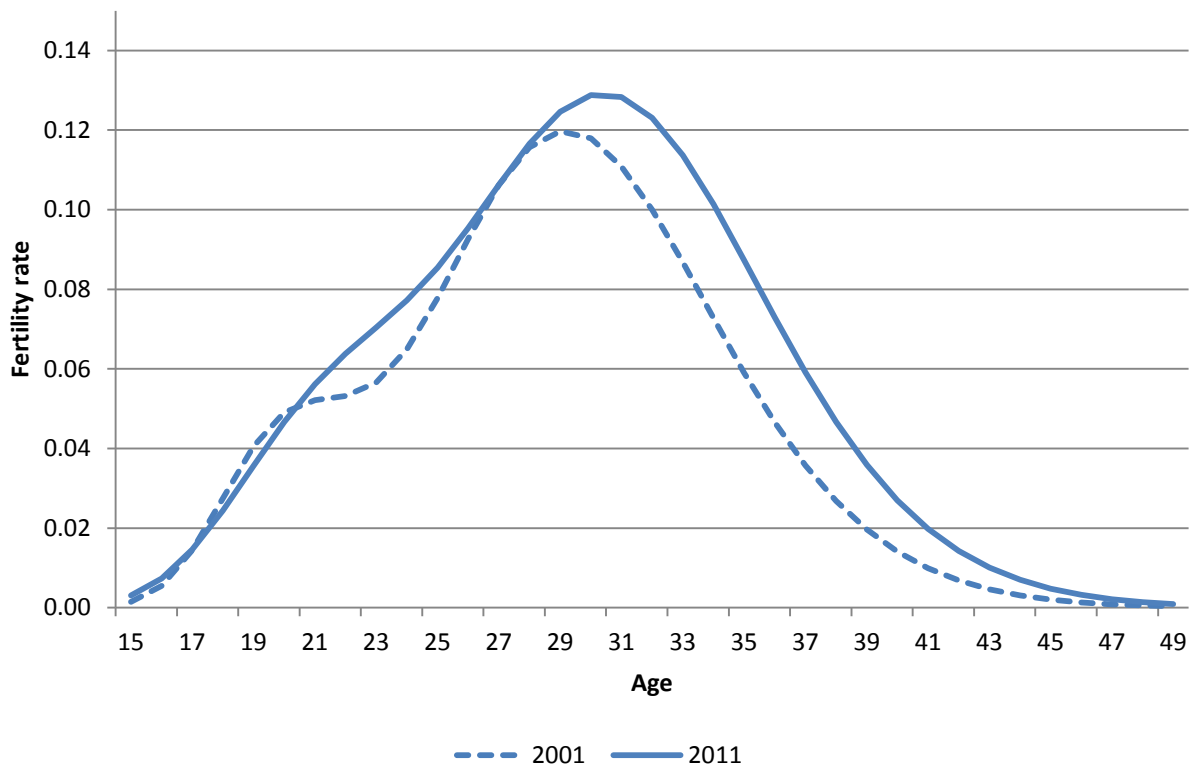
**Figure 33: Greenwich**
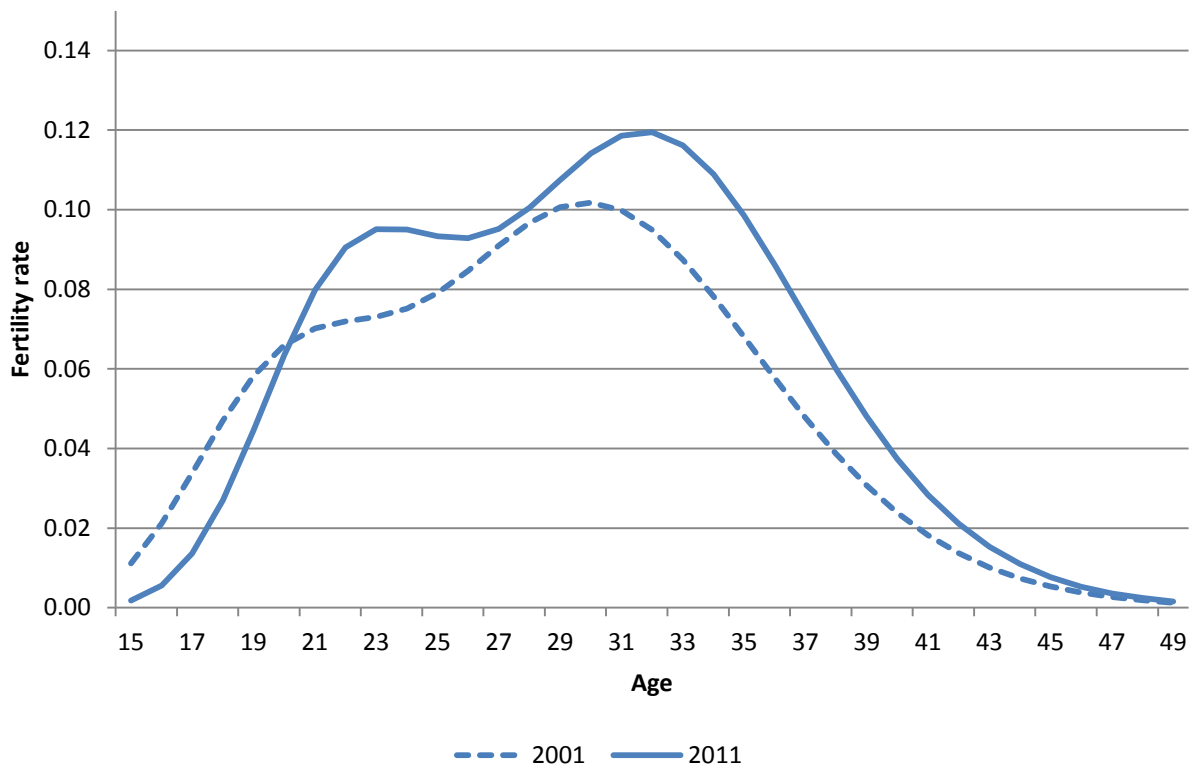


**Figure 34: Harrow**
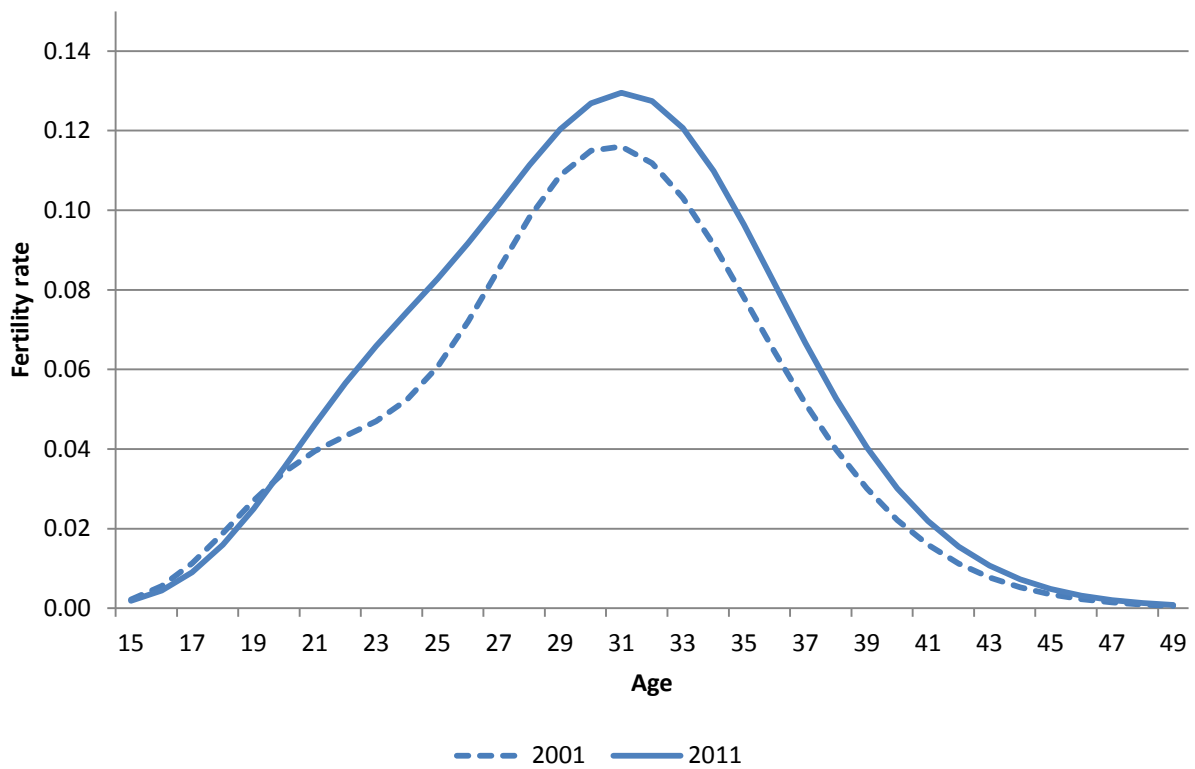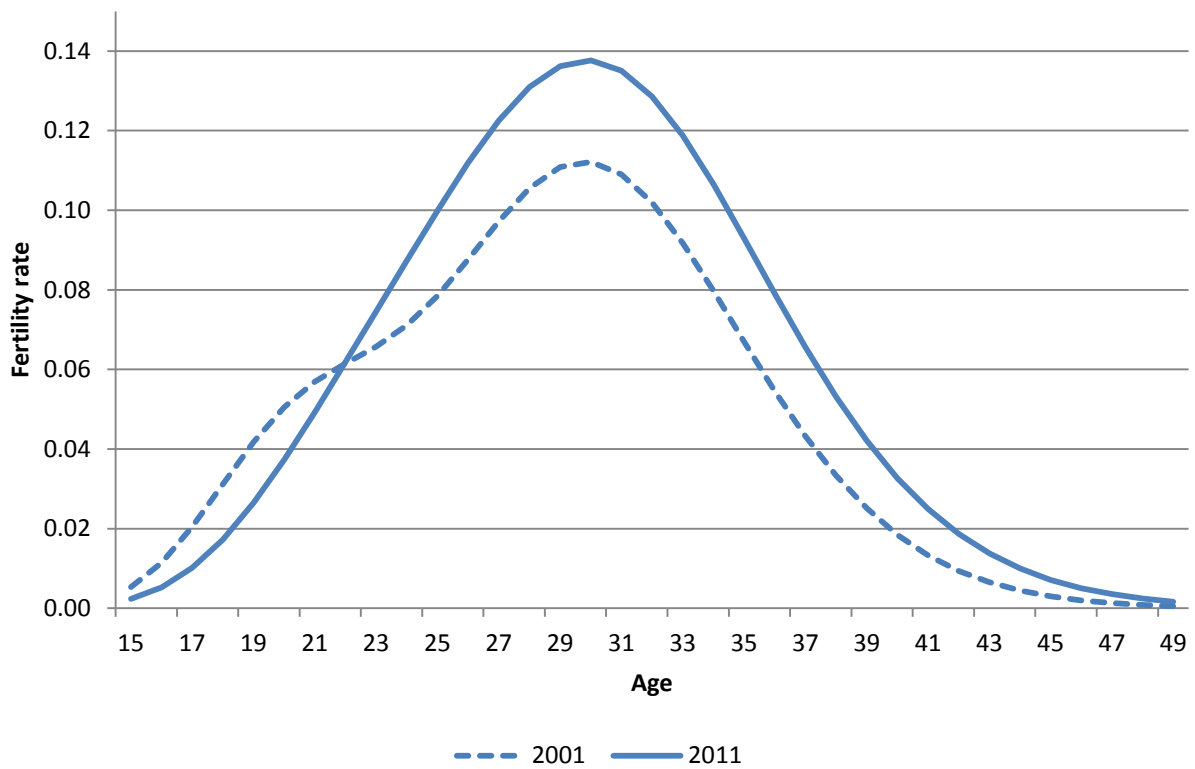
**Figure 35: Havering**
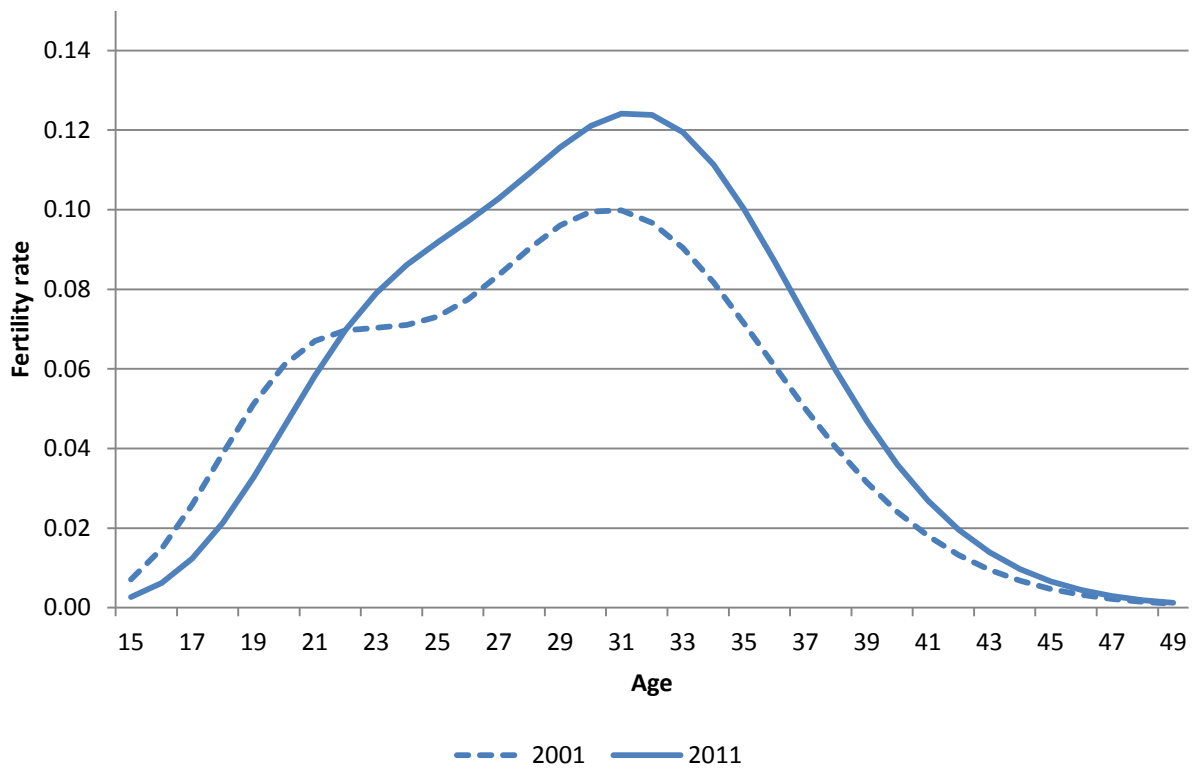


**Figure 36: Hillingdon**

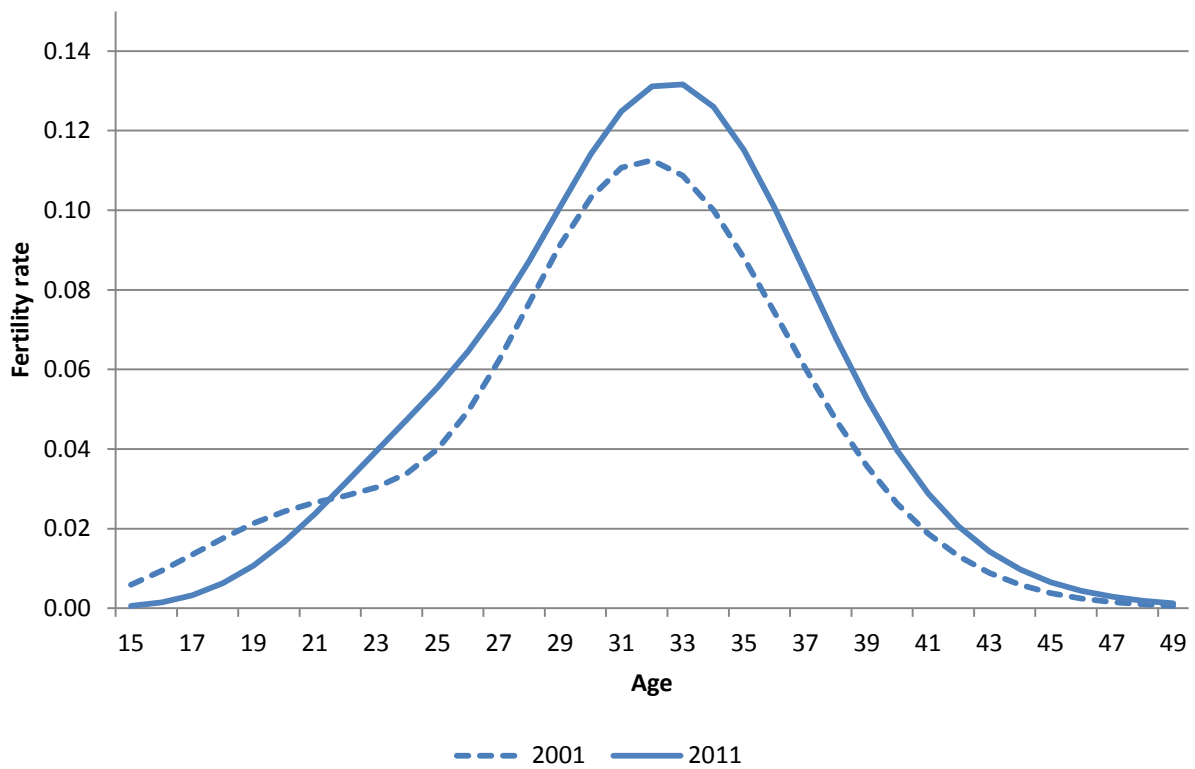## Figure 37: Hounslow
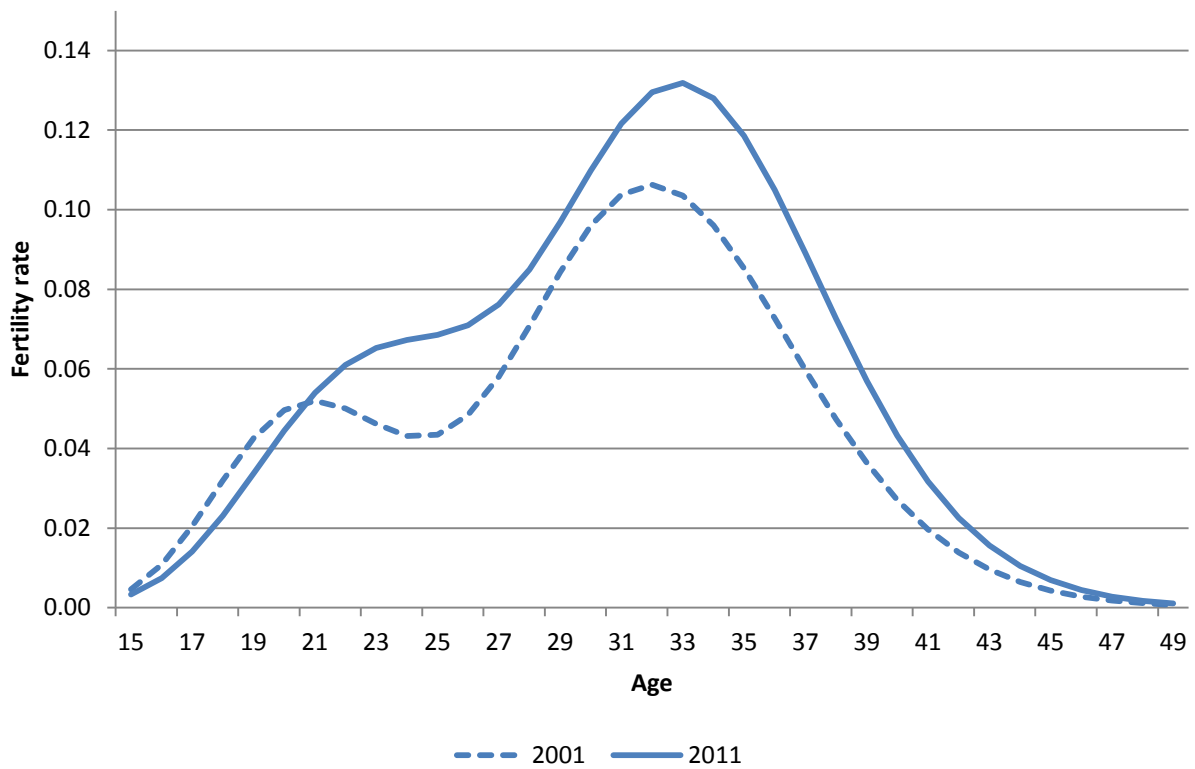


## Figure 38: Kingston upon Thames

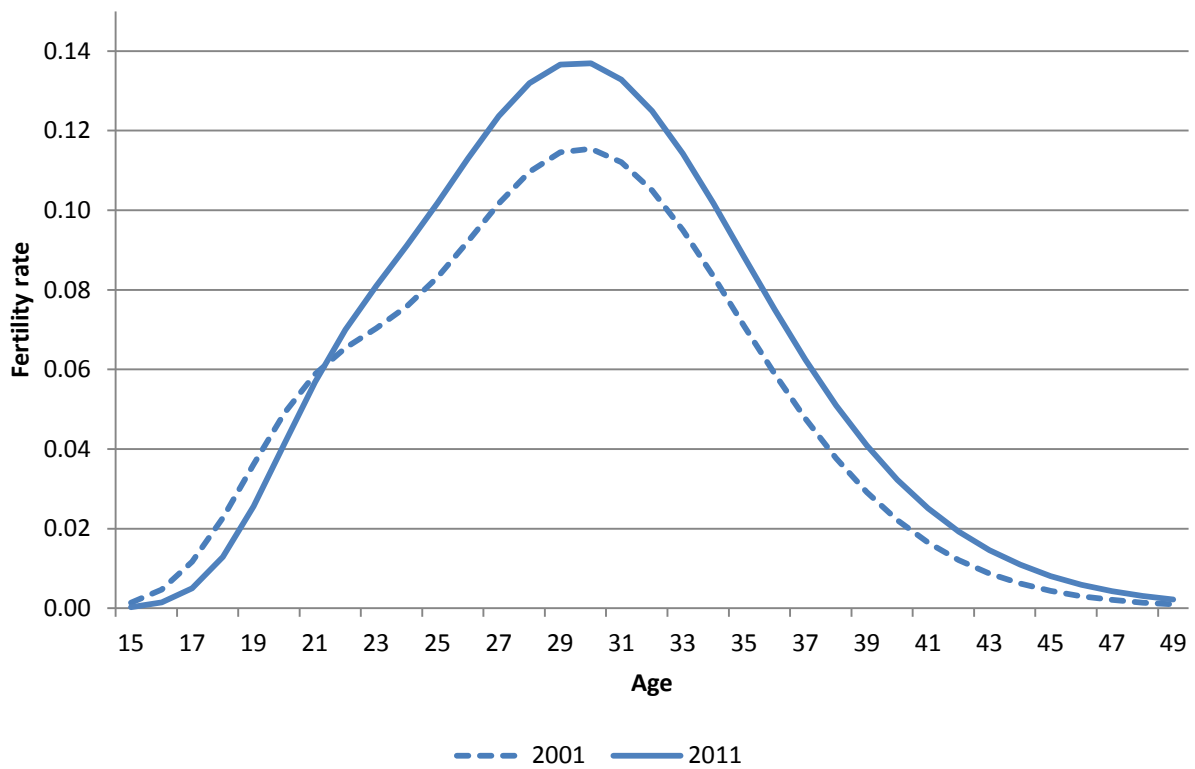**Figure 39: Merton**



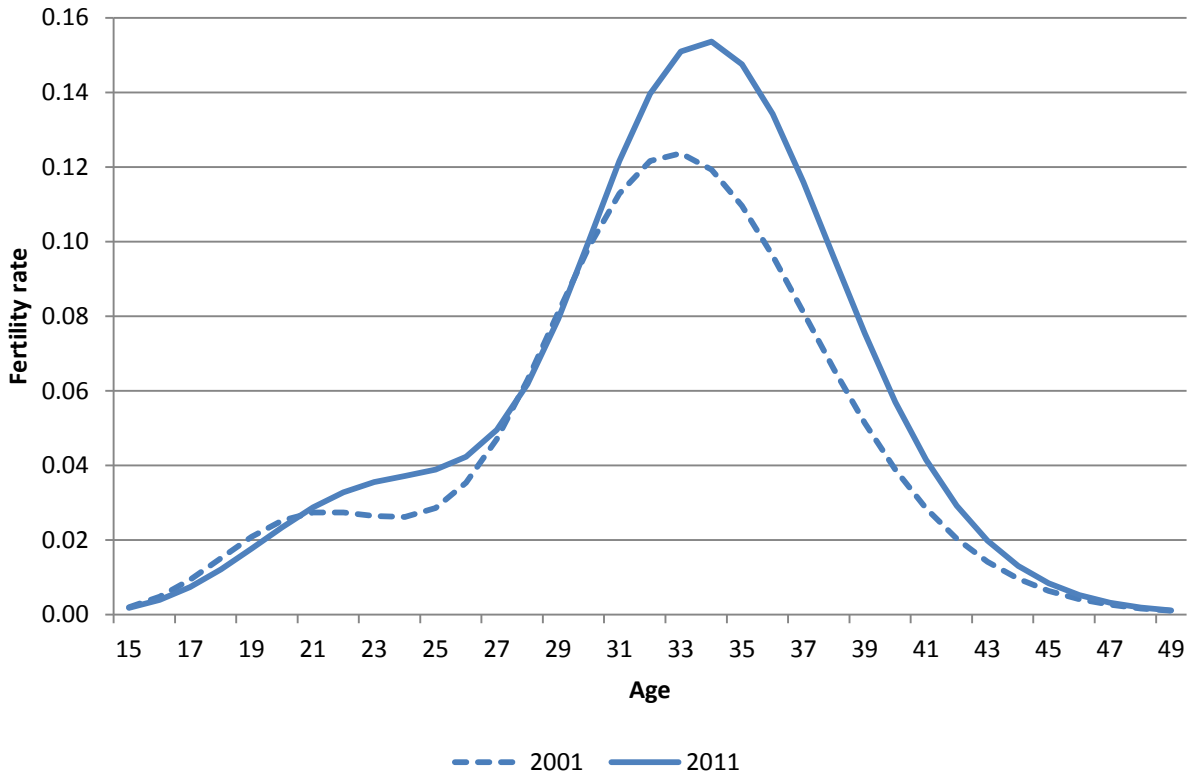**Figure 40: Redbridge**

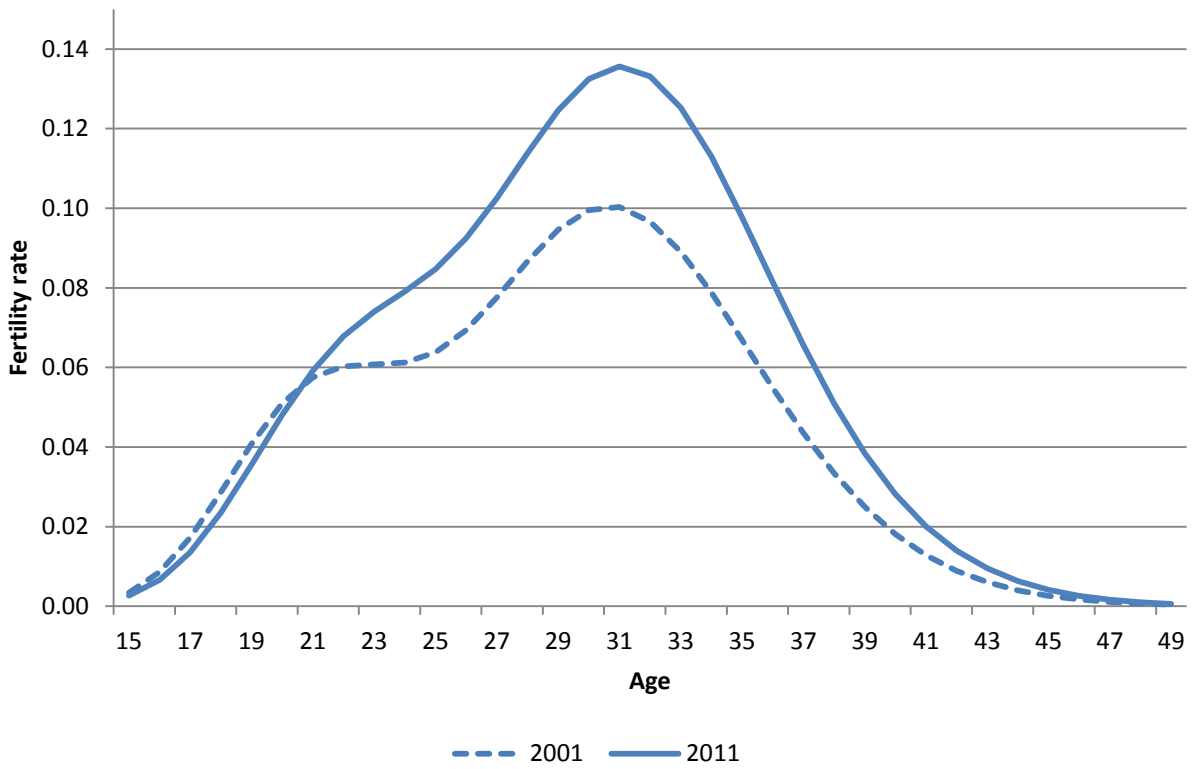**Figure 41: Richmond upon Thames**
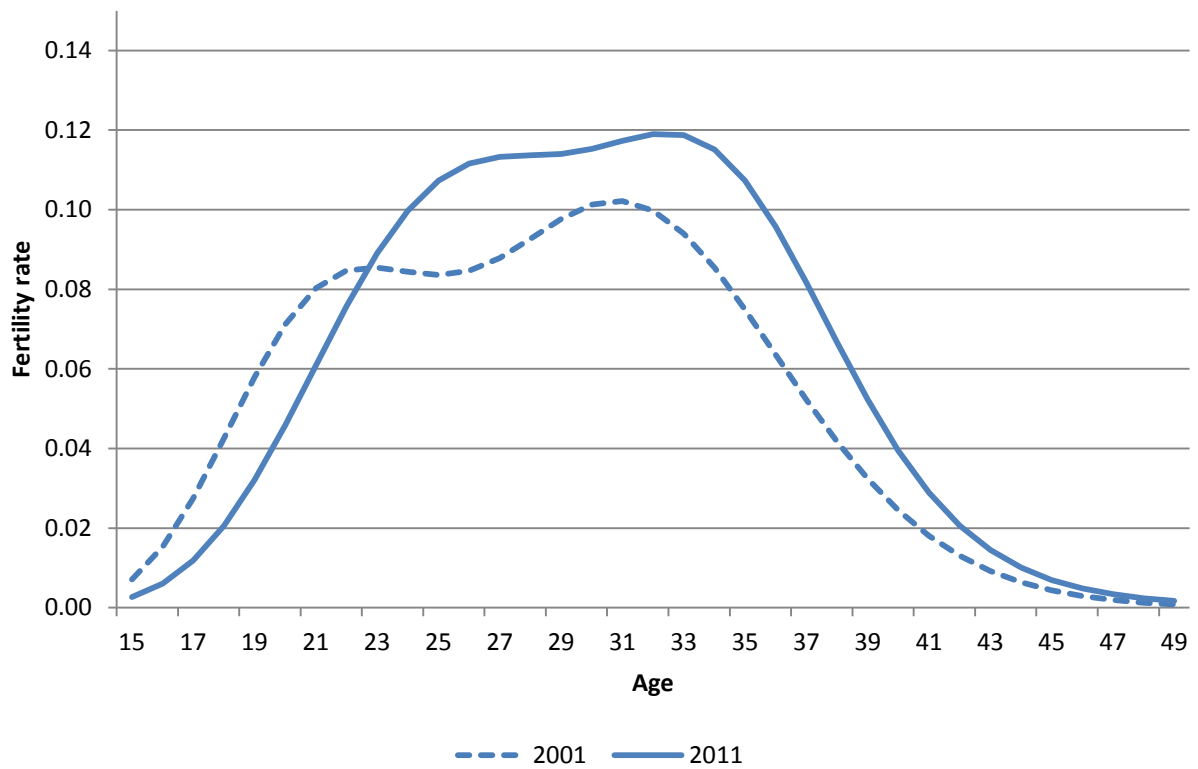


**Figure 42: Sutton**

**Figure 43: Waltham Forest**

# Glossary of terms

## Borough groups

### *Central*
Camden, Kensington & Chelsea, Westminster

### *Rest of Inner*
City of London and Hackney, Hammersmith & Fulham, Haringey, Islington, Lambeth, Lewisham, Newham, Southwark, Tower Hamlets, Wandsworth

### *Inner*
Central and Rest of Inner boroughs

### *Outer*
Barking & Dagenham, Barnet, Bexley, Brent, Bromley, Croydon, Ealing, Enfield, Greenwich, Harrow, Havering, Hillingdon, Hounslow, Kingston upon Thames, Merton, Redbridge, Richmond upon Thames, Sutton, Waltham Forest

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## Age-specific fertility rate (ASFR)
The age-specific fertility rate measures the annual number of births to women of a specified age or age group.  They are often presented as births per 1,000 women.  In this Update they are presented as births per individual woman in each age group.  The numerator is the number of live births to women in a particular age group during a period of time, and the denominator an estimate of the number of person-years lived by women in that same age group during the same period of time.

## Mean
The mean age of mothers' giving birth that year (in this case 2001 or 2011).

## Mean age at childbearing (MAC)
The mean age at childbearing is the mean age of mothers at the birth of their children if women were subject throughout their lives to the age-specific fertility rates observed in a given year.

$$MAC = \frac{\sum_a a f_a}{\sum_a f_a}$$

*a* is the mid-point for each age interval (e.g. 17.5, 22.5, etc)

*fa* is the age-specific fertility rate for women whose age corresponds to the age group of which *a* is the mid-point

## Total fertility rate (TFR)
Total fertility is the mean number of children a woman would have by age 50 if she survived to age 50 and were subject, throughout her life, to the age-specific fertility rates observed in a given year (in this case 2001 and 2011). The total fertility rate is expressed as the number of children per woman.  It is calculated by summing all the ASFRs over the 35-year age range. It is also known as total person fertility rate (TPFR).

*Source: United Nations, Department of Economic and Social Affairs, Population Division (2013). World Fertility Data 2012 (POP/DB/Fert/Rev2012)*

# GLAINTELLIGENCE

**MAYOR OF LONDON**