Understanding the decline in under-18 conception rates throughout England’s local authorities between 1998 and 2017

**Abstract**

We consider England’s two-decade teenage conception decline in the context of societal changes: rising educational aspirations; growing second- and third-generation teenage ethnic minority populations; increased deprivation associated with economic recession and post-2008 Government austerity; and changing housing availability. Using England’s Local Authority Districts (LAD) 1998-2017, we explore the role of area characteristics in explaining spatial differences in under-18 conception rates and how changing characteristics may explain temporal changes. Urban/rural distinctions in teenage conceptions are largely minimised after considering LAD characteristics. Area characteristics continue to partly explain teenage conception rates but are better at explaining area differences than variation over time.

**Keywords**

‘Teenage pregnancy’; ‘adolescents’; ‘England’; ‘spatial variation’; ‘trends’

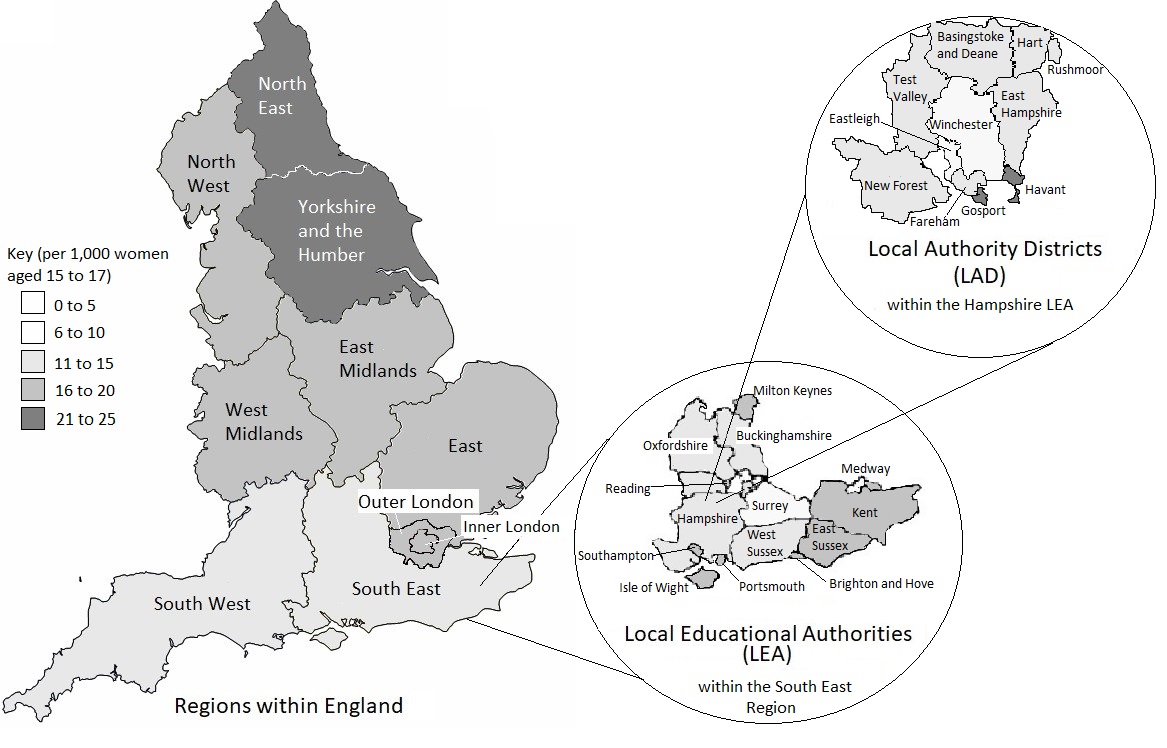
**Introduction**

The decline in under-18 fertility rates in England has recently accelerated. Rates started at 27 births per 1,000 15-17-year-old women in 1998 and fell by around a quarter to 20 per 1,000 in 2008, but then halved in the subsequent eight years (to 9 births per 1,000 in 2017). This decline was primarily driven by reductions in conception rates (from 43 conceptions per 1,000 in 1998 to 18 per 1000 in 2017) and, to a lesser extent, higher proportions of conceptions ending in abortion (42% in 1998 to 52% in 2017). Whilst all English regions have seen a decline in under-18 conception rates, there are significant geographical differences in the levels and rates of decline. Northern regions have higher conception rates than southern regions (Figure 1). Inner London has much higher initial conception rates but a faster decline.

Figure 1 The Regional Under-18 Conception Rates in England, 1998-2017

Although regional trends are clear, as presented in Figure 2, they condense heterogeneity at lower geographies such as Local Authority Districts (LADs) and may be explained by areas in regions having particular local area characteristics. This paper provides new insight into local area characteristics associations with these differential rates of decline. It moves beyond existing work in several ways; firstly, much of the existing literature focuses on the 2000s (prior to the accelerated decline). Indeed, the nationally representative source of individual-level data on teenage sexual behaviour previously used to consider teenage fertility (Wellings et al., 2016; Scott et al., 2020) is nearly a decade old, necessitating our ecological approach. Secondly, multitudes of societal changes have occurred alongside the decline in teenage conceptions such as rising educational attainment and aspirations, growing populations of teenagers who are second- and third-generation Black and South Asian, and rising economic deprivation and youth unemployment around the 2008 economic recession. We specifically capture these measures regarding teenagers in conjunction with a wider range of socio-economic factors than hitherto examined, including the per capita local stock of state-subsidised social rented housing, and housing affordability. Thirdly, we use variables capturing teenage- and youth-specific changes in local authorities, such as the changing teenage ethnic composition. Finally, by using both random effects and fixed effects models we demonstrate how relationships between these area characteristics and under-18 conception rates have altered throughout 1998 to 2017.

Figure 2.- A visualisation of the under-18 conception rate in 2017 across England with examples highlighting the hierarchical nature of the English geography



Past research has consistently found higher rates of teenage conceptions in more socio-economically deprived areas (Author et al., 1999; Conrad, 2012; Girma and Paton, 2015; McLeod, 2001; Uren et al., 2007; Wellings et al., 2016; Wright et al., 2016), whilst areas with larger proportions of non-White populations (at all ages) were found to experience higher rates of teenage conceptions (Blackman, 2013; Bradshaw et al., 2005). The generally higher conception rates found in urban areas have thus been explained by accompanying higher levels of economic deprivation and ethnic diversity (Author et al., 1999; McLeod, 2001; Wright et al., 2016). Past research highlighted educational attainment as a key factor associated with levels of teenage pregnancy at the individual (Crawford et al., 2013; Wellings et al., 2016), school (Crawford et al., 2013), and neighbourhood level (Girma and Paton, 2015; Paton and Wright, 2017). In local areas, educational attainment improvements were found to be the biggest predictor of a drop in teenage conception rates in the period 2004 to 2012 (Girma and Paton, 2015). Individuals attending schools with lower performance in results at age 15/16 have been found to have greater odds of conceiving by age 16 even after accounting for individual attainment (Crawford et al., 2013). However, the individual-level National Survey of Sexual Attitudes and Lifestyles data suggested a weakening relationship between educational attainment and the likelihood of teenagers experiencing a conception between 1999-2001 and 2010-2012 (Wellings et al., 2016).

A number of studies have attempted to quantify the impact of the 10-year governmental Teenage Pregnancy Strategy (TPS), which aimed to halve under-18 conception rates in England by 2010 by a national and local joined-up strategy aimed to improve access to contraception and sex and relationships education alongside a communications campaign for young people and their parents (Author, 2016). Authors have suggested that the declines in under-18 conception rates were greater in areas receiving more TPS funding (Paton and Wright, 2017; Wellings et al., 2016; Wilkinson et al., 2006). However, we argue that it is not possible to precisely attribute reductions to the strategy for several reasons: Firstly, areas with higher initial levels of under-18 conception rates, and/or greater numbers of teenagers, received higher amounts of TPS funding grants (Author et al., 2017). Furthermore, high conception rate areas with slower declines during the first half of the TPS received additional funding after the mid-course review (Author et al., 2017). It is therefore difficult to disentangle the causal direction of associations between funding amounts and declines in teenage conceptions. Finally, the decline in teenage conception rates accelerated just at the point when the Government policy officially finished. Local authorities have taken different approaches since 2010 in the funding and nature of young adult sexual health provision which is not captured in the earlier funding figures. Whilst some have argued for potential lagged effects of the policy (Author et al., 2017) it also seems likely that these declines in teenage conception rates (which were mirrored, albeit less dramatically so, in many other high-income countries) could also be, at least partly, explained by broader changes in society beyond considering earmarked funding.

Factors - such as increased education – must work through more proximate variables (Bongaarts, 1978) like levels of teenage sexual activity and contraceptive use, to determine conception rates. The contribution of changes in contraception use and sexual activity in the decline of teenage fertility has been examined in the United States (Lindberg et al., 2018; Santelli et al., 2007) but are difficult to measure for the UK due to lacking detailed comparative data. Wellings and colleagues found lower reported levels of sexual behaviour among men and women aged 16 to 24 in Britain in 2010-2012 compared to 1999-2001, but no data are available since that time (Wellings et al., 2019). Another study, by Scott and colleagues using the same representative data, found no difference in reporting of ever having had vaginal sex or the frequency of sexual activity within 16 to 19 year-olds between the surveys, which highlights how teenagers are distinctive within young persons and that declines in teenage conceptions may not be due to reductions in teenagers engaging in vaginal sex (Scott et al., 2020).

Teenagers can access Sexual Health Services (otherwise known as genitourinary medicine or GUM clinics, family planning, and reproductive health) alongside General Practice (GP) for free in England, and the former are often located in easily accessible areas and are centres providing free contraception and testing for sexually transmitted infections among other related services. Throughout the TPS, condom access through the post, schools, or at sites throughout the community were introduced in various local areas (Author et al., 2017). Overall, in Britain, condom use at first heterosexual sex has grown from around 80% of men and women aged 16-24 in 2010-2012 compared to 68% and 73% respectively in the older cohort aged 25-34 in 2010-2012 (Clifton et al., 2015). This other proximate determinant of teenage *conceptions*, contraceptive use, has limited data for England. Although the TPS promoted increased availability and uptake of reliable contraception (Connolly et al., 2014), measures of contraceptive pill or LARC (Long-Acting Reversible Contraception) uptakes are not available at the LAD level for teenagers or adults. Where contraceptive use data is available for larger geographical areas, they do not include access from every setting (i.e. LARCS from GPs were the only measured setting until 2014), are often not teenage-specific, and do not cover an extensive time period before the 2010s. Nonetheless, in the most recently available nationally representative survey, teenagers aged 16 to 19 were significantly more likely to use LARCs in 2010 to 2012 (13%) than in 1999 to 2001 (1%) (Scott et al., 2020). Whilst Girma and Paton (2015) did not find LARC uptake to be significantly associated with declines in teenage conception rate, they did not use youth-specific uptake.

The UK government also introduced access to over-the-counter emergency hormonal contraception or ‘the morning after pill’ in 2001 (access without a doctor’s prescription) (Ashraf and McCarthy, 2000) but have not measured the variation in the local use. Therefore, the only available measures of emergency contraception from Sexual and Reproductive Health Services do not capture most emergency contraceptive use. Whilst Black and colleagues found a slight increase of reported emergency contraceptive use during the previous year amongst sexually active females aged 16 to 24 from 1999-2001 (5.2%) to 2010-2012 (7.1%), this study does not include more recent years (Black et al., 2016).

The contexts of young people’s lives have changed in other ways that may have impacted on local area variations in conception rates. Certain areas, especially London, have experienced rapidly declining housing affordability and gentrification in the 2000s and 2010s. These gentrified areas experience the arrival of middle class (often White British) renters and homeowners (Paccoud et al., 2020) who may replace populations with traditionally higher teenage conception rates. Youth unemployment rose following the 2008 recession, particularly in the Midlands and North East of England. Economic recessions are often associated with fertility postponement (Sobotka et al., 2011) and, much like older groups, such uncertainty may motivate teenagers to avoid pregnancy. This rise in youth employment precariousness occurred alongside rising barriers to leaving the parental home (Fox, 2009). A transition to adulthood through experiencing residential independence has become more difficult for young people through declining housing affordability alongside country-wide reduced social (state-subsidised) housing and housing benefit cuts.

Aspirations for education or a career provide reasons for young people to want to avoid pregnancy and educational participation is associated with later childbearing throughout Europe (Neels et al., 2017). Government policy increased the minimum age of leaving education or training from age 16 to age 17 from 2013 and age 18 from 2015, which is towards the end of our time period. Young persons can leave school at 16 but must remain in full-time education, enter an apprenticeship or traineeship, or spend at least twenty hours a week working or volunteering whilst being in part-time education or training until participation leaving age. Higher proportions of young adults now remain in education beyond this participation age (Universities UK, 2018), reflecting rising aspirations for university. There were improvements in educational attainment in the 2000s, which varied by region (Greaves et al., 2014) and rapidity amongst certain ethnic groups (Author et al., 2016; Strand, 2015). In a study of a cohort of teenagers which took their GCSEs in 2008, all ethnic minority groups had a higher probability of attending university than White British teenagers (Crawford and Greaves, 2015). Larger urban areas have become increasingly ethnically diverse, with London LADs’ growing mean percentages of South Asian teenagers from 14.9% in 1998 to 19.6% in 2017, and Black teenagers from 16.9% to 21.5%. While historically Pakistani, Bangladeshi, and Black Caribbean teenagers displayed higher rates of young childbearing (Dubuc and Haskey, 2010), the limited available evidence suggests that childbearing is being postponed among all ethnic groups (Author, 2020). High numbers of second and third generation teenage ethnic minority populations in local areas may now represent a larger group of young women avoiding teenage pregnancy and contributing to reducing teenage pregnancy rates.

This paper identifies factors that explain geographical differences in teenage conceptions and the differential rates of decline between 1998 and 2017.

The research questions are:

1. To what extent do Local Authority District characteristics explain geographical differences in under-18 conception rates, and have these relationships changed between 1998 and 2017?

2. How are *changes* in Local Authority District characteristics associated with the *changes* in under-18 conception rates throughout the period from 1998 to 2017?

**Methods**

The mean and range of the time-varying explanatory variables by area and time period, alongside their sources, are in Table 1. The conception statistics for under-18s in LADs are rates per 1,000 15-17-year-old women published by the Office of National Statistics. The conceptions are calculated using the total numbers of conceptions from live births and stillbirths[[1]](#footnote-1) and the number of registered (and therefore legal) abortions[[2]](#footnote-2), whereby the estimated age *at* conception is determined by the estimated date of conception and the woman’s date of birth. Four of the 326 LADs have been combined into two (Isle of Scilly with Cornwall, and the City of London with Hackney) in the original conception statistics dataset due to small numbers. Therefore, for this analysis, the values for Hackney or Cornwall are taken to represent the merged LADs for the explanatory variables (unless the combined value is available). Boundary changes are addressed by assigning the values from historical geographies to current areas.

The main level of geography used in this paper is Local Authority District (LAD), which is an administrative district for local government that includes London boroughs and Unitary Authorities (often cities). As presented in Figure 2, Local Authority Districts are smaller than Local Educational Authorities (LEAs) and are the level of geography which school-related public figures are released. For urban areas which are Unitary Authorities like cities, the LEA and LAD level are often the same (i.e. Portsmouth, Southampton, and Brighton and Hove in Figure 2). For less populated areas, LADs fall into larger LEAs (i.e. Hampshire). Explanatory variables measured for the 152 Local Educational Authorities are applied to their respective LADs.

Although we are interested in explaining the regional differences, region cannot be included in the model alongside measuring urban/rural due to high correlations. We merged two measures to capture the urban/rural differences alongside the largest regional differences between London and the rest of England. We use the 2001 and 2011 urban/rural classification categorical measures from the Department for Environment, Food & Rural Affairs ranging from most urban LADs “Major Urban” to most rural “Rural-80” LADs. As all the London LADs are in the Major Urban category and, due to London’s distinctiveness, two additional categories are used to represent Inner London and Outer London. To check whether London influences the associations found, sensitivity analyses compare the models with and without London in Appendix B and C.

Multi-dimensional indices of deprivation were traditionally often used to consider the relationships between area level deprivation and England’s teenage conception statistics (Conrad, 2012; McLeod, 2001; Uren, 2007). Whilst such indices such as the nationally produced governmental English Index of (Multiple) Deprivation (McLennan et al., 2019) aim to capture a well-rounded measure of socio-economic deprivation (for example, from economic disadvantage to housing deprivation to local environment quality), the specific relationships between the outcome and the particular aspects of deprivation are not able to be considered. Rather than using standard multi-dimensional indices of deprivation we, therefore, identify which specific component(s) are most closely associated with under-18 conception rates. Specific measures are also available year-on-year, meaning temporal changes can be captured, compared to large-scale indices which are often updated less often. LAD youth unemployment rates are measured by the proportion of the 18 to 24-year-old male and female population claiming Jobseekers’ Allowance (JSA). We also considered the percentage of state-funded secondary school pupils in the LAD eligible for free school meals as a measure of economic hardship but found JSA to explain more model variation.

Educational attainment is measured by the percentage of students receiving five ‘passes’ (A\* to C) in their nationally standardised General Certificate of Education (GCSE) results. Extrapolation has been used for 2016 and 2017 due to changes in grading. Due to this extrapolation and missing data in 2005 which have been filled from interpolation, we perform sensitivity analyses using LAD-level attainment at age 11 where results at age 11 are assigned to the year when teenagers would be 16. Additionally, as GCSE results (at age 16) may be negatively affected or even disrupted by teenage pregnancy/parenthood, in certain areas where this is common our measure of GCSE attainment may be biased compared to areas with little teenage pregnancy and so comparing the attainment at age 11 ensures a robust interpretation. Results are generally unaltered and available on request, and there is evidence of the correlation between results at age 11 and 16 beyond our research (Benton and Sutch, 2014).

Areas with high house prices also have higher rent prices, although rent-price ratios vary by area affluence (Clark and Lomax, 2019). This paper considers housing unaffordability to represent the ease in which young people in the area can establish their independent living, but also the exclusion of lower income groups over our time period. We capture housing unaffordability by the ratio of median house price to the overall earnings of those working in that LAD from the Office for National Statistics (ONS). We measure the availability of social housing per capita to represent the other side of housing availability through public provision by dividing the stock of social housing for each LAD from the Ministry of Housing, Communities & Local Government, by the total number of adults aged 18 and over from the ONS estimates.

The UK has a growing number of second (and third) generation Black and Asian teenagers. To examine the ethnic diversity of teenagers in LADs, rather than completely grouping non-White populations, we utilise individual percentages of Black (Black Caribbean, Black African, Black British, and Black Other), and South Asian (Pakistani, Bangladeshi, and Indian) pupils within state-funded secondary schools. These measures are collected annually and so, unlike previous work, our models can control for year-on-year ethnic composition changes. A sensitivity analysis compared these state-funded ethnic composition variables to the 2011 Census resident teenage ethnic composition and found high correlation.

To control for the TPS, we use the local amounts of TPS funding from 1999 to 2010 (made available to us by the Department for Education) by creating annual per head amounts from dividing by the female 13 to 17 year-old population estimates by the ONS. Due to the lack of data on local authority funding dedicated to teenage pregnancy reduction after the official ending of the TPS, the values for 2011-2017 are coded as zero (although it is acknowledged local spending may have continued in certain areas). No data is available at the LAD level about frequency of sexual intercourse, quality of sexual education, or teenage-specific contraceptive use.

The time periods represent the different phases of teenage conception rate decline and the TPS. The baseline year, 1998, is pre-TPS and needs to be separate due to having zero values for the TPS funding. The subsequent categories are from 1999 to 2005, 2006 to 2010, and 2011 to 2017. The cut-off point, 2005, was chosen because of the more rapid decline in the late 2010s and to represent the second-half of the TPS after the mid-course review in 2005 where interventions occurred in areas not achieving their targets (Author, et al, 2017). Post-TPS is represented by 2011 to 2017.

**Analytical strategy**

This work was exempt from ethical approval, per the University of X ethical regulations, due to the aggregate data. We use two types of modelling to address two aspects of change. The approach for research question one considers whether changes in the specific relationships between area characteristics and conception rates have occurred and can explain areas becoming more similar (i.e. more recently, the level of youth unemployment has a smaller relationship/coefficient with conception rates than the earliest period). For the second research question, the models consider whether actual changes in area characteristics over time are related to the conception rate change over time (i.e. declines in teenage conceptions are changing at a similar pace to youth unemployment reduction).

Random intercept models address research question 1 and consider relationships between the outcome of teenage conception rates by LAD with the LAD characteristics. These models capture the *between* and *within* LAD variation and are used to view the changing associations between the covariates and the repeated annual conception rates from 1998 to 2017. For the random effect models, Model 1 considers the variation in under-18 conception rates when only controlling for the time period and urban/rural location. Model 2 additionally includes unemployment, educational attainment, ethnic composition, housing availability and TPS funding. By comparing the coefficients, we can see how much variation by rurality is explained by the additional LAD characteristics. The LAD-level characteristics are interacted with time period to explore if these relationships alter through time.

The second research question only focuses on change *within* LADs over time irrespective of the differences between areas. For our second research question, fixed effect linear regression models are used to view the variation *within* LADs’ under-18 conception rates from 1998 to 2017. Fixed effect models control for the time constant unobserved heterogeneity between the subjects (LADs) and so, unlike random intercept models, can focus only on change. These models focus on *change* in both the explanatory and outcome variables through time, meaning time-constant variables like urban/rural cannot be included in the model. For the fixed effect analyses we include three models. The first two models include the whole time period 1998-2017, whilst the third just 1998-2010. The different time periods are because, in the first two models, TPS funding at the LAD level is not included as the values post 2010 are effectively zero due to no available data on post-TPS dedicated funding by LAD. In Model 3 we include the value of TPS funding until 2010.

We have also applied these models without London LADs (Appendix B and C) to check if their particular characteristics influence the overall model.

**Results**

To show the changing LAD characteristics over time, Table 1 presents the mean and range of each time-varying variable in 1998, 2005, 2010, and 2017 (to match the time periods) in London LADs and LADs in the rest of England excluding London. The mean values of the LAD characteristics for each urban/rural category for 1998 and 2017 are presented in Appendix A. The mean percentage of 18-24-year-olds claiming Jobseeker’s Allowance reduced from 1998 to 2005 in London and the rest of England, but rose again by 2010, most likely due to the 2008 financial crisis. The mean educational achievement in LADs grew, whereby less than half of teenagers were achieving five A\* to C grades in 1998 but increased to over three-quarters of teenagers achieving this in 2010, with this mean later decreasing. Social housing per capita has declined across England alongside a growth in the median house price to workplace earnings measure of housing unaffordability. The mean percentages of the population that are Black and South Asian have consistently grown, but in 2017 there remain much higher percentages of Black teenagers in London LADs at 21.5 than the rest of England at 1.9, and South Asian teenagers at 19.6 and 6.0 respectively.

<Table 1>

The coefficients in Model 1 Table 1 follow the pattern in Figure 1, whereby reductions in conception rates are greatest during the most recent period. More rural LADs have lower under-18 conception rates; the most rural LADs have conception rates 15 per 1,000 women lower than the more urban non-London LADs in 1998. The consistent differences between the urban/rural conception rates were significantly reduced after including the LAD characteristics. This is shown in Figure 3, whereby the differences in the predicted under-18 conception rates in Model 2 for each urban/rural category are much smaller than in Model 1, suggesting variation between the rural LADs and the more urban non-London LADs are partly explained by characteristics. As presented in Appendix A, the characteristics of LADs in rural areas are more likely to include lower proportions of youth unemployment, higher educational attainment, lower per capita social housing, lower proportions of Black and Asian teenagers, and higher housing unaffordability, than urban (non-London) LADs.

Figure 3 The comparison of the predicted under-18 conception rates from the interaction between the urban/rural and time period from Model 1 and 2 of the random effect models, between 1998 and 2017 in England

To calculate the predicted under-18 conception rates in Model 2, the overall mean value has been used for each continuous explanatory variable: JSA 4.5, GCSE 62.3, House Price 7.0, Social Housing 4.5, % Black 3.1, % S. Asian 5.4, TPS 1998 & 2011-2017 0, TPS 1999-2010 7.8

Model 1

Model 2

LADs in Inner London have much higher under-18 conception rates than the most urban non-London LADs in 1998, and rates drop significantly across the period in Model 1. If we compare Model 1 and Model 2, coefficients for Inner London are no longer significantly different from the most urban non-London LADs after including characteristics. The speed of the decline is also no longer faster in Inner London. This suggests Inner London’s distinctive trend is due to the changes in socio-economic circumstances, ethnic composition, and housing availability in these boroughs. In contrast, Outer London LADs have lower conception rates in 1998 and controlling for LAD characteristics largely eliminates the distinction to most urban non-London LADs post-2006.

LAD-level deprivation is associated with higher conception rates. As the JSA and Free School Meal measures are correlated, we used the measure which explained more variation. In 1998, each additional percentage of 18 to 24-year-olds claiming for JSA is associated with a 0.89 increase in conception rates, which changes to 0.59 (0.89 for 1998 minus 0.30 for the time interaction) between 2006 and 2010. Therefore, each unit of JSA predicts a higher rate of teenage conceptions in 1998 to 2005 and 2011 to 2017 compared with 2006 to 2010.

Greater housing unaffordability and less social housing availability are significantly associated with lower conception rates, with this effect weakening through the period. We find mainly weak (negative) relationships between LAD educational attainment and teenage conception rates, apart from a large negative interaction effect (-0.48) with GCSE attainment in 2006-2010. So, each unit of GCSE attainment has a greater predictive ability for under-18 conception rates in 2006-2010, whilst other variables like JSA, housing affordability, or social housing have smaller effects. Due to this large interaction, during model building we found that including this interaction between time and educational attainment in Model 2 changes the overall time coefficient for 2006-2010 from a negative to 26.07. The other relationships in Model 2 were unchanged after including this interaction and, when predicted values are calculated, this positive coefficient for 2006-2010 is largely offset by the coefficient from the interaction between 2006-2010 and education (as presented in Figure 2).

Ethnic diversity is associated with rates of teenage conceptions, but this changes across the period. In 1998, each percentage increase in Black teenagers is associated with a 0.51 higher conception rate, but this coefficient declines to become small and negative or close to zero in 2006 to 2017 (Model 2). Teenage conceptions are lower in LADs with higher proportions of South Asian teenagers, with significant coefficients from 1999 to 2010. Without London, the association between more Black or South Asian teenagers and conception rates largely disappear.

The amount of received TPS funding was allocated using pre-TPS rates of teenage conceptions and if areas had a high population of young people, therefore areas with higher initial rates received more TPS funding (Author et al., 2017). The results in Table 1 reflect that this remains the case even after controlling for LAD characteristics and does not vary over time.

The captures the between-LAD variation not explained by the model; thus, including the LAD characteristics partly explains between-LAD variation as it is 8.43 pre- and 4.28 post-controls. The within-LAD variation, , reduces from 5.82 to 4.83 post-controls. Therefore, the larger reduction demonstrates that LAD characteristics are better at explaining why areas have higher/lower conception rates than the within-LAD temporal changes.

<Table 2>

Table 3 presents the fixed effect models which examine how changes in LAD characteristics relate to changes in under-18 conception rates when controlling for characteristics which are unaltered over time. Therefore, these fixed effect models can test whether the change in under-18 conception rates within LADs have followed the same trends in these variables like unemployment. Model 1 presents the average decline in conception rates in each LAD *before* controlling for the variation in LAD area characteristics over time. When compared to our reference period (1998 to 2005), the difference in the decline in conception rates was larger in 2011 to 2017 at -17.59 than in 2006 to 2010 at -3.73.

As Model 2 considers the within-LAD changes in characteristics over time, the comparison to Model 1 illustrates that the large decline in conception rates between 2011 and 2017 compared to 1998 to 2005 is only partly explained by controlling for changes in LAD characteristics, the time coefficient reducing from -17.59 (Model 1) to -10.03 after controls (Model 2). Reductions in area economic deprivation are associated with decreases in conception rates by 1.37 for each percentage of 18 to 24-year-olds claiming JSA. Increasing *educational attainment* is related to declining conception rates. House prices growing more unaffordable are associated with falling conception rates in the LAD. Each increase of social housing units per 100 people is associated with increased conception rates by 0.41. Increases in the percentages of Black teenagers *or* South Asian teenagers are associated with reduced conception rates by 0.31 and 0.55 respectively.

Model 3 considers only 1998-2010 to be able to control for TPS funding alterations alongside changes in LAD characteristics, where increased TPS funding is related to larger reductions in conception rates. Areas not on track to achieve their reduction targets were given additional funding and support after the mid-course review in 2005 (Author et al., 2017),which may explain why each increase of TPS funding in a LAD by one pound per female aged 13-17 is associated with a -0.12 reduction in the conception rate.

<Table 3>

**Discussion**

This analysis explored the relationships between the characteristics of England’s LADs with their spatially varying under-18 conception rates over a 19-year period, and how they altered between 1998 and 2017. England has experienced recent transformations in the contexts teenagers grow up in so we examined whether quantifiable societal changes within local authorities can account for the differential declines in conception rates.

Whilst most of the relationships between LAD characteristics and conception rates continued throughout the period, the size of the coefficients/effects altered. For example, we found areas with greater youth unemployment still had higher rates of teenage conception than their less deprived counterparts, but that area-level unemployment rates had larger effects between 1998 and 2005 and 2011 and 2017 compared to between 2006 and 2010. We also discovered weakening coefficients between conceptions and housing unaffordability, and time-varying relationships with educational attainment and ethnic diversity. These changing relationships are evidence that areas with contrasting characteristics became less diverse in terms of their teenage conception rates.

In the random effect models, the area characteristics were better able to explain the differences in conception rates *between* LADs as opposed to the within-LAD *changes* over time, and the majority of these within-LAD changes were not even explained in the fixed effect model. Changes in teenage conception rates are, thus, not only due to the contextual societal changes that we could measure but from other factors that could not be captured by this paper. Nonetheless, of the change *within*-LADs that was explained by the characteristics in the fixed effect models, larger declines in local authority under-18 conception rates were related to areas experiencing *growing* Black or South Asian teenage populations, *less* youth unemployment, *more* educational attainment, *increased* housing unaffordability, and reductions in social housing availability. Most of the relationships had the same direction in the random and fixed effect models, with exceptions being the prevalence of Black teenagers and TPS funding.

We went beyond past works that had used more imprecise measures of ethnic composition. Areas with greater proportions of South Asian pupils had lower conception rates throughout 1998-2017. This may be due to later sexual debut by Pakistani and Indian teenagers (Fenton et al., 2005),and because ethnicity may act as a proxy for religion; teenage Muslim or Hindu women are less likely to have had intercourse by age 18 than their Christian or non-religious counterparts (Coleman and Testa, 2008). The associations between both of the ethnic composition variables and conceptions were mainly removed when London LADs were not included in the analysis, which highlights the need for the careful consideration of the distinction between London and other LADs.

However, growing Black or South Asian populations were both associated with declines in conception rates regardless of including London. The fixed effect model may represent Black teenagers becoming less distinctive in their likelihood to conceive than White or South Asian teenagers. Ethnic minority teenagers in certain areas may have more reason to avoid pregnancy as a result of being more likely to aspire to higher education; both Black African and Caribbean teenagers had lower GCSE attainment than their White British counterparts in 2003 but by 2013, had closed this gap (Strand, 2015). Young people from ethnic minority groups are more likely to attend university now than in the past (Crawford and Greaves, 2015). The historical relationships with ethnicity are changing; ethnic groups may now represent growing populations of those less likely to conceive as teenagers.

Both education and employment for young people changed dramatically during this time period, including rising higher education participation and the 2008 economic recession. Improvements in educational attainment occurred amongst all ethnic groups (Author et al., 2016), and therefore the relationship between rising attainment and avoiding teenage conceptions may represent the greater improvements in certain ethnic minority groups and within the general White British population. Young people were most affected by the financial crisis, and the positive coefficient for youth unemployment did reduce between 2006 and 2010. With our particular analyses we were not able to isolate any direct effect of the crisis on teenage fertility, but Goldstein and colleagues found that unemployment resulting from the 2008 recession was associated with fertility declines at younger ages (aged 15-19) (Goldstein et al., 2013), particularly in Western Europe (Comolli, 2017). The financial crisis occurred during the period in which the rate of decline in under-18 conception rates increased.

The housing stock became less affordable throughout the 2000/2010s at the same time as a rising age of leaving education and the postponement of other young adult transitions (Author et al., 2014).We found areas with less affordable housing had lower conception rates and that increasing unaffordability was associated with larger declines in conception rates. The mechanism behind the relationship between living in an area with an expensive housing market and teenage pregnancy avoidance is unclear, particularly as housing affordability may capture gentrification or the changing characteristics of residents in areas which have rapidly become unaffordable. The effect of gentrification within areas in regard to teenagers is difficult to measure as families are likely to have entered the area when they were children or prior to birth.

It was not the aim of this paper to identify the contribution of the TPS towards reductions of teenage childbearing. We have seen that there is a possible reverse causation between areas with higher conception rates being given more money; however, the actual amount spent did not alter the other relationships in the models.

This paper provides evidence that the associations between traditional variables - like overall economic deprivation in an area – more recently had smaller, but still positive, relationships with under-18 conception rates. However, since the current study was based on area-level analyses we cannot assume the existence of these relationships at the individual level, as they may be acting as a proxy for heterogeneity that we have not measured elsewhere. England can be taken as an example of a country that has had declining teenage fertility from behaviour changes, but this paper highlights how countries should keep in mind how populations of teenagers and their areas have also changed.

**Further research**

Teenagers living in areas which had high rates in the early 2000s have altered their sexual behaviour in some way compared to the cohorts before them and, from our work, it is not enough to say that it is just because the characteristics of teenagers living there have changed. There are many unmeasured and unavailable characteristics related to sexual behaviour that may further explain the spatial differences, such as varying teenage contraceptive use, contrasting teenage fertility desires over time, and use of emergency contraception from all settings, all at the local authority level. There are also immeasurable characteristics like the quality of sex and relationships education and TPS efforts; it is a limitation that we measure the amount of funding rather than assessments of local TPS quality as in other works (Blackman, 2013; Coleman and Testa, 2008).

Word count 5859

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**Table 1 Summary statistics of the time-varying variables in LADs in London and the rest of England, 1998 and 2017**

| Variable name with sources as footnotes | Mean value across LADs (lowest value – highest value) | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| England excluding London | | | | Inner and Outer London | | | |
| 1998 | 2005 | 2010 | 2017\* | 1998 | 2005 | 2010 | 2017\* |
| Under-18 conception rate per 1,000 15-17-year-old womena | 42.6  (16.0 –84.6) | 37.5  (12.3-84.8) | 32.1  (7.6-63.7) | 17.0  (4.5-43.8) | 51.1  (23.1-87.2) | 43.8  (20.8-77.1) | 32.9  (17.4-51.1) | 15.9  (6.6-25.1) |
| % claiming Jobseekers Allowance among the 18-24-year-old populationb | 5.9  (1.0-18.8) | 1.7  (0.5-5.1) | 3.1  (1.3-7.9) | 0.7  (0.0-2.8) | 6.5  (2.0-14.4) | 3.2  (1.4-5.3) | 3.8  (1.8-5.6) | 0.8  (0.1-1.5) |
| % of Pupils Attaining at least 5 GCSEs A\*-Cc \* | 46.8  (23.7-61.4) | 56.0  (39.5-67.4) | 75.6  (63.7-86.9) | 65.6  (45.3-78.1) | 39.9  (23.3-59.0) | 54.5  (41.7-70.1) | 77.9  (64.0-92.4) | 70.3  (60.7-80.9) |
| Median House Price to Workplace Earnings Ratiod | 4.0  (1.9-9.4) | 7.2  (2.4-11.9) | 7.2  (3.3-14.0) | 8.5  (2.7-18.0) | 5.1  (2.6-11.9) | 8.8  (6.1-17.1) | 9.8  (5.9-24.3) | 15.8  (9.68-40.7) |
| Total Number of Social Housing Units for each LAD per 100 people (18 and over)e | 7.2  (0.0-20.4) | 4.2  (0.0-16.8) | 3.2  (0.0-15.9) | 3.5  (0.0-14.4) | 11.3  (0.0-28.4) | 8.1  (0.0-21.3) | 6.7  (0.0-17.8) | 5.7  (0-15.4) |
| % Pupils in Secondary Schools which were Blackf | 0.9  (0.1-9.0) | 0.9  (0.0-9.3) | 1.3  (0.1-12.3) | 1.9  (0.1-16.6) | 16.9  (1.7-51.7) | 19.8  (3.9-52.8) | 21.4  (4.1-48.3) | 21.5  (4.0-46.4) |
| % Pupils in Secondary Schools which were South Asianf | 3.2  (0.1-33.7) | 3.4  (0.1-43.4) | 4.4  (0.1-46.4) | 6.0  (0.3-51.8) | 14.9  (1.8-55.5) | 16.3  (1.9-56.8) | 17.6  (3.1-61.7) | 19.6  (4.4-69.7) |
| *\*In this table, the 2015 values for GCSE attainment have been taken for 2017 due to grading changes.*  Data sources: A – Conception tables from the Office for National Statistics.(3) B - Official Labour Market Statistics from the Office for National Statistics. C - GCSE and equivalent results in England from the Department for Education. D - House price to workplace-based earnings ratio from the Office for National Statistics. E – Ministry of Housing, Communities & Local Government, and population estimates from the Office for National Statistics. F - Schools, pupils and their characteristics tables which are derived from the School Census. | | | | | | | | |

Table 2 The random intercept models of the relationships between Local Authority District under-18 conception rates and the Local Authority District characteristics, between 1998 and 2017 in England

|  | Model 1 | | Model 2 | |
| --- | --- | --- | --- | --- |
| VARIABLES | Rurality and Time Period Only | |  | |
| **Time Period (Ref. = 1998)** |  |  |  |  |
| 1999-2005 | -4.21 | \*\*\* | 2.12 |  |
| 2006-2010 | -8.20 | \*\*\* | 26.07 | \*\*\* |
| 2011-2017 | -23.17 | \*\*\* | -23.01 | \*\*\* |
| **Urban/ Rural Measure (Ref. = Major Urban)** |  |  |  |  |
| Large Urban | -1.33 |  | 2.12 |  |
| Other Urban | 1.08 |  | 2.93 | \*\* |
| Significant Rural | -8.48 | \*\*\* | -4.11 | \*\*\* |
| Rural-50% | -10.99 | \*\*\* | -5.90 | \*\*\* |
| Rural-80% | -14.83 | \*\*\* | -10.00 | \*\*\* |
| Inner London | 15.90 | \*\*\* | 3.60 |  |
| Outer London | -6.85 | \*\* | -5.44 | \*\* |
| **Urban/Rural Interactions with Time Period** |  |  |  |  |
| Large Urban \* 1999-2005 | -0.60 |  | -1.22 |  |
| Large Urban \* 2006-2010 | 0.55 |  | -2.66 | \* |
| Large Urban \* 2011-2017 | 0.59 |  | -2.41 | \* |
| Other Urban \* 1999-2005 | -1.64 |  | -0.93 |  |
| Other Urban \* 2006-2010 | -1.88 |  | -2.86 | \*\* |
| Other Urban \* 2011-2017 | -5.51 | \*\*\* | -3.82 | \*\* |
| Significant Rural \* 1999-2005 | 1.07 |  | 0.56 |  |
| Significant Rural \* 2006-2010 | 2.81 | \*\* | -0.19 |  |
| Significant Rural \* 2011-2017 | 5.55 | \*\*\* | 0.60 |  |
| Rural-50% \* 1999-2005 | -0.45 |  | -1.34 |  |
| Rural-50% \* 2006-2010 | 2.56 | \* | -0.95 |  |
| Rural-50% \* 2011-2017 | 7.29 | \*\*\* | 1.57 |  |
| Rural-80% \* 1999-2005 | 0.05 |  | -0.22 |  |
| Rural-80% \* 2006-2010 | 3.22 | \*\* | 0.02 |  |
| Rural-80% \* 2011-2017 | 9.82 | \*\*\* | 4.04 | \*\*\* |
| Inner London \* 1999-2005 | -0.04 |  | -4.22 |  |
| Inner London \* 2006-2010 | -11.15 | \*\*\* | 1.87 |  |
| Inner London \* 2011-2017 | -18.21 | \*\*\* | -2.35 |  |
| Outer London \* 1999-2005 | 3.84 | \*\* | 1.94 |  |
| Outer London \* 2006-2010 | 1.57 |  | 4.89 | \*\* |
| Outer London \* 2011-2017 | 2.86 |  | 3.77 | \*\* |
| **% of 18-24 year-olds claiming Jobseekers Allowance** |  |  | **0.89** | **\*\*\*** |
| 1999-2005 \* Jobseekers Allowance |  |  | 0.14 |  |
| 2006-2010 \* Jobseekers Allowance |  |  | -0.30 | \* |
| 2011-2017 \* Jobseekers Allowance |  |  | 0.03 |  |
| **% of Pupils Attaining at least 5 GCSEs A-C** |  |  | **0.08** |  |
| 1999-2005 \* GCSE |  |  | -0.20 | \*\*\* |
| 2006-2010 \* GCSE |  |  | -0.48 | \*\*\* |
| 2011-2017 \* GCSE |  |  | 0.00 |  |
| **Median House Price to Workplace Earnings Ratio** |  |  | **-1.78** | **\*\*\*** |
| 1999-2005 \* Housing Unaffordability |  |  | 1.24 | \*\*\* |
| 2006-2010 \* Housing Unaffordability |  |  | 0.99 | \*\*\* |
| 2011-2017 \* Housing Unaffordability |  |  | 1.58 | \*\*\* |
| **Total Number of Social Housing Units for each LAD per 100 people (18 and over)** |  |  | **0.43** | **\*\*\*** |
| 1999-2005 \* Social Housing |  |  | -0.12 |  |
| 2006-2010 \* Social Housing |  |  | -0.30 | \*\*\* |
| 2011-2017 \* Social Housing |  |  | -0.47 | \*\*\* |
| **% Pupils in Secondary Schools who were Black** |  |  | **0.51** | **\*\*\*** |
| 1999-2005 \* % Black |  |  | -0.02 |  |
| 2006-2010 \* % Black |  |  | -0.49 | \*\*\* |
| 2011-2017 \* % Black |  |  | -0.54 | \*\*\* |
| **% Pupils in Secondary Schools who were South Asian** |  |  | **-0.01** |  |
| 1999-2005 \* % South Asian |  |  | -0.12 | \*\* |
| 2006-2010 \* % South Asian |  |  | -0.15 | \*\*\* |
| 2011-2017 \* % South Asian |  |  | -0.07 |  |
| **TPS Funding per each Female aged 13-17** |  |  | **0.23** | **\*\*\*** |
| 2006-2010 \* TPS Funding (REF. = 1999-2005) |  |  | -0.00 |  |
| **Constant** | **48.70** | **\*\*\*** | **39.78** | **\*\*\*** |
| **Random Effects** |  |  |  |  |
| Between LAD variation | 8.43 |  | 4.28 |  |
| Within LAD variation | 5.82 |  | 4.83 |  |
| Rho | 0.68 |  | 0.44 |  |
| \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 |  |  |  |  |

Table 3 The fixed effect models of the relationships between Local Authority District under-18 conception rates and the Local Authority District characteristics, between 1998 and 2017 in England

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Model 1 | | Model 2 | | Model 3 | |
| VARIABLES | Time Period Only | | 1998-2017 | | 1998-2010 with TPS funding | |
| **Time Period (Ref. = 1998-2005)** |  |  |  |  |  |  |
| 2006-2010 | -3.73 | \*\*\* | -0.64 | \*\* | 1.25 | \*\*\* |
| 2011-2017 | -17.59 | \*\*\* | -10.03 | \*\*\* |  |  |
| **% of 18-24 year-olds claiming Jobseekers Allowance** |  |  | 1.37 | \*\*\* | 0.13 |  |
| **% of Pupils Attaining at least 5 GCSEs A-C** |  |  | -0.18 | \*\*\* | -0.29 | \*\*\* |
| **Median House Price to Workplace Earnings Ratio** |  |  | -0.19 | \*\*\* | -0.06 |  |
| **Total Number of Social Housing Units for each LAD per 100 people (18 and over)** |  |  | 0.41 | \*\*\* | 0.13 | \*\* |
| **% Pupils in Secondary Schools who were Black** |  |  | -0.31 | \*\*\* | -0.26 | \*\* |
| **% Pupils in Secondary Schools who were South Asian** |  |  | -0.55 | \*\*\* | -0.16 | \*\* |
| **TPS Funding per each Female aged 13-17** |  |  |  |  | -0.12 | \*\*\* |
| **Constant** |  |  | 44.42 | \*\*\* | 55.63 | \*\*\* |
| **Random Effects** |  |  |  |  |  |  |
| Between LAD variation | 10.54 |  | 9.63 |  | 12.91 |  |
| Within LAD variation | 6.44 |  | 5.72 |  | 5.13 |  |
| Rho | 0.73 |  | 0.74 |  | 0.86 |  |
| \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 |  |  |  |  |  |  |

**Appendix A - Summary statistics of the time-varying variables by whether the LADs are urban/rural, 1998 and 2017**

| Variable name | Mean value across LADs | | | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1998 | | | | | | | | | 2017\* | | | | | | | |
| Major Urban | Large Urban | Other Urban | Significant Rural | Rural 50% | Rural 80% | Inner London | Outer London | Major Urban | | Large Urban | Other Urban | Significant Rural | Rural 50% | Rural 80% | Inner London | Outer London |
| Under-18 conception rate per 1,000 15-17-year-old women | 50.1 | 49.6 | 53.1 | 38.6 | 35.7 | 31.1 | 64.6 | 41.9 | 19.7 | | 19.7 | 19.7 | 15.3 | 14.7 | 12.6 | 16.3 | 15.6 |
| % claiming Jobseekers Allowance among the 18-24-year-old population | 7.7 | 6.1 | 6.9 | 5.2 | 5.1 | 4.7 | 8.5 | 5.2 | 1.1 | | 0.8 | 1.2 | 0.6 | 0.7 | 0.4 | 0.8 | 0.8 |
| % of Pupils Attaining at least 5 GCSEs A-C\* | 44.0 | 45.0 | 45.9 | 49.0 | 48.3 | 47.4 | 35.1 | 43.2 | 65.7 | | 65.4 | 59.7 | 66.7 | 65.6 | 65.5 | 69.5 | 70.8 |
| Median House Price to Workplace Earnings Ratio | 3.5 | 3.5 | 3.4 | 4.2 | 4.8 | 4.5 | 5.7 | 4.7 | 7.7 | | 8.2 | 5.3 | 9.3 | 9.2 | 9.3 | 18.3 | 14.1 |
| Total Number of Social Housing Units for each LAD per 100 people (18 and over) | 11.5 | 7.6 | 9.1 | 6.0 | 5.9 | 4.1 | 17.5 | 7.1 | 3.9 | | 3.7 | 5.7 | 2.0 | 1.8 | 0.9 | 8.4 | 3.9 |
| % Pupils in Secondary Schools which were Black | 1.9 | 1.1 | 0.9 | 0.7 | 0.7 | 0.5 | 27.5 | 9.6 | 3.5 | | 2.3 | 2.5 | 1.6 | 1.2 | 0.9 | 28.3 | 16.8 |
| Pupils in Secondary Schools which were South Asian | 7.2 | 4.5 | 3.2 | 2.7 | 1.7 | 1.3 | 14.9 | 15.0 | 11.7 | | 7.3 | 7.3 | 4.5 | 3.3 | 2.5 | 17.5 | 21.1 |
| \*In this table, the 2015 values for the GCSE variable are presented due to the 2016 and 2017 grading changes. | | | | | | | | | | | | | | | | | |

**Appendix B - Random intercept models of the Local Authority District under-18 conception rates' relationships with the Local Authority District characteristics, between 1998 and 2017 in the whole of England and excluding Inner and Outer London**

|  | Model 1 | Model 2 | Model 3 |
| --- | --- | --- | --- |
|  | Rurality and Time Period Only |  |  |
| VARIABLES | Whole of England | Excluding Inner and Outer London | Whole of England |
| **Time Period (Ref. = 1998)** |  |  |  |
| 1999-2005 | -4.21\*\*\* | 3.19 | 2.13 |
| 2006-2010 | -8.20\*\*\* | 29.80\*\*\* | 26.07\*\*\* |
| 2011-2017 | -24.17\*\*\* | -19.60\*\*\* | -23.01\*\*\* |
| **Urban/ Rural Measure (Ref. = Major Urban)** |  |  |  |
| Large Urban | -1.33 | 2.74\* | 2.12 |
| Other Urban | 1.08 | 3.47\*\* | 2.93\*\* |
| Significant Rural | -8.48\*\*\* | -3.37\*\* | -4.11\*\*\* |
| Rural-50% | -10.99\*\*\* | -4.80\*\*\* | -5.90\*\*\* |
| Rural-80% | -14.83\*\*\* | -8.81\*\*\* | -10.00\*\*\* |
| Inner London | 15.90\*\*\* |  | 3.06 |
| Outer London | -6.85\*\* |  | -5.44\*\* |
| **Urban/Rural Interactions with Time Period** |  |  |  |
| Large Urban \* 1999-2005 | -0.60 | -1.71 | -1.22 |
| Large Urban \* 2006-2010 | 0.55 | -3.12\*\* | -2.66\* |
| Large Urban \* 2011-2017 | 0.39 | -3.04\*\* | -2.41\* |
| Other Urban \* 1999-2005 | -1.64 | -1.52 | -0.93 |
| Other Urban \* 2006-2010 | -1.88 | -3.43\*\*\* | -2.86\*\* |
| Other Urban \* 2011-2017 | -5.51\*\*\* | -4.49\*\*\* | -3.82\*\* |
| Significant Rural \* 1999-2005 | 1.07 | -0.30 | 0.56 |
| Significant Rural \* 2006-2010 | 2.81\*\* | -0.84 | -0.19 |
| Significant Rural \* 2011-2017 | 5.55\*\*\* | -0.22 | 0.60 |
| Rural-50% \* 1999-2005 | -0.45 | -2.46\* | -1.34 |
| Rural-50% \* 2006-2010 | 2.56\* | -1.96 | -0.95 |
| Rural-50% \* 2011-2017 | 7.29\*\*\* | 0.39 | 1.57 |
| Rural-80% \* 1999-2005 | 0.05 | -1.47 | -0.22 |
| Rural-80% \* 2006-2010 | 3.22\*\* | -1.06 | 0.02 |
| Rural-80% \* 2011-2017 | 9.82\*\*\* | 2.74\* | 4.04\*\*\* |
| Inner London \* 1999-2005 | -0.04 |  | -4.22 |
| Inner London \* 2006-2010 | -11.15\*\*\* |  | 1.87 |
| Inner London \* 2011-2017 | -18.21\*\*\* |  | -2.35 |
| Outer London \* 1999-2005 | 3.84\*\* |  | 1.94 |
| Outer London \* 2006-2010 | 1.57 |  | 4.89\*\* |
| Outer London \* 2011-2017 | 2.86 |  | 3.77\*\* |
| **Rate of 18-24-year-old Jobseekers per 1000** |  | 0.98\*\*\* | 0.89\*\*\* |
| 1999-2005 \* Jobseekers Allowance |  | 0.13 | 0.14 |
| 2006-2010 \* Jobseekers Allowance |  | -0.39\*\* | -0.30\* |
| 2011-2017 \* Jobseekers Allowance |  | -0.05 | 0.03 |
| **% of Pupils Attaining at least 5 GCSEs A-C** |  | 0.14\*\* | 0.08 |
| 1999-2005 \* GCSE |  | -0.19\*\*\* | -0.20\*\*\* |
| 2006-2010 \* GCSE |  | -0.53\*\*\* | -0.48\*\*\* |
| 2011-2017 \* GCSE |  | -0.05 | 0.00 |
| **Median House Price to Workplace Earnings Ratio** |  | -1.81\*\*\* | -1.78\*\*\* |
| 1999-2005 \* Housing Unaffordability |  | 1.27\*\*\* | 1.24\*\*\* |
| 2006-2010 \* Housing Unaffordability |  | 1.02\*\*\* | 0.99\*\*\* |
| 2011-2017 \* Housing Unaffordability |  | 1.70\*\*\* | 1.58\*\*\* |
| **Total Number of Social Housing Units for each LAD per 100 people (18 and over)** |  | 0.46\*\*\* | 0.43\*\*\* |
| 1999-2005 \* Social Housing |  | -0.20\*\* | -0.12 |
| 2006-2010 \* Social Housing |  | -0.32\*\*\* | -0.30\*\*\* |
| 2011-2017 \* Social Housing |  | -0.52\*\*\* | -0.47\*\*\* |
| **% Pupils in Secondary Schools who were Black** |  | -0.29 | 0.51\*\*\* |
| 1999-2005 \* % Black |  | 0.74\* | -0.02 |
| 2006-2010 \* % Black |  | -0.10 | -0.49\*\*\* |
| 2011-2017 \* % Black |  | 0.15 | -0.54\*\*\* |
| **% Pupils in Secondary Schools who were South Asian** |  | 0.28\*\*\* | -0.01 |
| 1999-2005 \* % South Asian |  | -0.35\*\*\* | -0.12\*\* |
| 2006-2010 \* % South Asian |  | -0.34\*\*\* | -0.15\*\*\* |
| 2011-2017 \* % South Asian |  | -0.34\*\*\* | -0.07 |
| **TPS Funding per each Female aged 13-17** |  | 0.22\*\*\* | 0.23\*\*\* |
| 2006-2010 \* TPS Funding (REF. = 1999-2005) |  | -0.00 | -0.00 |
| **Constant** | 48.70 | 35.35\*\*\* | 39.78\*\*\* |
| ***Random Effects*** |  |  |  |
| Between LAD variation | 8.43 | 4.26 | 4.28 |
| Within LAD variation | 5.82 | 4.81 | 4.83 |
| rho | 0.68 | 0.44 | 0.44 |
| \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 |  |  |  |

**Appendix C – Fixed effect models of the Local Authority District under-18 conception rates’ relationships with the Local Authority District characteristics, between 1998 and 2017 in the whole of England and after excluding Inner and Outer London**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|  | Time Period Only |  |  |  |  |
| VARIABLES | 1998-2017 | 1998-2017 | | 1998-2010 with TPS funding | |
|  | Whole of England | Excluding Inner and Outer London | Whole of England | Excluding Inner and Outer London | Whole of England |
| **Time Period (Ref. = 1998-2005)** |  |  |  |  |  |
| 2006-2010 | -3.73\*\*\* | -1.69\*\*\* | -0.64\*\* | 1.40\*\*\* | 1.25\*\*\* |
| 2011-2017 | -17.59\*\*\* | -11.02\*\*\* | -10.03\*\*\* |  |  |
| **% Jobseekers among 18-24-year-olds** |  | 1.18\*\*\* | 1.37\*\*\* | -0.12 | 0.13 |
| **% of Pupils Attaining at least 5 GCSEs A-C** |  | -0.11\*\*\* | -0.18\*\*\* | -0.20\*\*\* | -0.29\*\*\* |
| **Median House Price to Workplace Earnings Ratio** |  | 0.34\*\*\* | -0.19\*\*\* | -0.20\*\* | -0.06 |
| **Total Number of Social Housing Units for each LAD per 100 people (18 and over)** |  | 0.34\*\*\* | 0.41\*\*\* | 0.10\* | 0.13\*\* |
| **% Pupils in Secondary Schools who were Black** |  | -1.21\*\*\* | -0.31\*\*\* | -0.71\*\*\* | -0.26\*\* |
| **% Pupils in Secondary Schools who were South Asian** |  | -0.70\*\*\* | -0.44\*\*\* | -0.32\*\*\* | -0.16\*\* |
| **TPS Funding per each Female aged 13-17** |  |  |  | -0.18\*\*\* | -0.12\*\*\* |
| **Constant** | 39.73\*\*\* | 37.09\*\*\* | 42.02\*\*\* | 53.58\*\*\* | 55.62\*\*\* |
| ***Random Effects*** |  |  |  |  |  |
| Between LAD variation | 10.54 | 11.18 | 9.63 | 12.94 | 12.81 |
| Within LAD variation | 6.44 | 5.40 | 5.72 | 4.95 | 5.13 |
| rho | 0.72 | 0.81 | 0.74 | 0.87 | 0.86 |
| \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 |  |  |  |  |  |

1. Pregnancy losses (miscarriages/spontaneous abortions) are not included in these official statistics due to the difficulty of recording them, particularly as individuals may be unsure if they experienced a pregnancy loss. It is estimated that, for all ages, one in five pregnancies end prematurely but only one in eight realise and/or report this as a miscarriage (Tommy’s, 2020). [↑](#footnote-ref-1)
2. Emergency contraception is not included in these statistics as numbers of conceptions that would have occurred without use cannot be known and, in any case, such use cannot readily be attributed to a specific geographical area. [↑](#footnote-ref-2)