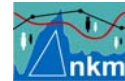# Estimating and mapping the population of Enfield using local administrative data sources

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neighbourhood knowledge management

Executive Summary

This study, commissioned by Enfield Council, is concerned with estimating Enfield's population using local administrative data sources (e.g. the General Practice Register, Council Tax and Electoral Roll).

Enfield Council believes that official published sources of information on population produced by the Office for National Statistics (ONS) undercount the true population. Population is the basis for central Government financial allocations to councils and primary care trusts, and so any inaccuracies in population estimates can make a significant difference to available local resources.

A key finding of the study is that the confirmed minimum population of Enfield as of 31st March 2006 was 283,921 persons. This compares with the ONS 2005 mid-year population estimate of 280,540. Nearly the entire difference of 3,381 is concentrated in the age range 0-15.

On exercises of this kind the total persons in all databases investigated are significantly larger than the confirmed population total. Our method, described in this report, removes duplicates and uses a system of rules to confirm each person exists and lives in Enfield.

Our resulting figure is called a 'confirmed minimum population'. We believe it is possible that the true population is higher still for reasons given e.g. where persons are not registered with doctors, for Council Tax, or do not attend school in Enfield. As a recent popular destination for international migrants, we think this is a plausible scenario.

Every person is assigned to an address using the local property gazetteer. We found that occupancy is around 96.8% with 3.2% of properties vacant. This is comparable with other boroughs that have used these methods.

Using the database created we publish and analyse novel and useful maps, charts and tables of population sub-groups by age, gender, tenure and benefit status. Wider uses of the database include service planning and resource allocation. Recommendations and suggestions are given in section 6.

October 2006
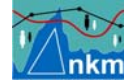
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November 2006

Estimating and Mapping the Population of Enfield Using Local Administrative Data Sources (DRAFT)

1. Introduction

1.1 According to informed local opinion the population of Enfield, London's northernmost borough and one of the largest, is increasing rapidly. Furthermore, the growth currently taking place is not reflected in official population estimates. A recent press release by Enfield Council Press Office[1] reporting the lack of an accurate population estimate for Enfield pinpointed recent population influxes as one of the reasons, although natural increase (an increase of births over deaths) is another possible factor. The press release states:

"Enfield has a rich multi-cultural population which we are proud of. While there are benefits of immigration to the country, there is also a need to provide services for immigrants and their families.

Because the government will not or cannot find out what the true picture is we are not properly funded.

Therefore we have had to find out for ourselves the facts and then look to government to fund the Council properly so the burden does not fall on Enfield Council Taxpayers."

1.2 A study (currently in draft) by the Chief Executive's Office[2] examined patterns of migration into and out of Enfield. According to the Office for National Statistics (ONS), there were 21,194 inward migrants from all sources between 2001 and 2002, offset by 19,828 outward migrants (net change +1,366). This compares with 18,097 inward and 20,275 outward migrants between 2003 and 2004 (net change -2,178). Within these totals however the net number of international migrants remained positive, but fell in size from +3217 to +1051. However, the exact numbers are uncertain[3].

1.3 This study is not about migration as such but about the establishment of an accurate population count for Enfield; nevertheless, the figures quoted above support the view that that Enfield is experiencing a moderate to large turnover of population

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[1] August 11th 2006, Enfield Council Press Office.

[2] Migration study 2006, Information and Research team, Enfield Borough Council.

[3] For example the gross (*not* net) number of new National Insurances Registrants living in Enfield in 03/04 was 4,770 of which Turkey, Ghana and Jamaica accounted for 23% of the total. In 05/06 the equivalent figure was 5030, with Poland, Turkey and Ghana accounting for 30% of the total; 78 countries of origin were represented.
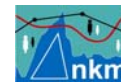
resulting from migration as well as from natural change. The primary purpose of this report is to establish the current population from administrative data sources and to check it against official ONS figures.

Background to population estimation

1.4 Population is the basis for central government financial allocations to councils and primary care trusts, and so any inaccuracies in population estimates can make a significant difference to available resources locally and hence to budgets.

1.5 Accurate population estimates are also vital for the proper conduct and stewardship of services at neighbourhood level, and thus robust population estimates at a local as well as at an Enfield level are arguably as important.

1.6 With extensive country parks and green space, large areas of Enfield are only lightly populated with much denser population concentrations along the southern and eastern border. Most of the recent population additions are believed to have been concentrated in areas that are already heavily populated so making the task of tracking change that much harder.

1.7 Within these concentrations are pockets of deprivation, possibly exacerbated by inflows of overseas migrants into already densely populated areas. This study finds Enfield has a large 0-15 age group relative to the number suggested in official sources (see below), and this population tends to be in areas that are likely to benefit most from a greater investment in services.

1.8 A largely untapped source of information about population is available from local administrative sources. This includes information contained in Council Tax registers, the electoral register, school pupil rolls, births and deaths and the General Practice (GP) register.

1.9 However, to be of value these data bases need to be joined together and systematically evaluated with duplicate persons being eliminated to avoid double counting. This study describes how this was done and the results obtained. The main aims of the study are hence threefold:

- To investigate the use of administrative data for purposes of population estimation in Enfield;
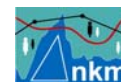
- To estimate the Enfield population by age and sex and to compare the results with the equivalent ONS mid-year estimates;

- To create a geo-referenced population source for Enfield that can be used for other purposes such as service evaluation and planning by both the local authority and Enfield Primary Care Trust (EPCT) (e.g. in housing, environmental services, and health needs assessment).

1.10 A key finding of the study is that the confirmed minimum population of Enfield as of 31st March 2006 was 283,921 persons. By confirmed we mean people whose identity can be confirmed by reference to different data sets and according to assumptions for linking people to addresses and hence households.

1.11 This compares with the ONS 2005 mid-year population estimate of 280,540. Nearly the entire difference of 3,381 is concentrated in the age range 0-15. We checked our higher figure against Child Benefit counts for Enfield. These indicated 61,005 beneficiaries at 31/08/05, which compares with our equivalent 31/03/06 estimate of 62,449 persons age 0-15. The equivalent ONS figure for 30/06/05 was 58,604.

1.12 The total persons in all databases investigated are significantly larger than the confirmed population total. It consists of people that have left the area or have died or people such as absent landlords who live elsewhere that are registered for Council Tax purposes. Our method is designed to remove these people as well as persons duplicated on different databases.

1.13 However, there are judgements to be made at the margin. For example if we had included people at addresses that registered with their GPs within 6 months of the current persons being registered at the same address, who did not share the same surname and who were not confirmed by another data base, the population count would have increased by a further 3,970[4].

1.14 The significance of these figures may be illustrated as follows. For each person not included in its population count, Enfield loses approximately £500 in grant. Meanwhile EPCT loses around £1400 and so the combined loss to Enfield of 3,381 persons represents an approximate loss of £6.4m per annum as compared with the ONS 2005 mid year estimate, and £14m based on the higher population estimate.

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[4] It is possible that these people have moved on but it is also possible that they remain, possibly sharing flats or bed sits with more recently registered persons.

The following sections of this report set out:

- ☐ The rationale for the approach taken in this study
- ☐ A detailed description of the method adopted
- ☐ The main results
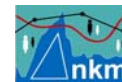- ☐ Areas for improvement

2. The Census

2.1 The principal reason why this study has proved necessary is due to the inadequacies of the UK Census, administered by ONS, and still the main method for assembling information about the size and condition of the UK population. A key problem is that the Census occurs only once every ten years. Although population estimates are updated annually this does not apply to accompanying socio-economic data collected at the same time.

2.2 Plainly if the baseline established in the Census is inaccurate then subsequent annual estimates will also be prone to error; meanwhile, socio-economic data collected at the time of the Census become very dated in areas undergoing rapid change. A feature of the 2001 Census is that it relied on postal survey techniques which were subsequently shown to be subject to incomplete response rates particularly in urban areas like London. To remedy this ONS used 'synthetic statistical estimates' to arrive at a final population figure – in other words it estimated, rather than measured, the true population.

2.3 This means that, alongside many other London Boroughs, the Enfield population count could not be readily or independently validated, let alone updated. This has caused problems in London Boroughs because of fears that this has resulted in central government under-funding. Figure 1 which shows the variability in response rates in London boroughs is indicative of the problems of using postal surveys.

2.4 It should be also noted that ONS population data only relate to fixed boundaries that are not necessarily compatible with, or relate to, the provision and management of local services or to specific neighbourhoods within local authority areas. This inflexibility and the fact that boundaries sometimes change limits the value of ONS population data and causes problems for planners and researchers who wish to track change over time.

2.5 A feature of the approach used in this study and described in our report is that all addresses where people live are geo-referenced (i.e. assigned an *x,y* co-ordinate). Co-ordinates of where people live can be manipulated within a Geographical

Information System (GIS)[5] so that we are able to analyse the population within any shape or size of area. This has considerable advantages for example in targeting local initiatives and identifying small populations. Examples of how this works are given later.

Figure 1: Map of response rates to 2001 Census forms delivered to addresses in London. In Enfield the response rate was between 87% and 89%.

3. Method

3.1 The approach actually adopted in this study is based on the idea of filling up as many addresses in Enfield with people that can be confirmed for example by more than one database. The techniques involved are collectively known as 'Neighbourhood Knowledge Management' or *nkm.* The aim of nkm is to develop comprehensive statistical information, including population counts, about local areas using administrative data sets.

3.2 The source of addresses is the Enfield Local Street and Property Gazetteer (LSPG) in which every address in Enfield is assigned a UPRN (Unique Property Reference Number)[6]. The method for estimating population can be envisaged as a kind of hybrid in which the addresses act as a check on whether a person lives in the area

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[5] Computerised software used by local authorities, police, health care providers, utility companies etc. for storing data and creating bespoke maps of populations, areas and services
[6] The LSPG extract used was an extract of 'live' domestic properties as at 31st March 2006.

and has not been replaced by another person at the address and that addresses are not over or under filled.

3.3 In our approach we adopt several tests before a person is deemed to exist:

1. Wherever possible the person and the address should be confirmed by more than one database.
2. If not they should be related to someone else at that address by name e.g. a young child.
3. If not the person should be the latest person at that address.
4. Persons may also be included if the address would be otherwise vacant.
5. All persons should have a UPRN and therefore an address

3.4 Where a confirmed person has conflicting addresses, we give higher priority to the address in the most current database. If both databases are of equal currency then we gave more weight to the GP register because this was our main population base. Where the total number of persons at any address exceeded 9, the data were then re-checked for accuracy and a further judgement made.

3.5 Homes and Hostels are treated separately as they typically have much higher occupancy. Whether persons are still alive is then checked against the deaths register for the previous 12 months. The births register is also checked in case there are some that have not been registered (e.g. on the GP register).

Data sources

3.6 Sources used are listed in Annex B and were current at March 31st 2006 so as to be a consistent as possible with the LSPG. They consist of information about housing or information about people. Both types are needed to establish the population but also to assist in splitting population into sub-groups (subsidiary objective 2 of the study).

3.7 In using administrative data sets two types of problem are encountered. The first is that not every database contains information about the whole population and therefore their value is mainly confirmatory – to make sure a person recorded at an address on one database can be confirmed elsewhere. Thus the electoral roll includes people that are eligible to vote and who have registered, not the whole population.

3.8 The database with the greatest coverage of persons and addresses is hence likely to prove the most useful. By far the most important is the GP register. This contains information on name, gender, date of birth, date of registration with GP, and full home address. As long as a person is registered with a GP (which applies
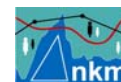
to the great majority of Enfield citizens), the register provides a firm starting point.

3.9 Numbers on the GP register are typically inflated because persons that have left an area may not yet have notified their GP of a change of address. Some may also have died and this may not yet been picked up by the register; the corollary is that recent births may not have been registered with a GP.

3.10 Some persons may not be registered with a GP because they have only just arrived in the area e.g. new arrivals from abroad. Sometimes these people may be picked up on other databases such as the Council Tax. Thus, the GP register must be systematically checked and if necessary cleaned as part of the creation of the population database.

3.11 The two other issues arising from the use of the GP register relate to the way addresses are recorded, which tends to be variable both within the register and between data sets. These issues have already been dealt with in a companion report[7]

3.12 Although it is natural that some details (such as date of birth) are not recorded in some databases (e.g. the electoral register), some data sets are in better order than others. In other words they have been maintained to a higher quality in terms of the consistency of addressing, the completion of post codes, correctly spelt names and so forth. Annex B provides an overview of what we found and suggested areas for improvement.

4. Data preparation and population counting

Data matching and address finding

4.1 Where a database (like the school pupil roll, PLASC) does not have a home address, we matched the name, date of birth, gender and postcode to the GP register and assigned an address to the database with the missing address field.

4.2 Using an address-matching algorithm to match addresses on each database to the LSPG, we extracted and assigned a UPRN to every person. We also kept a log of all persons that could not be

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[7] Estimating and mapping the population of Brent: The use of local administrative data sources, Mayhew L. and G.Harper (2006).

assigned a UPRN due to missing, incomplete or wrongly recorded addresses.

4.3 We simultaneously extracted the *x,y* co-ordinates for later use. This part of the process is referred to as geo-referencing because it enables the creation of detailed maps using GIS. This is process is shown in Figure 2.

4.4 Two algorithms are involved. The first, called the Address Matcher, matches addresses on a database to the addresses on the LSPG. The Address Matcher is designed to efficiently automate address matching (usually with an 80% to 90% success rate).

4.5 The second algorithm is called the 'Address Finder'. Unmatched, mostly non-standard or incomplete addresses are individually compared with the addresses on the LSPG to find possible matches. The user then selects which address is most likely to be correct and then proceeds to the next address in the list of unmatched addresses.

4.6 At the end of this process there will still be some addresses that are unmatchable due to insufficient information. These are stored and used again later. In summary, not all data sets were perfect and could be improved in a number of small but significant ways (see conclusions and Annex B for details).
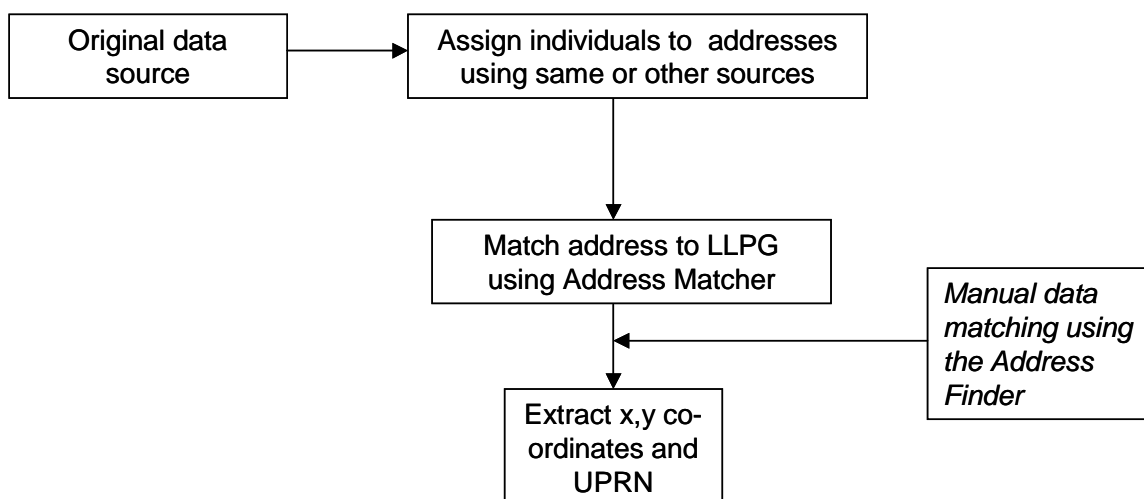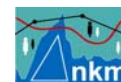

Figure 2: The process of matching and geo-referencing addresses

Population count

4.7 To estimate the population we used an 8-stage procedure as shown in the accompanying text box. In the procedure a 'residual' is defined as a person that cannot be confirmed because he or she does not meet the necessary criteria for inclusion. Fuzzy criteria are

used if for example a piece of information about a person is missing from their record such as forename, gender, date of birth, or street number. This arises because not all databases hold the same information about a person and so partial matching may be necessary to remove duplicates.

Summary of process

Stage 1: Clean GP Register, create initial population base and assign UPRNs. Keep record of person with unallocated UPRNs.

Stage 2: Match persons from other datasets to the population base using all available matching criteria. Eliminate people already included in Stage 1

Stage 3: Match additional people from other datasets to the population base using fuzzy criteria

Stage 4: Allocate people from other datasets that match UPRNs not allocated to people on the initial population base

Stage 5: Append those in stages 3 and 4 to the population base after removing duplicates

Stage 6: Add to population base births and remove deaths

**Stage 7: Re-assess all residuals (unallocated persons from all data sets) for duplicates**

Stage 8: Check for hostels and homes by identifying all UPRNs with 9+ people

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5. Results

5.1 Table 1 is a summary of the population identified or rejected at each stage. It shows a final confirmed population count of 283,921 persons occupying 114,099 UPRNs.

5.2 Figure 3 and Table 3 give a breakdown of the population and compares it with a similar breakdown based on the ONS 2005 mid-year estimates. As is seen our analysis produces 3,381 more people than the ONS figures do. Whilst some of this difference might be due to timing differences between our work and ONS's work we think this to be unlikely. A breakdown by gender and age and also further detail is given in Annex A.

5.3 We checked our higher figure against Child Benefit counts (0-15 year olds) for people living in Enfield. This produced 61,005 beneficiaries at 31/08/05. This compares with the equivalent ONS figure of 58,604 at 30/06/05 and our figure of 62,449 persons at 31/03/06. So there was already a big difference in counts in this
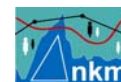
age group in 2005 between ONS and Child Benefit figures measured only two months apart. We believe it highly unlikely that this difference was the result of higher births or population influx.

Stage	Summary	Main Comments	Population Count
1 – Clean GP Register	Identify current registered patients at each UPRN	❑ 15,536 GP patient records could not be assigned a UPRN (because of address problems) ❑ 155 records removed from GP (not yet born duplicates or deceased) ❑ 101,582 of all 117,814 Enfield UPRNs on the LSPG are on the 'cleaned' GP Register ❑ 16,232 of all UPRNs on the LSPG were unused - i.e. they have no current GP patients registered there	**+ 265,128**
2+3 – Identify additional people from other datasets	Eliminate people on ER, CT and PLASC who are already on GP Register	❑ Eliminated 227,831 duplicate people using all available criteria where available (initial/forename, surname, DOB) and UPRN across all datasets ❑ Eliminated a further 6,901 duplicate people using 'fuzzy' criteria where available and UPRN across all datasets ❑ Leaves 69,605 records to check (Does not include 15,536 GP records without UPRN)	
4+5 – Allocate people to UPRNs not on the cleaned GP Register	Identify which of the remaining 110,294 records have unused UPRNs, and remove duplicates	❑ 24,120 records across datasets have unused UPRNs (i.e. from the 16,230 unused LSPG UPRNs after Stage 1) ❑ Reduced to 16,470 people after removing duplicates using available criteria ❑ Leaves 45,485 records that do not have a non-GP Register UPRN (note 1)	+ 16,470
6 – Add births and remove deaths		❑ 2,532 of the 5,025 births are already on the GP Register ❑ 2,493 births are additional ❑ Subtract 170 deaths from existing population base	+ 2,493 - 170
7- Assess all residuals for duplicates	Assess residuals for duplicates and non-residential names	❑ 36,512 residuals before assessment ❑ 21,256 residuals after assessment	
8 UPRNs with greater than 9 people		❑ 219 UPRNs were identified as having more than 9 people. ❑ This covers 2,554 individual records from population base	
Population Base = 283,921 Covers 114,099 UPRNs **Leaves 3,715 unallocated UPRNs (3.2% of total)**			**283,921**

Table 1: A summary of the processes involved in estimating the Enfield population

age groups	nkm total persons (A)	ONS 2005 mid-year estimate (B)	Difference
0-4	21,240	19,519	1,721
5-9	18,550	17,589	961
10-14	18,831	17,949	882
15-19	18,024	18,025	-1
20-24	18,505	18,532	-27
25-29	19,978	19,997	-19
30-34	21,530	21,556	-26
35-39	24,273	24,311	-38
40-44	23,434	23,457	-23
45-49	19,252	19,262	-10
50-54	15,545	15,552	-7
55-59	15,238	15,244	-6
60-64	11,749	11,749	0
65-69	10,797	10,802	-5
70-74	8,966	8,968	-2
75-79	7,407	7,410	-3
80-84	5,604	5,609	-5
85-89	3,057	3,061	-4
90+	1,942	1,948	-6
	283,921	280,540	3,381

Table 2: A comparison of the age-sex breakdown obtained using nkm techniques with the ONS 2005 mid year estimates (see also Annex A).
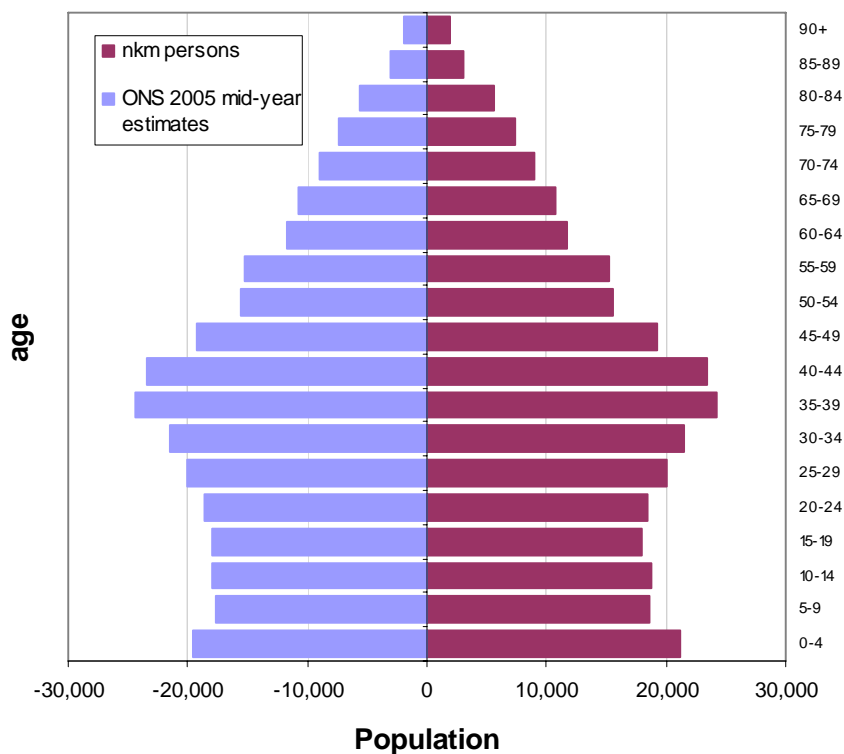
Figure 3: Population pyramid comparing nkm persons with ONS 2005 mid year estimates.

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Occupancy rates

5.4 Since the data sources are address based, it is also possible to analyse occupancy. We found that 114,099 UPRNS were occupied and 3,715 UPRNs unoccupied (equivalent to a vacancy rate in Enfield of 3.2% addresses). This is comparable to vacancy rates that we have found in other London Boroughs where these methods have been applied. Of the total UPRNs we estimate that 17,033 (17%) are in the social housing category.

5.5 The chart in Figure 4 shows the occupancy distribution by UPRN according to the number of persons per UPRN and according to tenure. It shows that social housing accommodation is less likely to be vacant than other housing accommodation (0.9% versus 3.5%). Further analysis shows that around 3.9% of private UPRNs (3,915) have 6 or more persons, whereas 6.4% of social housing UPRNs (1,083) have 6 or more persons.
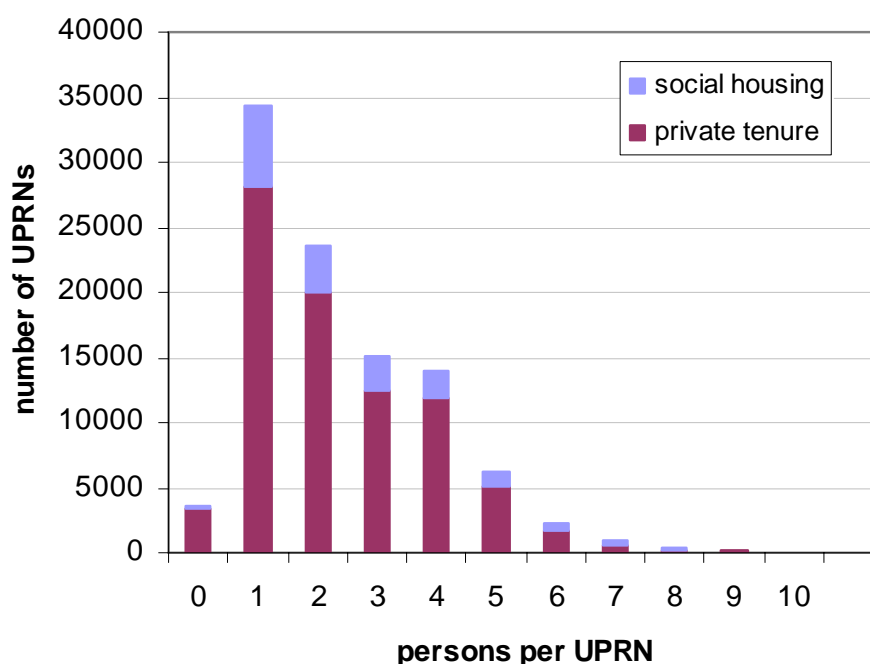
Figure 4: UPRN occupancy rates according to tenure and number persons per UPRN

Occupancy by age and sex

5.6 Figure 5 shows the number of people living alone, or with other persons by age and sex. The significance of this diagram may be judged by comparing it with another London borough such as Brent, a north west London suburb with a population of around 270k (see Figure 6).

5.7 Key differences that can be noted are that, compared with Brent, Enfield has:

- far fewer people aged between 20 and 49 that live alone;

- a more even balance between genders living alone at every age;

- a higher proportion of people aged 50+ and also more older people (70+) that live alone, especially females;

- more children and adolescents under 20, but fewer people of working age and, overall, much higher proportion of households with 3+ persons.
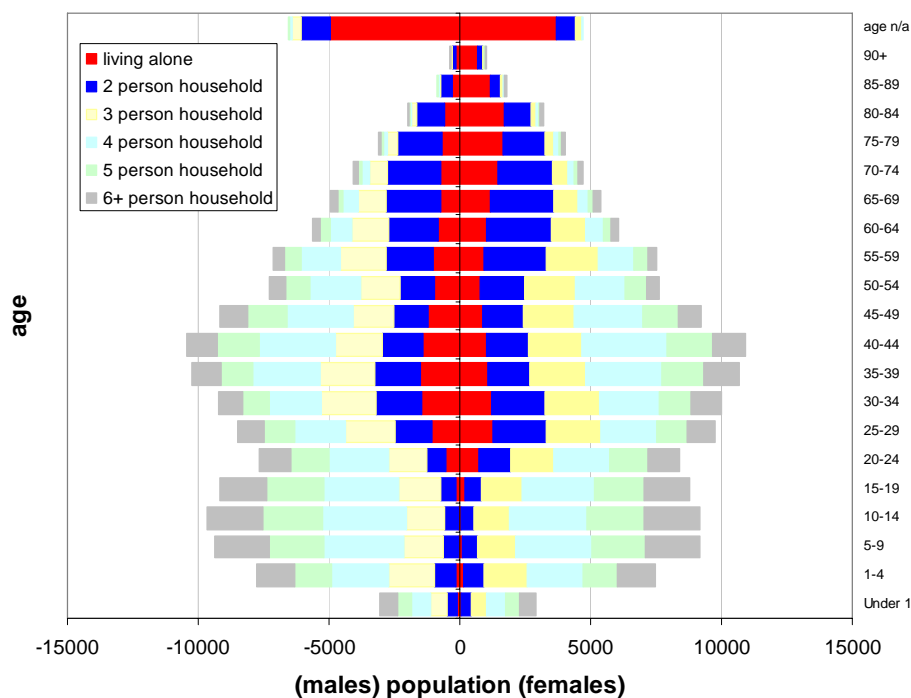

Figure 5: Population pyramid showing number of persons by age and gender living in Enfield households with 1,2,3,4,5,and 6+ persons
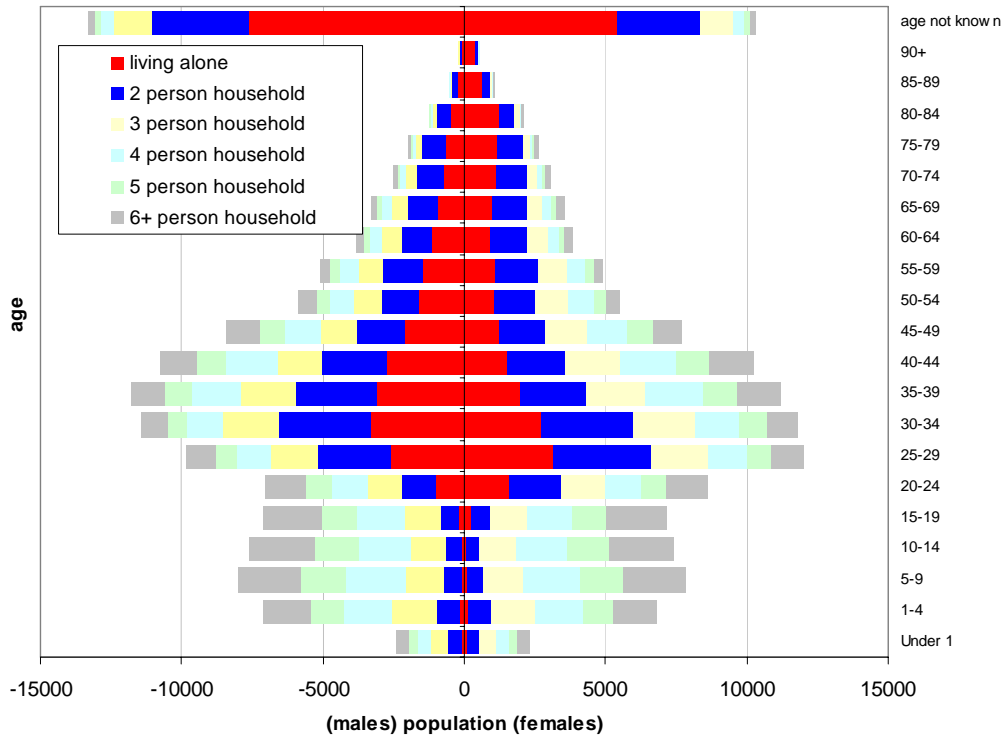
Figure 6: Population pyramid showing number of persons by age and gender living in Brent households with 1, 2, 3, 4, 5 and 6+ persons

Housing and deprivation

5.8 Deprivation is closely linked to housing. Figure 7 is a population pyramid showing the number of persons by age and sex living in the following types of Enfield accommodation:

- Private tenure

- Private tenure receiving Council Tax Benefit (CTB), a means tested benefit for people on low income and savings[8]

- Social housing

- Social housing receiving Council Tax Benefit

5.9 Clearly most people of all ages live in private accommodation in Enfield. However, our further analysis suggests that, while Enfield has a smaller percentage of the population living in homes

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[8] Council tax Benefit a means-based benefit to help people on low income to pay their Council Tax. Council tax is paid by the government and distributed through local authorities. Persons entitled to Council Tax Benefit have low incomes coming into their home and have savings of £16,000 or under, unless aged 60+.

receiving CTB (26% compared with 30%), in Enfield there are small and potentially deeper pockets of deprivation than may be generally appreciated.

5.10 For example 85% of people in Enfield live in private accommodation and of these around 17% live in households in receipt of CTB. The remaining 15% of the population live in social housing and of these around 74% receive CTB.

5.11 In Brent, by contrast, 77% live in private accommodation of whom about 23% live in homes receiving CTB. The remaining 23% live in social housing and of these about 58% receive CTB, a significantly smaller proportion than in Enfield.
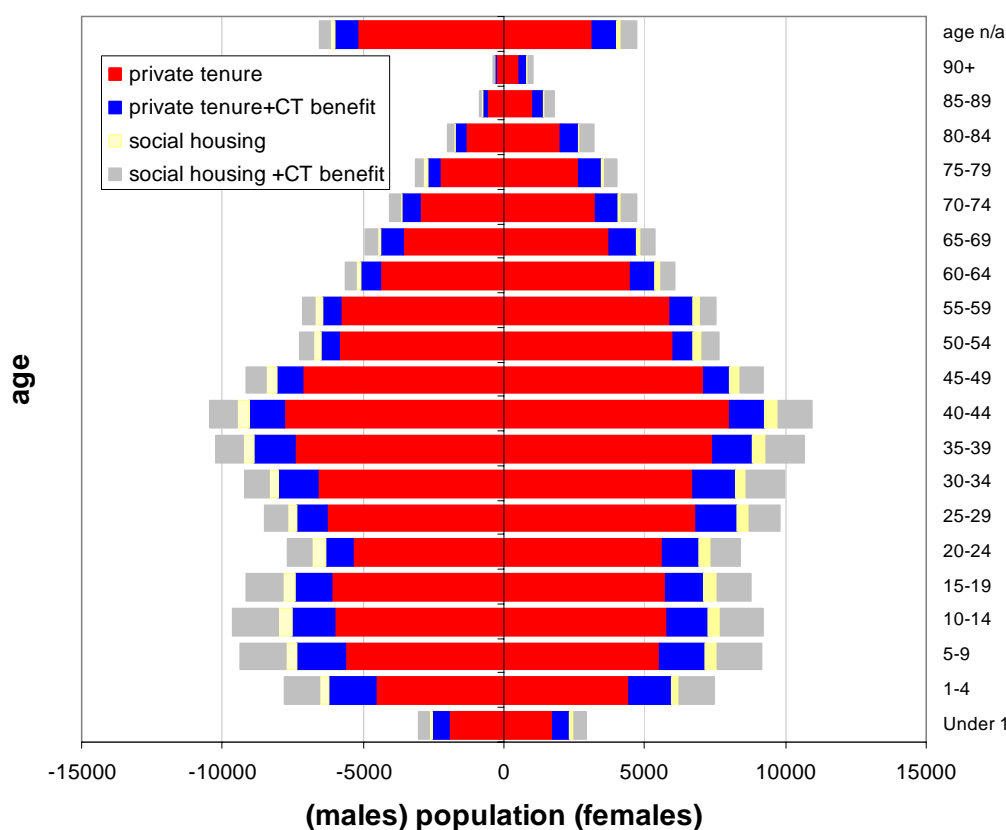

Figure 7: Population pyramid of Enfield breaking down the population by age sex housing tenure and benefit status.

5.12 The population database created for Enfield enables a fine grain analysis to be undertaken of either people or households or both. In the following paragraphs, we give illustrations of this. We do this by comparing and quantifying the position of different types of households with children aged 0-16 and the position of older people age 65+. We start with households that include children.
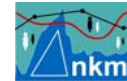
5.13 Table 3 is a decomposition of all households in Enfield according to the following: whether there are children aged under 5 or of school age (age 5-16) in the home, whether it is a single parent household, and according to tenure (social housing or privately owned). We then compare the number in each of the 16 possible household types (i.e. all combinations of each category) according to whether the household receives CTB (entitlement to CTB being used as a proxy for low income and wealth).

5.14 The table, known as a risk ladder, then ranks the categories from high to low according to the percentage of households receiving CTB. A number of observations follow:

- In the most deprived group of 950 households (row 1), 91.7% receive CTB. These consist of single parent households with young and school age children living in social housing;

- The top 7 most deprived groups with children (rows 1 to 7) consist of 16,321 of households, all based in social housing. The proportion of these receiving CTB is 64% and above.

- In the least deprived 90,872 households (see rows 13 to 16), less than 20% receive CTB.

Number	Households	single parent household	social housing	at least 1 child aged <5	at least 1 child aged 5-16	% of households on Council Tax Benefit
1	950	Y	Y	Y	Y	91.7
2	656	Y	Y	Y		87.7
3	1980	Y	Y		Y	83.3
4	97	Y	Y			78.4
5	871		Y	Y	Y	72.7
6	9973		Y			72.5
7	1794		Y		Y	64.3
8	1110	Y		Y	Y	63.1
9	552		Y	Y		61.4
10	1621	Y		Y		56.1
11	3371	Y			Y	36.6
12	252	Y				21.0
13	4282			Y	Y	19.0
14	67744					14.7
15	5750			Y		12.5
16	13096				Y	11.3
Total	114099	10037	16873	15792	27454	24.9

Table 3: Risk ladder showing the number and percentage of household according to the given criteria receiving CTB

5.15 Further analysis shows that the statistical odds of a household receiving CTB increase by:

- ☐ 13.4 times if the household is in the social housing sector
- ☐ 4.2 times if it is a single parent household
- ☐ 1.3 times if there is at least one child aged under 5
- ☐ 0.8 times if there is at least 1 school age child

5.16 Figure 8, known as a risk tree, confirms the concentration of deprivation in social housing as well as the cumulative impact of being a single parent household with young children.

5.17 We may summarise these findings in a more general way as follows. Of the 114,099 occupied households in Enfield, 19,604 have a greater than 55% chance of being on benefit and of these nearly 50% (9,534) contain at least one child age 0-16. Of the remaining 94,495 more affluent households, the probability of being on benefit is less than 37%. Of these, 26,499 contain children, so that the number of deprived households with children is roughly one third the number of more affluent households with children (9,534/26,499).
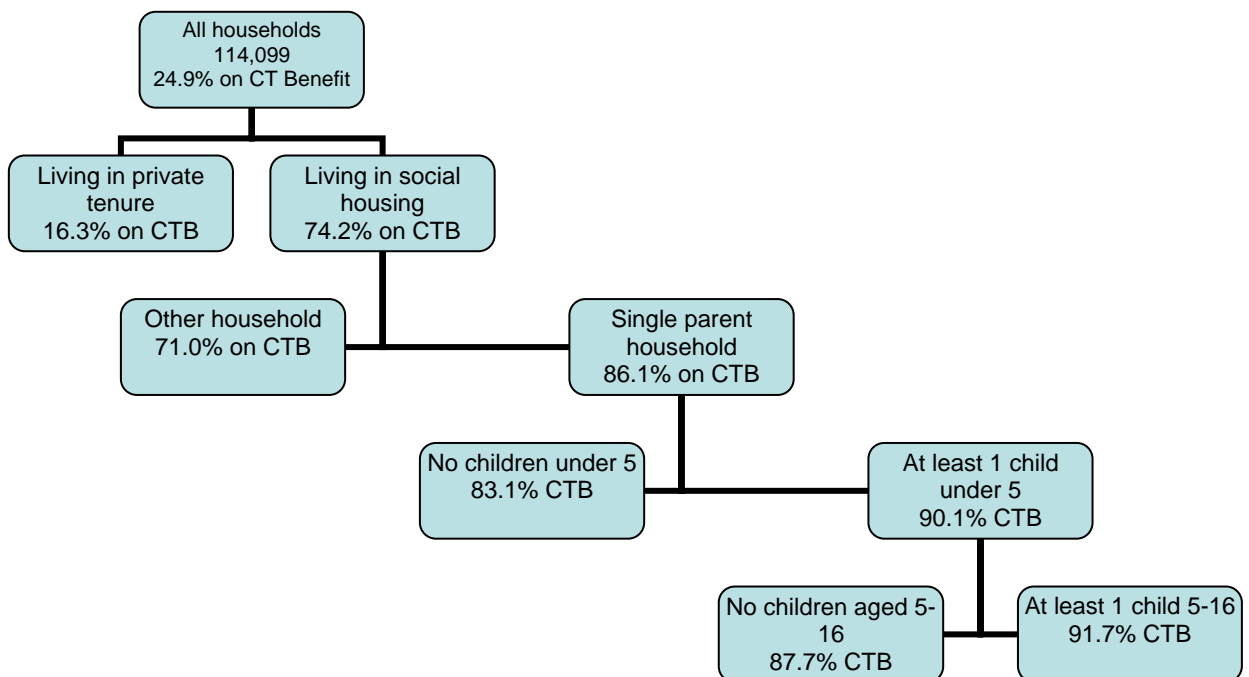

Figure 8: A risk tree showing a breakdown of Enfield households according to the percentage receiving Council Tax Benefit (CTB), and the cumulative impact of the factors shown.

Older people

5.18 The analysis performed above can be applied to people as well as to households. In the following paragraphs, we analyse income deprivation in the older Enfield population. Table 4 is a breakdown of the Enfield 65+ population of whom we estimate there to be 35,513.

5.19 As with the previous illustration we split the entire 35,513 population 65+ into 16 separate groups according to gender, whether they live alone, are of an older age (75+), and according to housing tenure. As noted, the difference between Table 4 and Table 3 is that we count people and not households. As previously, the rows are then ranked from high to low based on the percentage of persons at an address receiving CTB.

5.20 The table shows that the most income deprived, of which there are 1129 cases (row1), are females, living alone, in social housing and aged 75+; 86.5% of this group receive CTB. The top 8 most income deprived categories (rows 1-8) comprising 4,829 persons all live in social housing. More than 74% of this group receive CTB.

5.21 The three least deprived groups (rows 14 to 16), which contain 12,184 persons, are all male living in private tenure housing. Over 11 thousand of these live with their partners or somebody else. Below 19% of this group of people receive CTB.

5.22 Further analysis shows that the statistical odds of a person aged 65+ living in Enfield and receiving CTB increases:

- 14.7 times if they live in social housing
- 1.4 times if they live alone
- 1.1 times if they are aged 75+
- 0.8 times if they are male (i.e. males are less likely than females to receive CTB)

5.23 Figure 7 is a risk tree which confirms the key distinction between older people living in social housing as compared with people living in private tenure. Also confirmed are the cumulative effects of 'risk factors' such as living alone, and being female.

Number	number of persons 65+	living alone	social housing	person 75+	male	% of 65+ persons in household on CT benefit
1	1129	Y	Y	Y		86.5
2	575	Y	Y			84.3
3	354	Y	Y		Y	82.2
4	522		Y	Y		78.0
5	723		Y			77.3
6	686		Y		Y	75.9
7	464		Y	Y	Y	75.9
8	376	Y	Y	Y	Y	74.2
9	4089	Y		Y		28.6
10	2053	Y				24.8
11	1355	Y		Y	Y	22.7
12	4272			Y		22.6
13	6731					19.0
14	1106	Y			Y	18.1
15	6868				Y	17.7
16	4210			Y	Y	17.4
Total	35513	11037	4829	16417	15419	28.9

Table 4: Risk ladder showing the number and percentage of persons aged 65+ according to the given criteria receiving CTB

5.24 We may summarise this section more generally as follows. Of the 35,513 people in Enfield aged 65+, 13.5% or 4,829 have a greater than 74% chance of being on benefit, all of whom live in social housing. The remaining 30,684 have a less than 29% chance of being on benefit. The analysis therefore suggests a clear divide in the older population based on housing wealth and level of income.
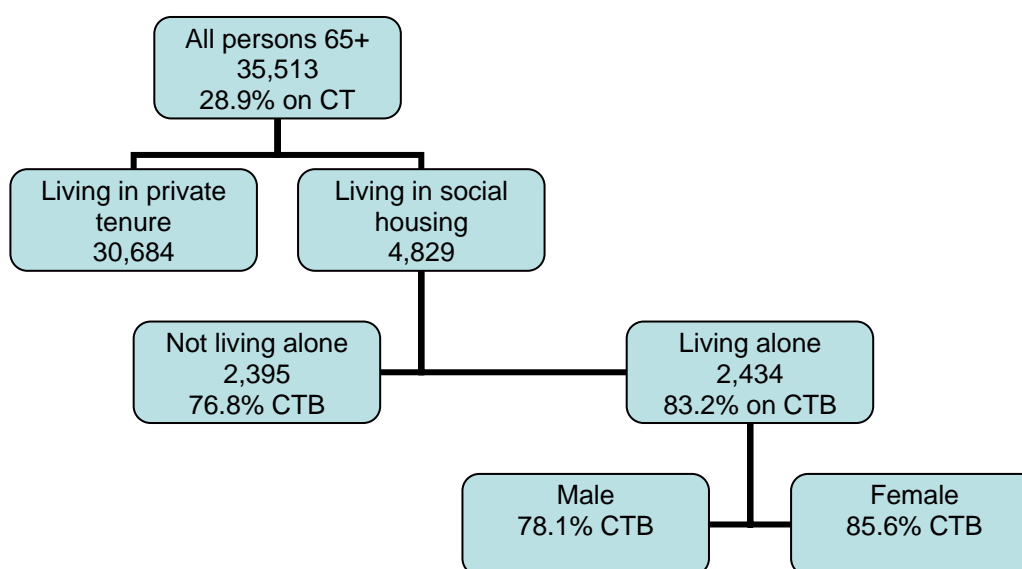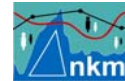

Figure 7: A risk tree showing a breakdown of Enfield people aged 65+ according to the percentage receiving CTB, and the cumulative impact of the factors shown.

6 Population maps of Enfield

6.1 Maps are valuable sources of information for targeting services (e.g. social services, community health services, children's services). In the section we provide some illustrative maps using the highly flexible data set created from Enfield's administrative sources which has then been manipulated within a GIS system. These examples link with the analysis in the previous section and demonstrate the ability to identify small and well defined areas and subsets of the population.

6.2 We use the population estimates in this study to develop maps about children and older people. We do so by mapping several of the more deprived groups identified in the previous section and comparing the results. Our findings agree with the broad thrust of the Eastern and Southern study published Enfield's Information and Research team in December 2005[9]. This showed concentrations of deprivation along the borough's eastern and southern flanks – differences that led the authors to consider Enfield to be a 'divided borough'. A departure in our study is that we highlight outliers of deprivation elsewhere in the borough but also quantify the number of vulnerable persons in specific categories.

6.3 Figure 8 is a basic population map. Rather than produce a customary ward based population map, we have reproduced the population in 500x500 metre grid squares. Each square is identified by the co-ordinate axes. For example square Q11 has a population of 2,761 persons and is shaded in the darkest tone; 14 other cells have similarly high populations (for a count of the population in each cell see Annex A). Ward boundaries have also been superimposed for ease of reference.

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[9] The Eastern and Southern Study, Information and Research Team, December 2005. Available on Enfield Observatory web site: www.enfield-observatory.org.uk. Wards identified in the Eastern and Southern Study comprised Turkey Street, Enfield lock, South bury, Enfield Highway, Ponders end, Jubilee, Haselbury, Lower Edmonton, Edmonton Green, Upper Edmonton and Bowles.
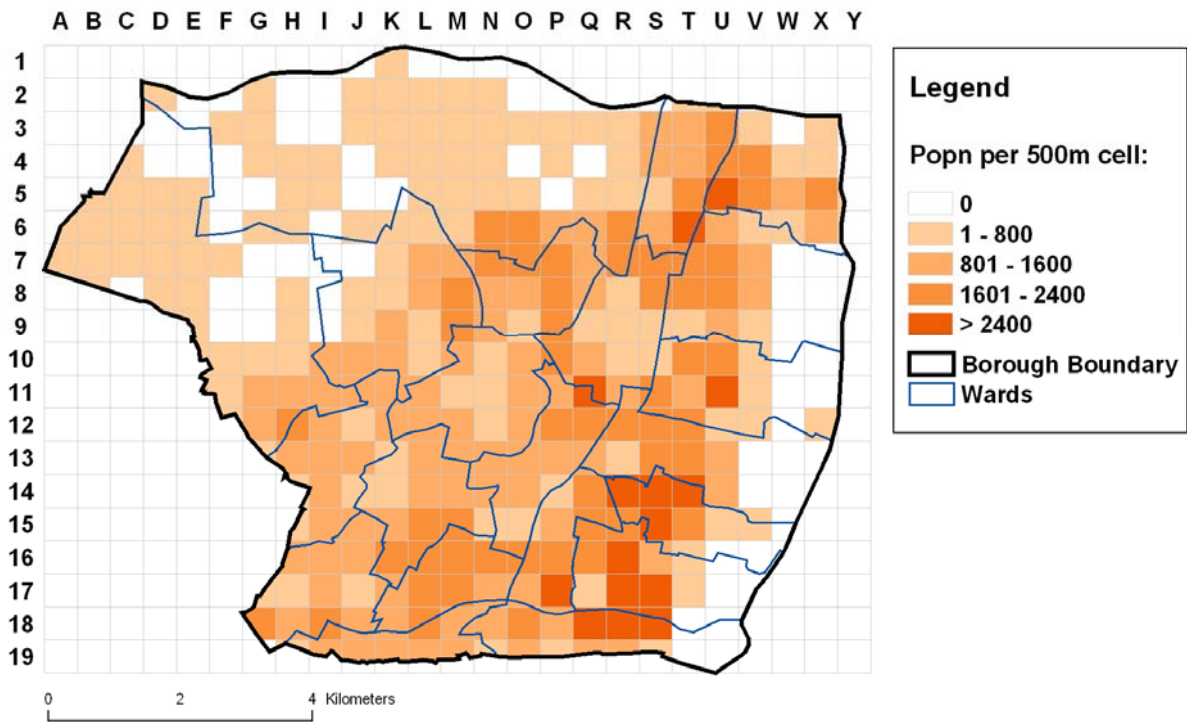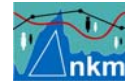
Figure 8: 500x 500 metre cell-based population map of Enfield

6.4 According to the Eastern and Southern Study, within Enfield there is a distinctive social and 60 divide (footnote 7). Using the Index of Multiple Deprivation it showed a concentration of deprived wards along the eastern and southern perimeter pf the borough.

6.5 Figure 9 is a similar map created this time for the 0-16 population. Superimposed on the map are the locations of households in which there are:

- children aged 0-16 living in social housing
- children aged 0-16 in social housing, in single parent households receiving CTB

6.6 The dots indicated on this map correspond to different rows in Table 3 above. For example, there are 3,095 dots representing households with children aged 0-16 living in social housing, in single parent households and receiving CTB.

6.7 These correspond to rows 1 to 3 in Table 3. This total may be verified from the number of households and percentages on CTB as follows (row 1 column 2 x 91.7% + row 2 column 2 x 87.7% + row 3 column 2 x 83.3% = 3,095, rounded down).

6.8 The map shows that this group of children tend to be located in an eastern strip of Enfield, with a scattering of concentrated pockets elsewhere corresponding to sites where there is social housing.

6.9 In Figure 10 the reference population comprises all 65+ persons living in Enfield. In contrast to the previous maps the information is presented as contours representing population density. Specific concentrations appearing in cells in N6, P11, S16 and K11 are likely to be residential or nursing homes.

6.10 The overlaying dots are the homes of 2,733 persons aged 75+ that live alone and are on low income (i.e. in receipt of CTB). This sub-group corresponds to rows 1, 8, 9 and 11 in Table 4 (row 1 x column 2 x 86.5% + row 8 column 2 x 74.2% + row 9 column 2 x 28.6% + row 11 column 2 x 22.7% = 2,733, rounded up).

6.11 The evidence of these maps is therefore that they confirm previous work but also provide additional information that was not previously available. One important finding is that pockets of deprivation exist outside areas with high indices of multiple deprivation (IMD). For example, in Figure 10 we count that there are 1,600 persons to the east and south of the principal boundary used in the Eastern and Southern Study and 1,133 to the west and north – in other words comparable numbers.
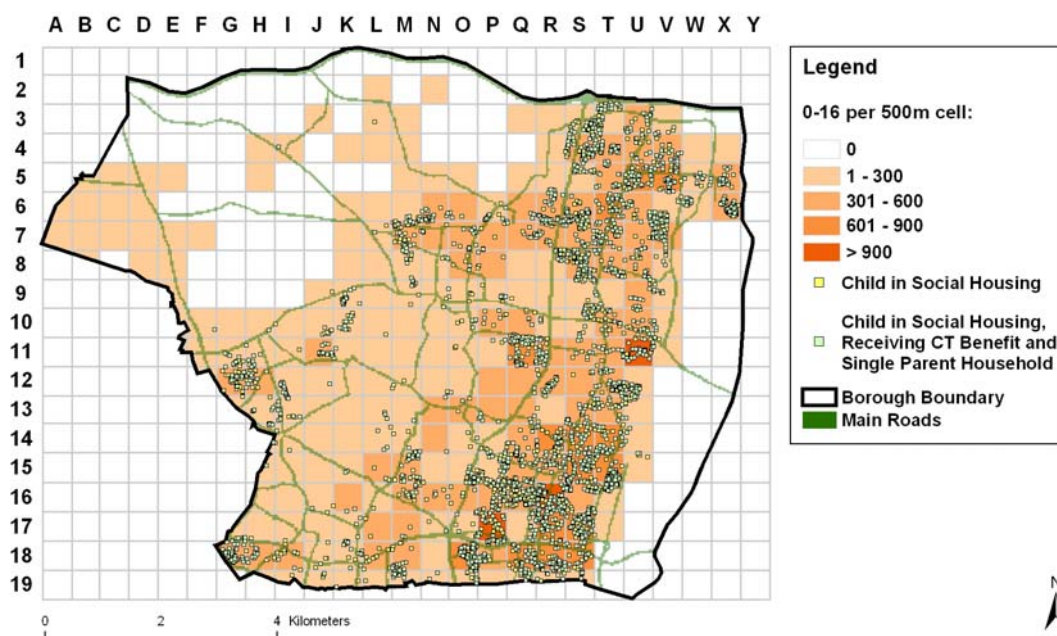

Figure 9: 500x 500 metre cell-based population map of Enfield showing 0-16 year olds. Dots represent living children in social housing (see legend for colour code).
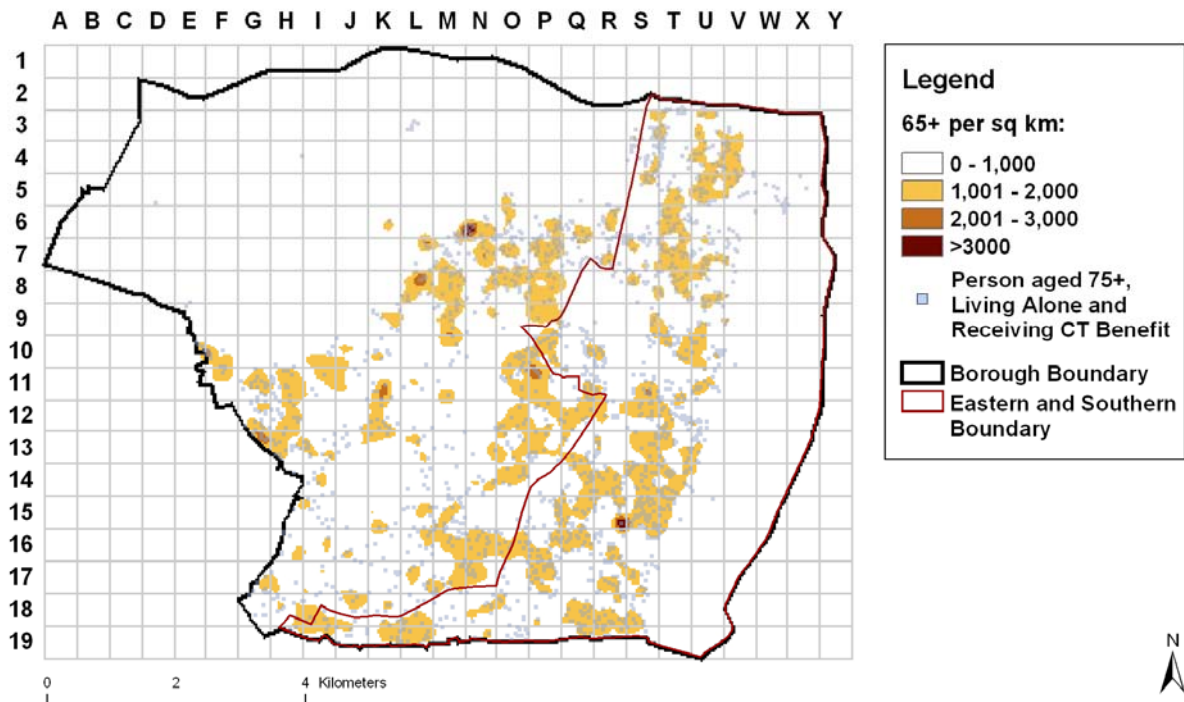
Figure 10: Contour density map of the 65+ population showing the distribution of 75+ persons, living alone.

7. Conclusions

7.1 This report has established a population figure for Enfield but also much more. Is there scope for improvement? In around 95% of cases we could establish or confirm all the necessary details (gender. date of birth, address, etc.) within the local administrative data sets provided by the Council and EPCT.

7.2 For some persons it was not possible to establish date of birth or gender, although it was possible to confirm the person from more than one source. We suggest that small changes to data collection could make a large difference to this – for example by including a requirement for mandatory date of birth on Council Tax Benefit applications (see also Annex B). Other key suggestions for improving data used in the count are:

- improved addressing in the GP database;
- filling gaps in NHS numbers (GP register);
- including missing flat numbers (all databases with addresses);
- checking missing addresses on the LSPG (some believed to be illegal flat conversions);
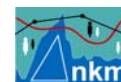
  ☐ obtaining PLASC level data on children living in Enfield but attending schools in neighbouring boroughs
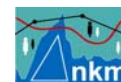
7.3 In conducting this study we started our work at precisely the time that the Council Tax, Council Tax Benefit computer systems were being redeveloped and migrated on to a new system along with tenure. In practical terms this held up this study for over three months. However, for obvious reasons this problem is unlikely to be repeated in any future exercise.

7.4 Our information on tenure was believed to be more or less accurate, although it was agreed that full validation checks would be desirable to improve the integrity and completeness of the re-developed Council Tax system as far as tenure was concerned. This is important because people living in social housing very often have greater needs and so identifying them is important. The means of achieving this need further consideration although the key probably involves the incorporation of registered landlords' names.

7.5 This study has concentrated on population estimates although clearly the Council and EPCT maintain numerous other databases relating to services they provide – for example children and older people's services, community health services, library services, adult education services, youth offending and so forth. Such information is linkable to the database created for this project and potentially available for profiling local populations, including ethnicity, allocating resources and improving the efficiency of service delivery.

7.6 By linking UPRNs to wards and other standard output areas, all the information contained in the data base can be analysed and mapped on the basis of any of the administrative or service area boundaries used by the Council, EPCT or other agencies such as the police or voluntary groups. Further applications are therefore strongly recommended. More generally, to make such information more accessible and easier to analyse in the future, we recommend embedding the UPRN into the records of all administrative data sets. With new, higher density housing developments underway in Enfield it seems especially important to be able to monitor change more effectively.

7.7 Apart from Council and EPCT owned datasets, other useful datasets belong to for example the Department for Work and Pensions (DWP) and police. Enfield Council may wish to open up discussions with it on data access or shared analysis for statistical purposes along with appropriate provisions as far as confidentiality and disclosure are concerned.

7.8 It must be borne in mind that a person cannot be counted if they are not registered on any of the data sets used, and so the possibility that there are others staying at addresses of friends and relatives on a semi permanent basis cannot be discounted. As an area attracting high numbers of overseas migrants in recent years, this remains a plausible scenario.

7.9 The cell map at Annex A gives a population figure for each cell based on our analysis. It is recommended that Enfield Council uses the database behind this map as a baseline or sampling frame in the event that it decides to conduct it own targeted surveys of local residents, especially ones that do not fit into standard administrative boundaries[10].

7.10 In conclusion, we find that the confirmed minimum population of Enfield (283,921) is nearly 4,000 greater than the ONS 2005 mid-year estimates. The actual population would have been higher if certain categories discarded in our analysis were to be added back. It is difficult to put a precise figure on this but it may be as high as 4,000 based on the most likely of the discarded categories. The net impact is that the council and EPCT may be under funded by between £6m and £14 based on 2005/06 average capitation rates.

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[10] We understand that Enfield use Ipsos MORI for surveys who in turn use Census data as 'weights'. For surveys that span sub groups such as persons living in social housing or specific neighbourhoods, the figures produced by this study are potentially more accurate, depending on the scope and design of the survey.
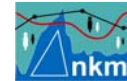
Annex A: Age and gender breakdown

A1. Figure A1 is a population pyramid of Enfield based on administrative sources. Table A1 splits it down by age and gender. We observe that there are more females than males (145k versus 139k), 86.7% of all persons are aged under 65, and 27% aged under 20.

A2. In 16.3k cases (5.7% of the population) it was not possible to ascertain the exact age of a confirmed individual (because they do not appear on the GP register or because the confirming data sets do not have or omit age, e.g. the electoral roll). The great majority are adults between the ages of 20-49.

A3. This has been pro-rated to the appropriate age groups using independent population estimates of the age distribution to produce the pyramid and table shown below. Figure A1 shows a map of the population by 500 x 500 metre cells. To preserve confidentiality cells with under 25 persons are shaded green.
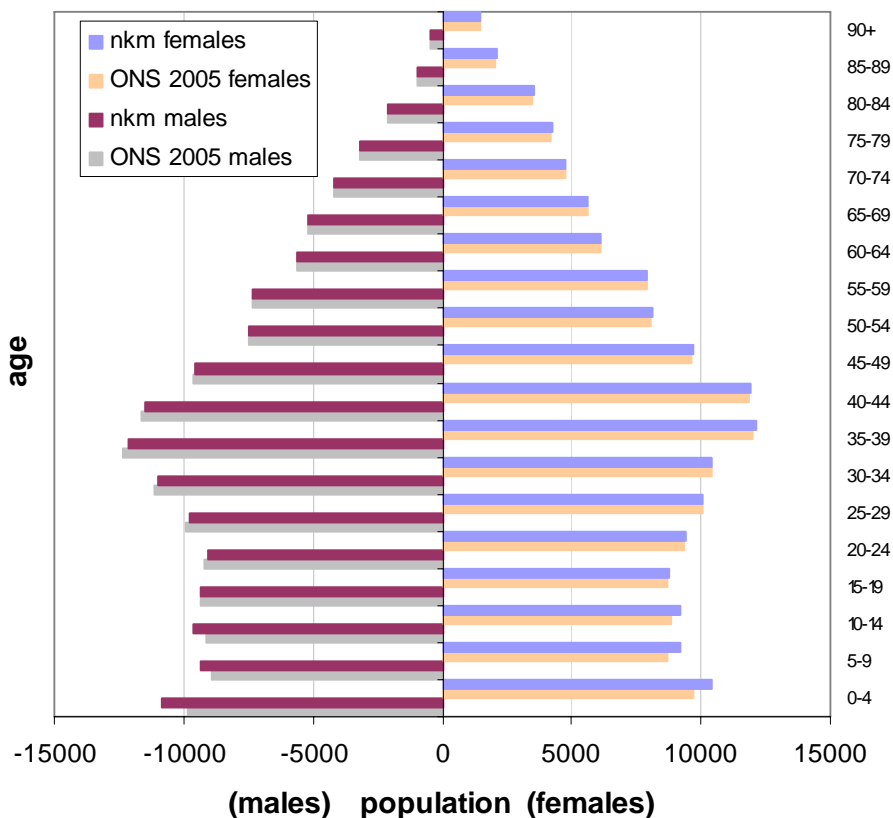

*Figure A1: Population pyramid of Enfield based on administrative sources*

age group	nkm males	nkm females	total nkm	% by age	cumulative % by age
0-4	10817	10423	21240	7.5	7.5
5-9	9377	9173	18550	6.5	14.0
10-14	9639	9192	18831	6.6	20.6
15-19	9319	8778	18097	6.4	27.0
20-24	9044	9439	18483	6.5	33.5
25-29	9800	10085	19885	7.0	40.5
30-34	10965	10448	21413	7.5	48.1
35-39	12131	12110	24241	8.5	56.6
40-44	11507	11929	23436	8.3	64.9
45-49	9576	9684	19260	6.8	71.7
50-54	7480	8092	15572	5.5	77.1
55-59	7344	7911	15255	5.4	82.5
60-64	5652	6136	11788	4.2	86.7
65-69	5161	5641	10802	3.8	90.5
70-74	4209	4749	8958	3.2	93.6
75-79	3197	4225	7421	2.6	96.2
80-84	2103	3527	5630	2.0	98.2
85-89	990	2088	3078	1.1	99.3
90+	479	1501	1980	0.7	100.0
total	138790	145131	283921	100.0	100.0

Table A1: Population of Enfield by age and sex estimated from administrative sources
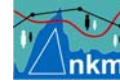

Figure A2: 500 x 500 metre grid map showing the population in each cell. Cells with under 25 people in green have been suppressed to preserve confidentiality
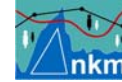
Annex B: Data sets and quality issues arising

Data base	Original number of records	Addresses	UPRNs	DoB (date of Birth)	Forename	Surnames	Gender	Other comment
GP register	311,082		15,536 not assigned a UPRN	OK	OK	OK	OK	❑ Variable addressing conventions so that same address could appear in many guises. ❑ UPRN could not be assigned where e.g. flat number is missing
Births	5,025		321 not assigned a UPRN	OK	OK	OK	OK	❑ Not all records have NHS numbers ❑ Some addresses may be out of Borough
Deaths	2,521		319 not assigned a UPRN	OK (4 missing)	OK	OK	OK	❑ Some addresses may be out of Borough ❑ Four records without addresses
Electoral register	99,828 in edited version	Not all (35) had post code	2,546 not assigned a UPRN	N/A	OK	OK	N/A	❑ Edited version only
PLASC	49,849	PLASC only contains postcodes	8,505 PLASC records could not be assigned a UPRN where the name or DoB differed too much from the GP register, although probably was the same person.	OK	OK	OK	OK	❑ Only captures pupils who live and go to school in Enfield. Enfield should consider obtaining records of children living in Enfield but at school elsewhere from neighbouring boroughs

								□ Addresses are assigned using person matching to the GP Register. This may not capture 100% of possible matches.
Council Tax benefit	36,783	Postcode had to be separated from address string	1,223 not assigned a UPRN	NA	All names in one field (i.e. First, middle and family name)	All names in one field	NA	□ Address problems include missing flat numbers, or having flat numbers that are not yet recorded in the LSPG
Council Tax Properties	117,920	Postcode had to be separated from address string	4,155 not assigned a UPRN	N/A	Some records were business names. All names in one field	All names in one field	4,651 records were Dr, Rev, Prof, Exors of, or missing, so gender could not be deduced	□ Address problems include missing flat numbers, or having flat numbers that are not yet recorded in the LSPG □ Liable person may not live at that address
Local property gazetteer	117,814			Not applicable	Not applicable	Not applicable	Not applicable	□ There may be HMOs and illegal conversions that are not yet included. □ No property type description