



The 2001 One Number Census and its quality assurance: a review

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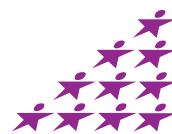
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Local Government Association

the 2001 One Number Census and its quality assurance

a review

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preface

The population statistics that are based on the census have to include all those who are difficult to count. This aim is central to the common understanding of those who produce the statistics and those who use them. Population statistics underpin government allocation of resources and in many other ways are fundamental to good quality public services.

For the 2001 Census, the Office for National Statistics, and the statistical agencies of Scotland and Northern Ireland implemented ambitious and innovative plans to maximise response and to minimise the variation in response between different types of people. Through a very large interview survey of 300,000 households after the census, the number and characteristics of non-respondents were estimated, the census database was expanded to include records representing non-respondents, and census output represents an estimate of the full population. This is the One Number Census (ONC).

In the process of estimating and quality assuring the full population estimates based on the census, ONS made a number of judgements to deal with evidence that could not have been foreseen before the census, including a gap between the census and previous population estimates for 2001 of 1.14 million residents, and many local discrepancies between the census and population indicators from administrative counts.

Responding to concerns expressed by some local authorities, the Local Government Association (LGA) circulated a series of questions on 19 February to the chief executive and statistical liaison officers of all local authorities in England and Wales:

- In what ways was the information provided by ONS about their procedures to estimate the 2001 population satisfactory or unsatisfactory?
- Were the 2001 census and mid-year estimate population totals for your authority considered to be accurate and credible?
- If you consider them not to be accurate and credible, were they too high or too low?
- Were any of the age-groups considered to be less reliable? (If, yes please give details of which age groups were too high or too low)
- What independent evidence led you to your assessment of the accuracy of the census outputs?
- Did your authority contact ONS, ODPM or National Assembly for Wales about any perceived problems with the population figures for your authority? (Please provide details of any discussions to help inform this review).

Sixty-two responses were received (Appendix A), some from county authorities and joint research teams replying on behalf of several districts. Of these 62, which are likely to contain a high proportion of those wishing to express concerns, 14 were satisfied with the ONC as regards both information provided and accuracy and credibility of the results. The general acceptance of the census results is not in question for the great majority of local authorities. However, 24 expressed serious concern about the information provided, while 35 expressed concern about the accuracy or reliability of the ONC population estimate. All were measured in their responses, many providing evidence to back their concern about the population estimate for their own area. Eighteen have approached ONS with concerns over their data. ONS have responded to all of them and are continuing to work with them.

This review is intended to identify concerns that have most impact on local authorities, particularly the question of the quality of the census results, and to recommend ways in which confidence in the census results could be extended. It does not attempt to address the issues of specific local authorities, which are also discussing their concerns directly with ONS. The review focuses on the estimation of the population on census day rather than the relatively minor adjustments to reach a mid-year population. It is not within our

resources to undertake original analyses of the mass of data relevant to an assessment of the population statistics, although we do recommend such analysis as a high priority.

This report was largely completed and passed to ONS in April 2003. Since then ONS have revised international migration statistics, announced revisions to population statistics, and begun an evaluation into the census address lists in Manchester and Westminster. The report's recommendations remain valid, and should be pursued alongside new emerging priorities.

The concerns we have reviewed express a lack of full local authority confidence in the ONC and its quality assurance procedures, but within a commitment to complete and accurate population statistics. The strategy of providing an estimated full population database from the census, that is less biased than the raw census count, commands general support. However, for these fundamental statistics it is not appropriate simply to take an executive decision and move on. We believe the following steps would help towards fuller confidence in the results. Many of these steps are already being taken by ONS. However, each requires a timetable and a forum in which local authorities and other users of population statistics can contribute. The Central and Local Government Information Partnership (CLIP) groups may provide that forum for local authorities.

These recommendations are collected from the discussion in each of the first four chapters of this report, and are repeated with some extra explanatory comments in the final chapter.

1. The evidence and expert judgements involved in the quality assurance of the One Number Census should be supported with published analyses.
2. The issues of enumeration that make population size hard to estimate should be tackled in an open and scientific manner.
3. Key administrative sources must be assessed and calibrated not against the census but as independent indicators of population size.
4. Development of population statistics and the census should be accompanied by a focus on the needs of statistics users in such a way that maintains their confidence in the methods and products.
5. Local authority concerns about their own population estimates should be treated as opportunities to learn how population statistics can be improved generally.
6. The precise definition of the population to be counted in each location should be reviewed and agreed.

executive summary

The LGA commissioned a survey to review population estimates based on the 2001 census, from three leading academics in the field.

Local authorities regard the provision of complete and accurate population statistics as vitally important. For that reason they enthusiastically welcomed an initiative from the ONS to produce a full and unbiased population database from the 2001 census, by means of the 'One Number Census' process. The 2001 census was the first in the UK to have procedures in place to estimate those missed by census fieldwork in each part of the UK. The strategy was discussed and agreed beforehand with main census users including local authorities. The report summarises each element of the One Number Census (ONC) and reviews concerns about how the strategy worked in practice expressed by local authorities.

The addition of that estimated undercount to the raw census count makes the census better - much less biased - than had it been issued without adjustment. The review recommends that local authorities should use the detailed census results as published.

There remain concerns about specific areas of the population estimates based on the census, partly due to outcomes that were not foreseen when the One Number Census strategy was drawn up. Some of these concerns would affect the interpretation and uses of census results. These must be addressed, and are being addressed. The key concerns are:

- areas of transient populations: students, armed forces, seasonal labour, recent immigration, and inner city multiple-occupied dwellings;
- areas with low response rates; and
- the inability fully to disentangle estimates of emigration and estimates of non-response.

These concerns have an impact in the affected areas on estimates of population but also and in particular on measures of housing stock, commuting and migration.

Work to avoid these concerns for future censuses, and for population estimates between censuses, needs to get to grips with two big issues:

- the most useful definition or definitions of residence for the main purposes of the census which include government distribution of resources; and
- the development of administrative records, surveys and statistical records to provide accurate measures for total population and households that are independent of the census.

ONS are undertaking work on each of these. Local authorities are contributing to this work and should continue to do so. Early release of the analyses that led ONS to accept the ONC will help local authorities engage in this further development work.

The review makes recommendations in these areas which require a timetable and a forum in which local authorities and other users of population statistics can contribute. For local government, the Central and Local Information Partnership Census sub group and the Liaison Group on Population Statistics should provide the fora. In that CLIP is about partnership, then local authorities, ONS and government departments should work together on these issues.

1. the estimation for local authority districts

Recognising the growing impact of non-response on the quality of census results, the UK statistical agencies developed a new strategy for the 2001 Census. It aimed to:

- reduce the variation in non-response between areas and sub-populations by focusing fieldwork on residents expected to be hard to count;
- estimate non-response in every local authority district through a much increased post-Census Coverage Survey (CCS), followed by matching census and CCS records for the same areas, Dual System Estimation (DSE) of the full population in each postcode by age and sex, estimation of an age and sex-specific non-response rate for each hard-to-count stratum in each of 101 'estimation areas' in England and Wales as well as a different response rate for each local authority within the estimation areas that were not a single district; and
- provide output for the full-population cross-tabulated by socio-economic characteristics, by imputing records into the census database for those estimated to have been missed, these records being copies of existing records selected to have the characteristics of non-response as evidenced in the CCS; missed households were located where possible in the places that enumerators had reported non-responding households.

This strategy was developed with wide consultation prior to the census. Key documentation is given in 'A guide to the One Number Census', and supporting working papers are available from the ONS website¹.

Local authority concerns

Responses from local authorities to this review confirmed the support which the strategy above had gained during consultation. Local authorities put very high priority on a complete and accurate population estimate with equal reliability in each area.

Concerns were expressed about the following issues:

- a) the census fieldwork did not successfully achieve a reduction of under-enumeration in hard to count populations relative to other areas;
- b) the technical complexity of the estimation procedures and its documentation did not lend itself to confidence in the results;
- c) the assumption of independence between the census and the CCS was risky and not sufficiently validated;
- d) the enumerators' estimates of absent and non-responding households were not a good basis for estimating non-response;
- e) the sample CCS was insufficient in smaller districts, particularly where transient populations included students or temporary workers;
- f) the strategy for estimating the age-sex composition of non-response insufficiently differentiated between local authority districts; and
- g) the CCS sample was not representative of the population in each local authority district.

Review of concerns

Local authorities have expressed few doubts about the ONC strategies, or the implementation of the CCS, matching records, Dual System Estimation and imputation. We agree that their design, their planning and their implementation are highly positive developments for UK statistics. The ONC procedures were generally carefully implemented, thoroughly and in a sensible manner. Estimates of response rates specific to each Local Authority District (LAD) are a fine achievement.

The first concern (a) relates to the aim of reducing the variation of response rates between sub-populations. No absolute comparison between what was achieved and what might be achieved is possible. However, the variation in measured response rates between LADs remains high; half of

¹www.statistics.gov.uk/census2001/IntroOneNumber.asp

all LADs have a response rate of 96 per cent or better, while for 28 the response rate is below 90 per cent and for 11 it is below 80 per cent. Hard-to-count areas were allocated twice as many enumerators as other areas. Fieldwork managers were allowed to direct enumerators to where enumeration proved most difficult. Postback of forms aimed to release fieldwork resources to those same difficult areas. However, the inability of the Post Office to deal with the high level of postback and other constraints meant that the fieldwork was not easily directed to the remaining households². In practice the response rates were still lower in the hard-to-count areas, with estimated response rates of below 90 per cent for only 10 of the 335 easiest areas (three per cent), 21 of the 366 medium difficulty areas (six per cent) and 74 of the 151 hardest areas (49 per cent)³. Survey and census methodology still has to devise ways of gaining a high response rate from certain sections of the population, including the young, the mobile, and the socially excluded.

Concern (b) with the technical level of the documentation for the One Number Census is a threat to the confidence of users in the results, if it means they do not trust the results. Where accuracy is not clearly threatened, estimation procedures should be kept simple. Complex methodologies usually deal with problems that are simple to express, and implement straightforward principles. They can therefore be documented in plain language. Plain language guides that did not shirk the problems but plainly described each main step to resolve them was an aim of ONS. Guides were produced but did not always achieve confidence. The description of dependence and its estimation has caused particular concern. The LGA representatives on the One Number Census steering and project groups had expressed the concern (c) that the assumption of independence between census and CCS was risky; this is dealt with further in section 2 of this report.

Concern (d) regarding enumerator reports of absent households is misplaced, as these had no effect on the estimation of response rates and population estimates for LADs. They were used to guide the location of the estimated number of non-responding households within LAD. This is a logical approach and was approved by local authorities during consultation for the censuses of both 1991 and 2001, although its accuracy is limited by the quality of enumerator reports.

Concerns (e), (f) and (g) refer in different ways to the adequacy of the CCS sample. Those expressing such concerns accept the advance that the ONC represents in achieving local population estimates independently in 100 of the 101 estimation areas. The sample size used in the estimation was sufficient to estimate response rates for each local authority with only one case (Sheffield) of borrowing information from another estimation area, and one case (Shepway) of substituting information from other local authorities within the same estimation area. If the sample had been too small, the estimated response rates would have been too volatile to accept, and this did not occur.

The concerns regard the adequacy of the sample in extreme cases. This is a reasonable concern: a poorly estimated LAD gains no solace from the accuracy of other areas.

Any sample can by chance be unrepresentative of its population. Comparisons based on 2001 Census data show that the CCS was representative nationally, as one would expect with such a big sample, but with moderate variation between LADs. The CCS reported significantly higher levels of private rented housing than the census (15.1 per cent versus 11.7 per cent), which may reflect its concentration in hard-to-count areas. Where a moderate degree of deviation between sample and population coincides with other indicators of problem areas, this would be of importance. We would urge that detailed representativeness comparisons are released with supporting information.

²ONS evaluation of fieldwork, www.statistics.gov.uk/census2001/pdfs/datacollectiones.pdf and Simpson, L (2001) *Census fieldwork - the bedrock for a decade of social analysis*. CCSR Occasional Paper 22, www.ccsr.ac.uk/publications/occasion/occ22.pdf

³These response estimates are approximations derived from LAD level Dual Sample Estimation files.

Release of the LAD characteristics of non-respondents as estimated by the CCS, and as imputed into census records representing non-respondents, would also help to reassure regarding the robustness of the census procedures.

The non-response for LADs within an estimation area was computed as a single all-age differential from the estimation area's response rates, as the sample size was considered insufficient for further detail. It might be improved in future by differentials that vary with broad age-sex groups at the cost of more constraints across the age-sex groups in an estimation area.

The ONC strategy involved a quality assurance process for each local area, that was intended to identify any serious problems with the sample or the estimation based on it, and thus was designed in part to deal with these concerns on sample representativeness. It specifically addressed the completeness of enumeration of students. The quality assurance for local areas is discussed in chapter 3.

2. the quality assurance of the national results

As the estimation areas were processed, an aggregate population estimate for each country in the UK emerged. In each country this was considerably less than expected from previous estimates based on previous censuses. Because of difficulties with the 1991 Census, the previous estimate for 2001 had been rolled forward by adding counts of births, deaths and migration to the 1981 census, which is considered relatively reliable. In England and Wales the initial population estimate based on the 2001 Census and the procedures outlined above was 1.37 million below the 'rolled forward estimate' for 2001 and was not released.

The possibility that people who had been missed by the census were likely to be also missed by the CCS is usually summed up by the term 'dependence'. Dependence between the census and CCS would mean that the population estimates were too low. ONS sought a measure of such dependence and found an estimate of the number of households that suggested the initial population estimate was too low. For this reason, 230,000 people were added to the population of England and Wales representing people missed due to household dependence between the census and the CCS. ONS accept that there is no estimate of the number of residents within counted households who were not estimated by the procedures because their chance of enumeration was low in both census and CCS, termed 'person dependence'. ONS feel that this number should be low since the response rate for people in counted households was measured by the CCS to be very high.

ONS has concluded that the remaining 1.14m gap between the ONC population and the rolled forward population, represents primarily a net underestimate of international emigration during the two decades 1981-2001. This gap is predominantly made up of men aged in their twenties and thirties.

Local authority concerns

While local authorities have naturally focused on the ONC results for their area, concerns were expressed about the following issues regarding the national results:

- a) the conclusion of unmonitored emigration has not been backed by independent evidence of such a level and composition of unmonitored migration;
- b) the dependence checks were not discussed and have not been explained clearly;
- c) the adjustment for household dependence is not robust; and
- d) dependence for individuals within households could be a significant issue.

Review of concerns

The concerns can be expressed bluntly:

- have those 1.14m emigrated, or were they simply too hard to find by the census procedures?
- Is it possible that a significant proportion of them were young adults with a desire not to be included in official enquiries or with a lifestyle that does not lend itself to inclusion in censuses and their coverage surveys?

One can speculate on the types of people, largely young men, who might be so missed:

- those working the informal economy;
- those refused permission to stay in the UK but nonetheless resident;
- those resident with a family which is claiming benefits on the basis of their non-residence; and
- those sought by the Family Support Agency or other agencies seen as punitive.

One can equally speculate on the types of people who may have emigrated but not been monitored by migration surveys:

- those attracted by the relative ease of travel and the possibility of casual work abroad but not originally intending to leave for a year or more (the definition of an emigrant in UK statistics); and
- those whose application to stay was refused but who left the UK within a year of arriving;
- those who were born in the UK to temporary visitors.

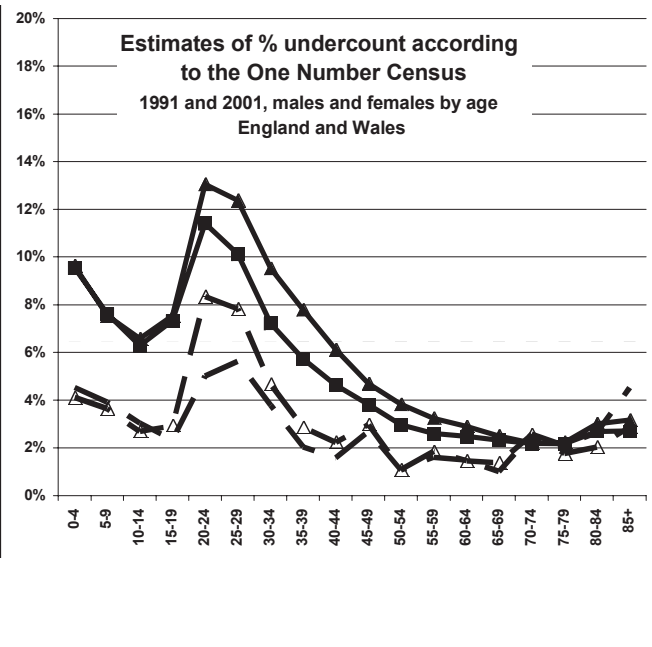
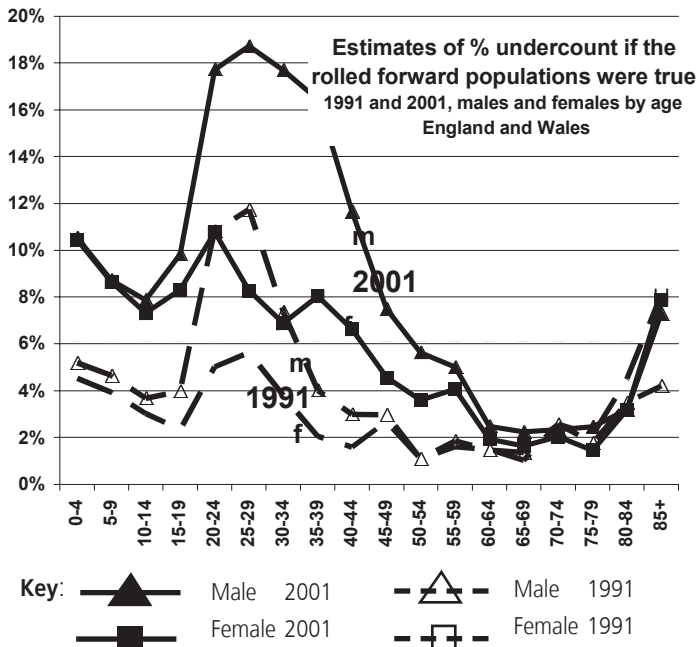
Rather than speculation, it is reasonable to expect evidence of such trends, in order to be reassured as to the real explanation of the 'missing million' in 2001. Reliance on internal evidence from the census regarding its own completeness is not convincing and external validation is essential.

There are three ways in which evidence may pin down the reason for the discrepancy between the ONC and the rolled-forward estimates. First, demographic analysis can suggest whether the discrepancy is reasonable in terms of its implications for non-response, for sex ratios and for other demographic rates. Second, analysis of UK and overseas migration data may show evidence of the unmonitored emigration. Third, another estimate of population, independent of both the census and the CCS, would help to dispel concern about the dependence of those two.

It was not this review's aim to undertake original analysis, except in limited circumstances, but to review the evidence that was available. We discuss each of these three types of evidence and in doing so address the concerns (a) to (d) expressed by local authorities. But it is clear that more could be learned from further analysis including further publication of the analyses that ONS considered during their own quality assurance of the census results.

Demographic analysis

The charts overleaf show the non-response to the census implied by two estimates of the full population in 1991 and 2001 for England and Wales. First, the population rolled forward from 1981 to 1991 and the projection of 2001 from 2000 by the Government Actuaries Department. Second, the ONC population estimate for 2001, and the 1991 population after revisions in 2003. In each case the undercount is the difference between the population estimate and the number of residents enumerated in the census, before imputation of records for absent households and other non-response (the data are given in appendix B).



If the ONC were wrong, and the populations rolled forward from 1981 were correct (left hand chart) then there has been a high level of non-response among men and women in their thirties, a change from 1991. This could be seen as a 'cohort effect', a continuation of non-participation by the cohort who were in their twenties in 1991.

If, on the other hand, the ONC is correct, 1.14m people have left England and Wales unmonitored during the 1980s and 1990s (right hand chart). The estimated response rates are lower than if the rolled forward population were true. On these assumptions embodied in the ONC, estimated non-response to the census has increased most among groups other than men in their twenties, rising to 5 per cent to 10 per cent for children as well as those in their thirties and forties; it has become less male-dominated than in 1991 for adults in their twenties.

Both these findings would be unusual and are sufficiently large to expect corroboration in studies of social attitudes. However, neither pattern is found. For example, the British Social Attitudes Survey found neither a relative increase in voting

abstentions and disaffection among those in their 30s during the 1990s, nor a greater increase in groups other than men in their twenties (who if anything showed deeper disengagement than in earlier years).⁴

On this basis one might believe that two things have happened. The census has indeed highlighted a bias in the estimates of international migration. At the same time, it has missed a substantially greater number of young men aged in their twenties than have been allowed for in the ONC.

However, a third explanation would be that the revised 1991 populations are in error, such that the child and older-age non-response was in fact higher in 1991 than shown by the revised estimates in the right hand chart. Given the weaknesses in all estimates of the 1991 population, this is also quite feasible. In this case, the implied level of emigration would remain unchanged, but its distribution between the two decades 1981-1991 and 1991-2001 is in question. A clear consequence is that analyses based on the 1991 population should not take it as reliable.

⁴BSAS indicators of political interest and involvement in organisations, 1989-2001 collated by Eldin Fahmy.

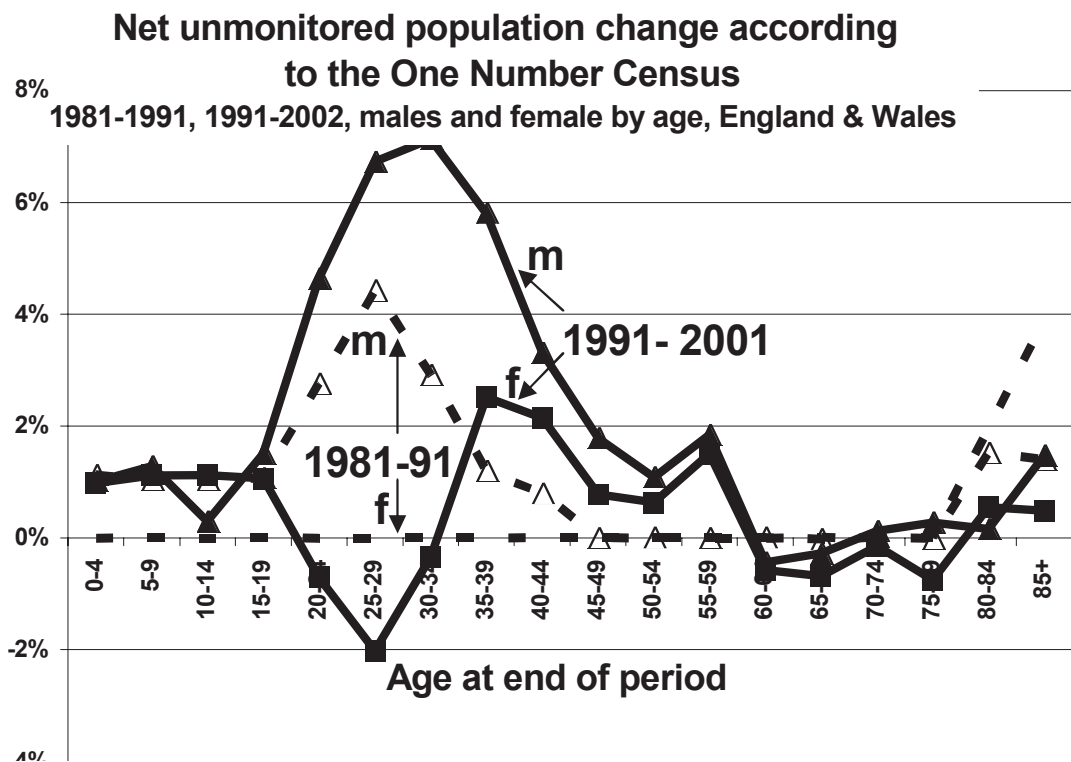
Other demographic analyses of mortality, household change and sex ratios may help to validate the ONC. We have compared change in household spaces with the change in dwelling stock estimated by government, but conclude again that the differences may indicate a shortfall in the ONC resident households, or be due to the changed measurement of students and vacant spaces in the two censuses, or a mixture of both (appendix C).

Non-response rates estimated by the ONC by broad age-bands and type of authority show unusual patterns (appendix D), which require either explanation or questioning of the adjustments in the ONC by sex and age for authority type. Nationally the ratio of male non-response rate to female non-response rate shows an excess of 20 per cent. This excess is only 11 per cent for Inner London and 15 per cent for Outer London and nearer 30 per cent for other authority types. The

patterns by age-band are also puzzling, with the percentage excess of male over female non-response bigger at ages 40-59 than at ages 20-39 rather than the reverse we would expect.

Migration

The chart below shows the net unmonitored migration implied by the ONC results (the data are given in appendix B). The ages shown are those at the end of the decade. The age at migration would be somewhat younger. The chart is calculated from the difference between the population estimates before and after the 2001 ONC.



The allocation between the two decades (351,000 in 1981-1991, and 789,000 1991-2001), was made by ONS by assuming that sex ratios changed evenly between 1981 and 2001, and that the estimates for women under age 80 in 1991 cannot be improved upon in the light of the findings of the 2001 Census.

The patterns are not consistent across the two decades. If the 2001 ONC is correct, then either the nature of unmonitored emigration changed towards older men and women in the second decade, or the allocation to the first decade is insufficient. There is significant net unmonitored emigration (around 1 per cent of their population) of children. These children could be, argue ONS, children of mothers temporarily in Britain whose birth is registered but who leave Britain within a year of their mothers entering Britain. They are never residents and therefore not strictly speaking emigrants either. To this extent the births registration would be erroneously adding residents to the population estimates. This points to another area of uncertainty - the definition of a resident in England and Wales when an increasing number of people live for some parts of the year in different countries.

There is also some implied unmonitored emigration of adults of older working age, and the very elderly. There is no implication of unmonitored emigration associated with retirement ages of 60-74, as might be expected of those born overseas. The net unmonitored immigration of 54,000 women aged 20-34 in 2001 requires a separate explanation.

The above paragraphs describe the composition of unmonitored emigration implied by the ONC. One might expect some evidence of this large unmonitored outflow of residents. At an annual average of 79,000 during 1991-2001, it represents a very substantial addition of between one third and one half to the monitored outflow.

International migration statistics generally are not of high quality; the weaknesses of the International Passenger Survey (IPS) have long been recognised, and concern its sample structure, its sample size, and the identification of migrants through their stated intention at the time of migration to remain in or out of the UK for a year or more.

We have found no direct evidence of such a large strongly male-dominated stream of migration away from the UK. It is hard to find such evidence because the UK is not alone in having poorly estimated international migration. Australia is considered to have the only reliable and complete international migration statistics. ONS has drawn attention to the discrepancy between Australian and UK statistics of migration between the two countries, but although it records a greater net flow from the UK than the UK records to Australia, there is no male dominance of flows from the UK. Key evidence would be the composition of those emigrants from the UK with visas for less than a year who extend their stay in Australia. This has not yet been tabulated. Australia is only one of the key destinations for emigrants from Britain. There may be other ways of identifying the composition of emigrant flow, for example through the requests for driving license details from other countries' licensing authorities.

Had there been strong economic or social pressures encouraging movement of young people from the UK to other countries, one would expect some of that movement to have been monitored; on the contrary, the IPS shows equal numbers of male and female young adult emigrants and little change in the size of flows during the 1990s. Both in 1991-95 and in 1996-2000, more women than men aged 20-24 were recorded as leaving England and Wales for overseas. Only flows recorded by the IPS to the 'old Commonwealth' in 1999-2000 were in favour of males: 72,000 males to 54,000 females aged 15-44.

Immigration to developed countries has increased despite a variety of legal restrictions through immigration controls. It has been suggested that those asylum seekers and other immigrants to Britain who have left the country shortly after their application to stay has been refused, would not be recorded as emigrants by the IPS. Their original immigration is included in population estimates through figures provided by the Home Office. Applications for asylum are 80 per cent from males, and over 50 per cent aged 20-34. Dependants represent a further 25 per cent to 30 per cent above applications. These are likely to be women and children, but the age and sex composition of dependants is not compiled by the Home Office. An unmonitored emigration of refused asylum seekers is plausibly male dominated, even if not exclusively so. On the other hand, those who do not emigrate have a strong incentive to remain statistically invisible.

Taken together, the evidence for such a male-dominated unmonitored flow of migrants is not forthcoming from an area of statistical data with many weaknesses. ONS has considered all these data and many others which will be reported from its current quality review of international migration in 2003. It is essential that ONS publishes, as a matter of urgency, a detailed case as to why the missing million is likely to be a result of unmonitored migration rather than census undercount. It is also essential to find a measure of international migration that is accurate and independent of the census, so that population estimates can be reliably updated. ONS' current reviews of international migration statistics intend to do this.

Dependence

ONS felt that since the CCS was organised separately from the census, and undertaken by pairs of interviewers, those missed by the Census would not be more likely than others to be missed by the CCS. While there was an intention to test this assumption, plans were put in place ahead of

the census that relied on stable sex ratios over time. Since the census showed a very different sex ratio from previous years, other methods of measuring dependence were addressed by ONS during the analysis of the results, when the shortfall of 1.37m people in England and Wales demanded an explanation. An addition of 230,000 people in households missed by the combination of census and CCS, was made by ONS. An independent estimate of the number of households in each region was used, derived from the calibration of the Postal Address File (PAF) by fieldwork of the Labour Force Survey.

In their documentation for this adjustment, released on December 24 2002, it was stressed that a similar calculation for additional individuals missed within households that had been enumerated was not possible due to the lack of an independent count of individuals. We have looked at the two aspects separately. It is our understanding that dependence is a possible source of error in the ONC and a priority to address in future census developments.

(a) Household adjustment

We believe that it was correct to have made an allowance for dependence between the census and the CCS, and view the adjustment made as a brave and justifiable one. The lateness of the documentation, its lack of technical clarity, its high technical level at most points, its tag as a draft, contradictory results in different tables, and the untested assumptions that were involved in the adjustment, all emphasise the lateness with which the work was developed.

Some examples of the assumptions point to the uncertainty added in the application of this adjustment (page references refer to the ONS dependency paper⁵). First, the pattern of odds ratios (p14) and percentage adjustments (p32) across hard-to-count areas within regions is counter to the assumption made of higher dependence in areas of higher non-response when

⁵Dependence within the One Number Census, Abbott, Brown and Diamond. ONS, www.statistics.gov.uk/census2001/pdfs/dependency_paper.pdf

sharing the adjustment to local authorities, and is not discussed. Second, the arbitrary decision to average Census and PAF estimates (p12 of the ONS paper) seems worth having reported tests for robustness. Third, the allowance is unlikely to be distributed properly to areas where non-response is occurring in multi-occupation areas with single PAF address and where response to CCS and census is dependent. Fourth, the use of rather small samples and data a little out of date (1999), though the best data available. Fifth, the region/hard-to-count stratification as a substitute for specific address to household ratios in each CCS sample area or LAD. Sixth, it is likely that gross undercount and gross overcount in PAF are not globally counterbalancing, nor distributed in similar locations. It is likely that some locations are significantly undercounted and others significantly overcounted, via new construction, demolitions, conversions or other systematic errors.

None of these uncertainties are incorporated in the ONC confidence intervals.

(b) Lack of adjustment for dependence of individuals within households

The ONS contingency strategy relied on accurate sex ratios from the rolled-forward estimates. Evidence from the census threw doubt on the accuracy of those sex ratios and therefore this plan was not implemented. There is no obvious solution. None of the person comparators such as patient, birth and benefit records have been calibrated independently of population estimates, though this must clearly be a priority for future government demographic work.

Despite every effort to get independence of fieldwork, real independence in the results is unlikely. ONS have argued that internal evidence from the CCS shows that the coverage of people within counted households was good (and therefore the estimates are robust to even high levels of dependence). We are not convinced that such a claim can be substantiated without

evidence external to the CCS. It must remain probable that people who were missed from counted households were also likely to be missed by the CCS. These would include people who were not considered resident in any household, those who feared enumeration for a variety of reasons including those related to illegal immigration, receipt of state benefits or payment of child support, and those whose refusal to co-operate was respected by the form-filler at enumeration and at the time of the CCS. Young men are most likely to fit these categories. The extent of the undercount induced by dependence within households is unknown, and this remains a pressing problem for investigation. It may be indicated by the demographic analysis given above showing an unusually low measured non-response for young men.

Overall the dependence adjustment of 230,000 additional persons is roughly equivalent to a national odds ratio for dependency of about 1.5. The simulation work before the census dependency adjustments were made examined an odds ratio of around 3:1 and an extreme case of 8. A uniform national odds ratio of 2:1 would add about a further 230,000 persons and one of 4:1 would recover the missing million adding about 1,150,000 persons⁶. With a uniform national odds ratio (an unlikely occurrence) about 44 per cent of all additional persons would be allocated to Inner London and 23 per cent to Outer London, as might be expected on the basis of differing response rates.

To put these numbers in context, the table overleaf shows an example population of 1,155 people. The numbers are fictitious, chosen to make some of the calculations easier. This population shows a response rate of 95.2 per cent to the census and 90.9 per cent to the CCS, close to the ONS estimates for the 2001 census in England and Wales (93.9 per cent and 90.8 per cent respectively). The level of dependence is measured by the odds ratio of CCS response rates for those

⁶These estimates are based on the estimates of proportions of persons missed in both the CCS and the Census at the national level. Since an odds ratio of 1 (independence) was assumed everywhere at the cluster-age-sex group level, we can simply multiply the proportion by the odds ratio minus one to get an approximate estimate of the impact of differing dependence assumptions.

missed by the census and those counted by the census. In this case that ratio is $(5/100)/(50/1000) = 1$, showing no dependence. The bottom right hand cell can never be counted in practice - these people missed by both the census and its coverage survey are estimated to number five on the assumption of independence. If there were dependence, this number would be larger than five and the population would also be estimated to be larger. For example, an odds ratio of two implies that 10 people were missed in this way, five extra than would have been expected with no dependence. The total population would be estimated as 1,160 and the response rates of the Census and the CCS would as a consequence be slightly lower.

Without an independent check, the actual level of dependence cannot be known.

	Census - counted	Census - missed	Total
Coverage Survey - counted	1,000	50	1,050 (90.9 per cent)
Coverage Survey - missed	100	5	105
Total	1,100 (95.2 per cent)	55	1,155

3. the quality assurance of the sub-national results

The Quality Assurance (QA) strategy for the ONC included the use of comparators from demographic estimates and administrative records "to calculate a range of plausible values for the number of people of each sex within five-year age groups in each geographical area" (ONC⁵). The comparators were available for each local authority, based on counts of GP patients, child benefit cases, pensions, school census and births, and the rolled forward estimates. If the ONC did not fall within the diagnostic range of plausible values, set at approximately double the range of the comparator data sets, then a number of more qualitative checks were to be made before a contingency strategy could be invoked. The contingency strategy would not substitute the comparator datasets for the census data, but would 'borrow strength' from similar areas by substituting their non-response rate. Further specific checks on the numbers of students, prisoners and armed forces were made for each area.

In the event, the strategy of borrowing strength from other areas was used in only two cases, and then due to a small sample size rather than use of the comparators' range of plausible values. This was so even though the final ONC value falls outside the diagnostic range on many occasions.

Local authority concerns

Many local authorities have compared the results of the census with their expectations, much as in the QA process planned by ONS. They have expressed concerns about the following issues:

- a) the information released from quality assurance has been inadequate;
- b) the agreed QA process was abandoned by ONS;
- c) poor quality enumeration of difficult areas may have been missed;
- d) local data and knowledge were not sufficiently included;
- e) too few students were allocated to areas close to higher education institutions;
- f) there are patterns of poor, non-white and student areas suffering from lower than expected population counts that could be due to un-monitored non-response;
- g) the national 'story' of emigration does not fit the areas with lower population estimates than expected; and
- h) More detailed and localised information from the census should be used for further quality assurance.

Review of concerns

When population estimates for census day 2001 were published on September 30 2002, local authorities had questions about the quality assurance procedures, especially where their population was lower than previously estimated. Given that most areas' quality-assured populations were below the diagnostic ranges given by comparators for the total or for several age groups, the level of interest in the ONC quality assurance was entirely predictable and ONS should not have been taken by surprise.

Thus their concern (a) that information on quality assurance was insufficient reflects ONS' inability on this occasion to be focused on the needs of local authority customers. This is not to suggest that ONS did not attend to local authority queries. Local authorities attended seven 'walk-throughs' at ONS offices where the quality assurance process was described and specific data from their areas were discussed. This review team has also received willing help and many relevant data from the ONC staff at ONS.

The issues are more the timing and completeness of the information provided. Quantitative information from the quality assurance was issued on 24 December in the form of a 'QA pack' for each local authority, three months after the census

results had been issued. It lacked the qualitative information that had been contained in an illustrative example pack circulated by ONS in October, and contained no values for the individual comparators.

The ONS did not sufficiently plan for the interest that the quality assurance would give rise to, and dealt with that interest in a fire-fighting mode, area by area. That was certainly a necessary response, which engaged the authorities with greatest concern. In addition, an overall multi-area and multi-variable analysis of the discrepancies between the ONC and the comparators is a necessary output. As staff involved take their experience with them to new posts, it is likely that opportunities to learn from the quality assurance will be lost. There are potential lessons about the census fieldwork, about the comparators themselves, and about the potential for future quality assurance.

Concerns b) to e) suggest that the comparators' role could be greater than was implemented by ONS. The general point was summarised very strongly by one local authority: *"I doubt that we would have agreed the methodology if ONS had said they would ignore the quality assurance data whatever the differences showed and would make 'judgement calls' based on whatever they thought best, but they wouldn't be telling us what that was and there would no appeals procedure"*. While ONS did not ignore the comparators, the diagnostic ranges did not often trigger a change to the ONC, and this requires explanation.

In several cases there was evidence in the quality assurance to suggest a problem with the ONC estimate, such that the estimate was changed, and these were described in documents published on 24 December 2002. They involved the adjustment for household dependence; increasing the non-response for children under one to match that of one-four year olds; the collapsing of age sex categories where the sample results for an individual category seemed unreliable; student,

prisoners and armed forces adjustments where independent evidence suggested it was necessary. Many of the details of these adjustments and the comparisons involved have not been published. For student numbers for example, it would reassure local authorities and census users generally to report the regional quality assurance analysis, and the adjustments made to 40 local authorities.

In over 20 per cent of the 13,912 comparisons (37 age-sex groups in each of 376 LADS), the ONC, after these adjustments and those for household dependence discussed in chapter 2, still lay outside the diagnostic range of values based on the comparators. In accordance with the agreed quality assurance strategy, this did not trigger an automatic adjustment to the census. Instead, a range of qualitative and quantitative information was considered to determine whether the census or comparator data should be believed. The ONS argument is as follows: given the differences with the comparator data, there was no corroborating evidence to suggest a wide-scale failure of the census and CCS fieldwork or the ONC methodology. Comparisons between the census and the comparator data revealed similar patterns across the country, in areas of both high and low response. For example, the difference between the census and the comparators for young men in their twenties and thirties was repeated in most areas of Britain, including those areas where a high response was achieved and has always been achieved historically. Given:

1. the absence of any evidence of failure with the Census fieldwork or methodology;
2. the findings of demographic analyses, investigation of parameters from the estimation process and other ad hoc analyses conducted as part of the quality assurance process; and
3. the well-known problems with the comparator data;

this confirmed the accuracy of the ONC results.

We would question this argument in two ways. Insofar as the ONC is robust and consistent, it is reassuring that there are not irregular holes in the census. However systematic biases may remain. First, there may be dependency between the census and the CCS as discussed above. Second, there may be undetected failure of the CCS in the hard-to-count areas because there are no similar areas from which to borrow strength. A CCS of poor quality in the hard to count districts could not be corrected by the quality assurance strategy. In these circumstances, rejection of the evidence of the comparators, even where they suggest problems with the ONC, seems a practical decision rather than a scientific decision.

We look forward to the publication of demographic analyses, parameters of the estimation process and other ad hoc analyses conducted as part of the quality assurance of census results by ONS.

A major difficulty with the administrative comparators is their lack of comparability with a population estimate based on the census enumeration. Each administrative register tends to lag behind population change for a specific area as moves are registered with an unquantified delay. Delayed entries onto a register cause a deficit such as is observed in patient and child benefit records for infants; delayed exits cause an excess; amendments to records cause duplicate counts in some registers. Additionally, the definition of a resident and of a household is often different in each register because the rules for eligibility have regard to entitlement to benefits or duties of one kind or another, rather than to population counts.

It is thus not so surprising that no local authority has yet produced a completely persuasive case for the census being wrong rather than different; nor that the ONS were not persuaded by the ONC lying outside the diagnostic ranges. That unfortunately does not mean that the census is more correct than the comparators in every case. We fully support both ONS' declared intention to

improve the use of administrative records for population statistics and local authority efforts to validate their own comparisons of administrative records in relation to the census.

The use by ONS of an adjusted administrative count to give an independent count of households allowed them to measure household dependence between the census and its coverage survey. This indicates the goal of administrative records in this context. It is not enough to calibrate counts from administrative records against the census. It is essential that surveys calibrate the best administrative records to achieve a source of population counts at least at national level that are accurate independently of a census. Only then can the census-based population estimates be fully quality assured.

The pattern of discrepancies between the ONC and comparators is the subject of concerns (f) and (g). There seems to have been relatively little analysis of the discrepancies beyond the area by area examination planned as the quality assurance. Where the absolute numbers of the comparators were wrong, rejection of these sources as containing no useful information (or at least none strong enough to question ONC estimates) would be unwise.

Much more could be made of regression-type relationships to take account of the weaknesses of each indicator prior to examining the apparent outliers. The knowledge of local authorities where the comparator datasets are shown to be unusually divergent from the ONC should be included in detailed evaluation aimed to improve both the comparators and census procedures.

Regarding concern (f), it is not the case that the excess of the rolled forward estimates is higher in poorer areas, but it is higher in student areas and areas of ethnic groups other than White (Appendix E). This would indicate a problem of estimating not necessarily these groups but areas of change and transient populations in which they often live. The

discrepancy is not a measure of error in the ONC, given the difficulties of producing accurate rolled forward estimates in such areas. For example, previous investigations in 1981 and 1991 have shown them to under-estimate city areas more than other types of area. Since the rolling-forward methodology has been unchanged for most of the past decade, perhaps it is of concern that there was no difference between city areas and others in 2001. Again, an analysis of the patterns of discrepancies would yield useful information about the census and the comparators.

Concern (g) notes a mismatch between the national 'story' of unmonitored emigrants from all parts of the UK, and the sub-national distribution of that effect. The differences between the rolled forward and ONC estimates for 2001 are heavily concentrated in a limited number of LADs (Appendix F). A few districts in each region account for over half the difference. In some cases the cause has been recognised as a distribution of international immigrants wrongly concentrated in a few Districts with existing high numbers of residents born abroad. Superficially, the sub-national discrepancies give the impression of an over-estimation of in-migration, rather than a general under-estimation of emigration. There is a need for the sub-national 'story' to be explained in a way compatible with the 'national' story.

The concentration of the bulk of such differences in a limited number of districts suggests that more narrowly defined streams of emigrants may need investigating, including return migration streams relating to students and US armed forces and their dependants. It is plausible that the IPS misses some return emigrants because despite initial intentions, they do not end up staying 12 months; or they leave for another intermediary destination which they do not intend to stay in for over 12 months; or they leave via transport systems not surveyed by the IPS. Perhaps a residual analysis of the population by country of birth could provide evidence of an under-estimated return migration stream associated with returning asylum seekers,

students and US armed forces and their dependants, or other possible return streams.

Many local authorities expressed concern (h), that further information would become available with which to judge the quality of the population estimates, in particular from the census releases relating to detailed district tables and the tables for areas within districts. Inasmuch as the ONC aims to provide population counts for these district sub-populations, such comparisons will be useful. However, these sub-population comparisons will not necessarily throw light on the quality of district population totals. This is because the methodology of the One Number Census smoothes the variation in response rates within a local authority district. Non-respondents from substantial holes in the fieldwork may be correctly included by the ONC within the total for the district, but are likely to be spread more evenly than residents' real addresses, despite the use of dummy forms and the characteristics of areas with missed people when allocating non-response within districts.

We want to express our agreement that the 2001 Census and its quality should be the starting point of discussion, not the rolled-forward estimates. The latter become progressively less accurate because of the impact of uncertain estimates of migration within Britain. Interesting work on mortality rates confirms the general pattern of the 2001 Census as preferable to the rolled forward populations. ONS have published life expectancies for local authorities using registered deaths, and population estimates before and after the 2001 ONC⁷. Life expectancy is affected most by mortality among infants and at middle age, where relatively high mortality rates combine with many lost years of life. These analyses do not throw light on the numbers of younger adults, but do confirm that the census makes more plausible mortality rates than the rolled forward estimates for local authorities, as a whole. One would expect the ranking of local authorities to remain relatively unchanged over a decade. This is more so for the revised population estimates than for the previous

⁷Life expectancy, Denominators compared, November 2002. ONS. www.statistics.gov.uk/downloads/theme_health/LE1991_2001_websitereport_a.pdf
Life expectancy, revised March 2003. ONS www.statistics.gov.uk/statbase/Product.asp?vlnk=8841

series; as a summary, the correlation between 1991 and 2001 female life expectancy rankings is 0.855 and 0.817 for the revised and rolled forward series respectively, and 0.898 and 0.880 for males . This is comfort for the pattern of sub-national population change shown by the 2001 ONC.

In summary, the information from quality assurance of the ONC populations has not met the reasonable needs of local authorities. There are many investigations that could help to evaluate the census and improve future estimation, that have not yet been undertaken and published, and which should focus on the pattern of discrepancies between the ONC and comparator statistics. In these investigations, local authorities have much to contribute. One aim must be to develop population estimators based on administrative records that are independent of the census.

4. uncertainty in the population estimates

Another first for the ONC is the provision of confidence intervals around census output.

In addition, the size of the changes from the rolled forward population to the 2001 ONC population, greater for many areas than after the rebasing of previous decades, has focused attention on the reliability of rolled forward populations between censuses.

Local authority concerns

Local authorities expressed the following concerns:

- a) confidence intervals imply that some district population estimates will be in extreme error;
- b) uncertainty is too great in the district population estimates; they may no longer be fit for purpose;
- c) the relative uncertainty for sub-populations will be greater than for district populations; and
- d) confidence intervals and the ONC estimate of a full population demand a new attitude to census accuracy.

Review of concerns

The 95 per cent confidence intervals relative to the population total, published with the ONC, show a maximum of plus or minus 6.1 per cent of Luton's population estimate, falling to 5.6 per cent for the outer London borough of Croydon, between 4 per cent and 5 per cent for five Inner London boroughs, and less than 4 per cent of their population for every other district in England and Wales. The relative confidence intervals for age groups are higher than those for district totals. Taking the confidence intervals at face value, most true populations would lie much closer to their estimate than to the outer limit of the confidence interval. But by definition, as in concern (a), one would expect 1 in 20 of the 376 local authorities' true populations to lie either higher or lower than the stated 95 per cent confidence interval. About nine local authorities' true population would be higher, and nine lower than the confidence

interval. In principle the hope would have been that the quality assurance process would have identified and eliminated these outliers, but doubts about comparators eliminated this possibility.

Some of the adjustments made during the quality assurance, for students and armed forces for example, may have the impact of reducing the confidence interval from that published. On the other hand, the uncertainty surrounding other adjustments such as that for household dependence is likely to be larger and add to the published uncertainty. Any systematic bias resulting from census procedures, including higher levels of dependence than estimated, would not be taken into account at all in the confidence intervals.

There is a need to work through the implications of this level of uncertainty to its impact on the allocation of resources and other applications of the census, to address concern (b). ONS have begun to quantify the reliability of census output for sub-populations as in concern (c). For many variables, imputation is the greatest component of uncertainty in the tabulated output. For other variables including ethnicity, other influences (data capture, editing of missing values and rounding) together add an equal or greater uncertainty. Local authorities are right to be wary of the output for certain themes such as commuting between authorities with low response rates, which could usefully be the subject of special quality reviews.

Confidence is not purely statistical. There is a wide understanding that the published confidence intervals depend on the assumptions made during their estimation. To the extent that quality assurance of the ONC has proceeded without the transparency hoped from procedures agreed beforehand, confidence in the accuracy and fitness of the results is reduced. In that sense, concern about the estimation of the population total has led to concern about the census itself.

Three general conclusions emerge. First, the

production of confidence intervals around the census and population estimates is a consequence of the aim to achieve a complete representation of the population through an expanded census coverage survey. It is a strategy which local authority users have supported and continue to support. It does not reduce the population estimates' reliability but simply attempts to express it honestly. ONS' description of the ONC as "the best possible population estimates for every area" will be underscored, not undermined, by a discussion of weaknesses and improvements.

Second, the 0.5 per cent non-enumerated population of 1981 has turned into a worryingly high 6 per cent in 2001, with some uncertainty about the estimation of this figure and much higher levels in some LADs. The uncertainty in population estimates is too much to accept as a regular and continuing phenomenon. It reflects the UK population's circumstances and relationship with official enquiries. Methods of better estimating those who are hard to reach and hard to count must be a high priority for future work. This applies not only to censuses but to other population estimates and more generally.

Third, while the process of quality assuring population estimates should be and in this case was agreed beforehand, confidence in the outcome also requires release of evidence used during the implementation of the agreed process.

5. recommendations

The concerns we have reviewed express a lack of full local authority confidence in the ONC and its quality assurance procedures. Local authorities regard the provision of complete and accurate population statistics as of vital importance and for that reason enthusiastically welcomed the ONS initiative to produce a full and unbiased population database from the 2001 Census by means of the ONC process. The fact that the outcome has raised some worrying questions should not be allowed to detract from recognition that the ONC is a major step forwards.

However, our review has raised a number of issues which must be addressed if greater confidence in the 2001 Census results is to be achieved, and the process refined for subsequent censuses. We believe that each of our recommendations to ONS requires a timetable and a forum in which local authorities and other users of population statistics can contribute.

We strongly recommend that, for local government, the Central and Local Information Partnership (CLIP) Census sub group and the Liaison Group on Population Statistics should provide the fora. In that CLIP is about partnership, then local authorities, ONS and government departments should work together on these issues. The recommendations should be divided between the sub groups according to topic, and by agreement between ONS and the LGA, and the agendas for future meetings linked to the timetables at which ONS expect to report.

1. The evidence and expert judgements involved in the quality assurance of the ONC should be supported with published analyses.

User confidence is built on an understanding and acceptance of the imperfections in any census data, and knowledge that those imperfections are being addressed for the future. The following should be among the analyses performed and released:

- a full and complete account of the evidence for the ONS case that the missing million is indeed a result of unmonitored emigration rather than residual undercounts in the ONC. This would include a full review of evidence concerning the age and sex composition among migrants from the UK to Australia who overstay their visa for under one year, and other overseas evidence that helps to assess the quality of UK international migration statistics;
- multivariate and other analysis of the discrepancies between comparators and District ONC estimates, to identify outliers which pinpoint problems with the comparators and the ONC estimation, followed by work with local authorities and others to improve use of the comparators;
- dependence measurement, strategies considered and adopted;
- analysis of the characteristics of estimated non-respondents and imputation within districts, including release of output area and ward imputation counts by age and sex;
- analysis of mortality over time, place and social class;
- detail of the representativeness of the CCS;
- analysis of sex ratios of the ONC population and response rates for LADs;
- analysis of household size, structure and comparison with changes in stock of dwellings;
- detail of all adjustments made during quality assurance; and
- consideration of extensive follow-up of the Longitudinal Study's 1991 members who were not found in 2001, to quantify emigration.

2. The issues of enumeration that make population size hard to estimate should be tackled with high priority:

- some weaknesses of census fieldwork and estimation procedures have highlighted this issue. It is not new nor is it limited to the census;
- the household matching exercises currently being undertaken for Manchester and Westminster with cooperation from ONS should be carefully assessed to improve household listings;
- significantly improved enumeration may involve statistical, political, and ethnographic strategies which should each receive dedicated attention.

3. Key administrative sources must be assessed and calibrated not only against the census but as independent indicators of population size:

- it is essential that surveys calibrate administrative records to achieve a source of population counts that are accurate independent of a census, in much the same way as the address count was calibrated by the Labour Force Survey. We would strongly support pilot work on matching the various administrative records in order to improve their use in subsequent censuses. This will provide at least one independent count of persons that was missing for the 2001 census and its coverage survey;
- the definition of which temporary residents and many-homed residents should be counted in population statistics will need to be answered to succeed in this work.

4. Development of population statistics and the census should be accompanied by a focus on the needs of statistics users in such a way that maintains their confidence in the methods and products:

- the welcome attention of the ONC to accurate area-by-area population statistics created legitimate interest in the methods and results of statistics which could have been better served. Given the high interest in statistics for sub-national areas and their greater availability, a more directed resource may be needed to implement the 'citizen

focus' enshrined in the National Statistics codes of conduct and the CLIP Concordat on Statistics;

- access to data and to analyses that support ONS judgements can be planned for as a matter of course;
- documentation in plain language can address the detailed strategies and assumptions of sophisticated methodology;
- methodology should be no more complex than can be shown to achieve greater fitness for purpose in the outputs;
- the best use of confidence intervals in sub-national planning should be the subject of study and advice.

5. Local authority concerns with their own population estimates should be treated as opportunities to learn how population statistics can be improved generally:

- the understanding gained by ONS and local authorities in their current questioning of the ONC and comparator datasets should be collated, reviewed and disseminated.

6. The precise definition of the population to be counted in each location should be reviewed and agreed:

- at least part of the difficulty in enumerating students, the armed forces and temporary residents of other types in 2001 was the absence of clear instructions on the census forms as to who was to be included and where. The occupation of more than one dwelling for different parts of the week or year, and the consequent confusion as to who should be counted where is a possible cause of the alleged undercounts in some of the larger cities;
- a research project is required to investigate all the varying living arrangements within the UK, with recommendations as to what is the optimum definition of population for the planning of public

services, and therefore the population to which the bulk of census output should relate;

- there should also be recommendations regarding subsets of the population on which it would be desirable for the census to collect limited information, to maximise the utility of the census in the widest range of contexts: the optimum definition of population is unlikely to be sufficient;
- these recommendations should be the subject of detailed discussion through the population and census advisory committees, with a view to defining that definition of the population commanding the support of the largest number of census users.

The following current government initiatives are addressing some of the above points, with timescales unavailable at the time of our reporting:

- National Statistics Quality Review of International Migration;
- Citizen Information Project, a feasibility study for the linking of information from personal administrative records;
- Population Estimates Study, a cross-department review of the demand population statistics and how best to meet it;
- One Number Census, quality report.

Advice to local authorities

For the great majority of authorities, there is every reason to believe that the 2001 Census results are reliable. Whether they are accurate to + or - 0.2 per cent, as ONS believe is debatable, but margins of error are likely to be very low. The advice of this report is therefore that most authorities should use the census results with confidence.

There are two groups of authorities who need to look carefully at their Census results. Firstly, those authorities with large numbers of students or armed forces. Secondly, those with high proportions of houses in multiple occupation or

other types of temporary residents including seasonal labour and recent immigrants.

For those authorities containing populations in group one only - students or armed forces - there is no reason to doubt the census results for the non-student and non-armed forces population. Where possible, authorities should compare the census counts of students and armed forces and their dependents with their own estimates, since it is known that ONS had to have recourse to alternative sources to compensate for low response from these two groups. Authorities are advised to raise any serious discrepancies with ONS.

The census results for those authorities in the second group above are the most prone to serious error because they are likely to contain the highest concentrations of the difficult to count populations. Low response rates in these areas require the highest margin of correction via the ONC process, and any under estimate of the degree of dependence between the census and CCS would affect the census results for these areas most severely. On the other hand, without a reliable alternative population figure, it is impossible to improve on the published census results.

The advice to these authorities is to furnish ONS with whatever evidence they have which would question the veracity of the census, and to cooperate whole heartedly with the recommendations to ONS above, designed to increase confidence in the 2001 census results, and to improve quality assurance in future censuses.

Local authorities should use the census as published. The ONC procedures emphasise that the census count should not be treated as exact truth, but contain a margin of error which should be respected when analysing and understanding the results. Investigations will continue into specific possible weaknesses of the census, but there will not be an improved census database.

appendix A: local authorities responding to the survey

Arun	Stafford
Barnet	Stoke
Barnsley	Stratford-on-Avon
Basingstoke	Suffolk CC
Birmingham	Suffolk Coastal
Blackpool	Surrey CC
Bournemouth	Surrey Heath
Bradford	Telford and Wrekin
Bristol	Tower Hamlets
Broxtowe	Westminster
Cambridgeshire CC	Wiltshire CC
Cannock Chase	Windsor and Maidenhead
Cardiff	Wirral
Chester	
City of London	
Cleveland	
Coventry	
Crawley	
East Sussex CC	
Epsom & Ewell	
Gateshead	
Gloucestershire CC	
Greater London Authority	
Hampshire CC	
Haringey	
Herefordshire CC	
Hertfordshire CC	
Hull	
Kensington & Chelsea	
Leicestershire CC	
Manchester	
Milton Keynes	
Neath Port Talbot	
Newcastle	
Norwich	
Nottingham City	
Nottinghamshire CC	
Oldham	
Oxford	
Peterborough	
Richmondshire	
Rochdale	
Rotherham	
Salford	
Sedgefield	

appendix B: data for demographic analysis

Comparisons of Census enumeration, Census-based population estimates and rolled forward population estimates, 1991 and 2001, before and after revision to 1991 data.

15 April 2003

England and Wales

The age-structure of those missing in 1991 and 2001 is one of the key pieces of evidence by which to judge the ONC.

To examine that evidence, six age-sex compositions are required as follows:

Total for E&W

- 1 49,084,000 The census enumerated count by age and sex in 1991. Received from ONS March 2003, subsequently rounded to nearest 10.
- 2 48,843,000 The census enumerated count by age and sex in 2001. Derived by applying published response rates to the ONC.
- 3 51,100,000 The Rolled Forward estimate for 1991 – the revised final estimates for mid-1991, published 1993.
- 4 53,174,000 The Rolled Forward estimate for 2001. The GAD projection from 2000 has been used.
- 5 50,748,000 The ONC estimate for mid-1991. As revised Feb 2003.
- 6 52,042,000 The ONC estimate for 2001.

1 Census enumerated 1991.

Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	23,791,990	1,669,320	1,580,100	1,515,710	1,618,130	1,806,380	1,968,780	1,762,340	1,617,670	1,516,290	1,341,470	1,256,030	1,215,860	1,133,320	855,960	641,300	369,060	186,010
F	25,291,960	1,594,330	1,504,090	1,439,700	1,843,360	1,966,250	1,788,850	1,638,720	1,815,390	1,517,190	1,340,780	1,272,650	1,299,890	1,312,880	1,123,000	993,620	726,230	565,650
P	49,083,950	3,263,650	3,084,200	2,955,400	3,660,740	3,875,030	3,551,200	3,256,390	3,615,670	3,033,480	2,682,260	2,528,670	2,515,750	2,446,190	1,978,960	1,634,910	1,095,280	751,660

2 Census enumerated 2001

Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	23,626,441	1,431,903	1,566,647	1,638,844	1,520,229	1,350,749	1,476,304	1,862,387	1,704,033	1,556,141	1,712,414	1,419,287	1,213,253	1,073,430	923,219	716,752	422,098	271,920
F	25,216,964	1,365,613	1,490,205	1,566,006	1,457,928	1,389,935	1,884,598	1,954,623	1,755,997	1,599,652	1,756,256	1,456,190	1,262,872	1,163,859	1,105,766	999,574	723,090	711,735
P	48,843,405	2,797,516	3,056,852	3,204,850	2,978,157	2,740,684	3,651,429	3,817,010	3,460,030	3,155,793	3,468,670	2,875,477	2,476,125	2,237,289	2,028,985	1,716,327	1,145,188	983,655

3 1991 before revision, RP91, ie revised final as published 1993

Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	24,995,139	1,760,614	1,656,987	1,573,624	1,685,021	2,025,248	2,162,659	1,685,228	1,853,804	1,562,875	1,356,252	1,279,689	1,233,835	1,148,875	878,502	652,750	382,421	194,179
F	26,104,382	1,669,916	1,565,571	1,484,718	1,586,451	1,940,582	2,083,329	1,672,805	1,844,544	1,559,217	1,355,311	1,293,398	1,319,370	1,326,462	1,152,569	1,014,819	760,490	615,502
P	51,099,521	3,430,530	3,222,558	3,058,342	3,271,472	3,965,830	4,245,988	3,358,033	3,698,348	3,122,092	2,711,563	2,573,087	2,553,205	2,475,337	2,031,071	1,667,569	1,142,911	809,681

4 RP01 (2001 projected from 2000 by GAD)

Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	26,285,717	1,600,538	1,716,402	1,778,922	1,685,808	1,641,656	2,146,390	2,228,819	1,925,968	1,682,050	1,814,518	1,494,040	1,244,225	1,097,926	945,246	734,862	436,021	293,325
F	26,888,266	1,524,711	1,631,317	1,689,731	1,590,221	1,557,823	2,024,090	2,125,536	1,880,767	1,676,121	1,821,740	1,517,794	1,287,580	1,183,202	1,128,680	1,014,249	746,947	772,712
P	53,173,983	3,125,249	3,347,719	3,468,653	3,276,029	3,199,479	4,170,480	4,354,355	3,809,735	3,358,171	3,636,258	3,011,834	2,531,805	2,281,128	2,073,926	1,749,111	1,182,968	1,066,037

5 1991 revised (thousands), from ONS

Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	24,681,337	1,740,974	1,639,864	1,557,564	1,667,177	1,970,839	2,070,814	1,646,792	1,833,269	1,562,875	1,356,252	1,279,689	1,233,835	1,148,875	878,502	652,750	376,639	191,340
F	26,066,696	1,669,916	1,565,571	1,484,718	1,586,451	1,940,582	2,083,329	1,672,805	1,844,544	1,559,217	1,355,311	1,293,398	1,319,370	1,326,462	1,152,569	1,014,819	745,794	592,512
P	50,748,033	3,410,890	3,205,535	3,042,282	3,911,421	4,154,143	3,708,120	3,337,992	3,683,813	3,122,092	2,711,563	2,573,087	2,553,205	2,475,337	2,031,071	1,667,569	1,122,433	783,852

6 C01 One Number Census 2001, Census day

Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	25,327,290	1,584,463	1,694,688	1,754,093	1,644,089	1,684,803	1,952,713	2,019,751	1,815,022	1,632,853	1,780,622	1,466,997	1,249,624	1,100,967	940,029	733,092	435,252	280,844
F	26,714,626	1,509,894	1,613,284	1,670,982	1,573,336	1,568,991	2,031,261	2,073,466	1,841,313	1,663,178	1,810,282	1,495,133	1,295,004	1,191,419	1,130,433	1,021,772	743,017	731,556
P	52,041,916	3,094,357	3,307,972	3,425,075	3,122,379	3,435,108	3,983,974	4,093,217	3,656,335	3,296,031	3,590,904	2,962,130	2,544,628	2,292,386	2,074,462	1,754,864	1,178,269	1,012,400

data for demographic analysis (continued)

Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	958,427	21,714	24,829	41,719	88,268	131,198	193,677	209,068	113,946	49,197	33,896	27,043	-5,399	-3,041	1,217	1,770	769	12,481
F	173,640	14,817	18,033	16,885	-11,168	-35,260	-7,171	52,070	39,454	12,943	11,458	22,661	-7,424	-8,217	-1,753	-7,523	3,950	41,156
P	1,132,067	30,892	39,747	43,578	58,604	77,100	186,506	261,138	153,400	62,140	45,354	49,704	-12,823	-11,258	-536	-5,753	4,699	53,637
% of ONC2001.																		
Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	4%	1%	1%	3%	6%	8%	10%	10%	6%	3%	2%	2%	0%	0%	0%	0%	0%	4%
F	1%	1%	1%	1%	-2%	-2%	0%	3%	2%	1%	1%	2%	-1%	-1%	0%	-1%	1%	6%
P	2%	1%	1%	2%	2%	3%	5%	6%	4%	2%	1%	2%	-1%	0%	0%	0%	0%	5%
3-5. Difference RF91-C91Rev: net unmonitored emigration implied by ONC, 1981-1991																		
Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	313,802	19,640	17,023	17,844	54,409	91,845	53,784	20,041	14,535	0	0	0	0	0	0	0	5,782	2,839
F	37,686	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14,696	22,990
P	351,488	19,640	17,023	17,844	54,409	91,845	53,784	20,041	14,535	0	0	0	0	0	0	0	20,478	25,829
% of C91Rev.																		
Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	1%	1%	1%	1%	3%	4%	3%	1%	1%	0%	0%	0%	0%	0%	0%	0%	2%	1%
F	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	4%
P	1%	1%	1%	1%	1%	2%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	2%	3%
4-2. Difference RF01-CE01: Under-enumeration if RF2001 were correct.																		
Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	2,659,276	168,635	149,755	140,078	165,579	339,697	379,559	366,432	224,935	125,909	102,104	74,753	30,972	24,496	22,027	18,110	13,923	21,405
F	1,671,302	159,098	141,112	123,725	132,293	167,888	139,492	170,913	124,770	76,469	65,484	61,604	24,708	19,343	22,914	14,675	23,857	60,977
P	4,330,578	327,733	290,867	263,803	297,872	458,795	519,051	537,345	349,705	202,378	167,588	136,357	55,680	43,839	44,941	32,784	37,780	82,382
% of RF2001.																		
Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	10%	11%	9%	8%	18%	19%	18%	16%	12%	7%	6%	5%	2%	2%	2%	2%	3%	7%
F	6%	10%	9%	7%	11%	8%	7%	8%	7%	5%	4%	4%	2%	2%	2%	1%	3%	8%
P	8%	10%	9%	8%	14%	14%	12%	12%	9%	6%	5%	5%	2%	2%	2%	2%	3%	8%
3-1. Difference RF91-C91: Under-enumeration 1991 if RF1991 were correct																		
Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	1,203,139	91,294	76,887	57,914	66,891	253,879	140,236	67,558	55,534	46,585	14,782	23,659	17,975	13,555	22,542	11,450	13,361	8,169
F	812,412	75,586	61,481	45,018	37,061	117,079	70,478	34,085	29,154	42,027	14,531	20,748	19,480	13,582	29,569	21,199	34,260	49,852
P	2,015,551	166,880	138,368	102,932	103,952	370,958	210,714	101,643	84,688	88,612	29,313	44,407	37,455	29,137	52,111	32,649	47,621	58,021
% of RF1991																		
Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	5%	5%	4%	4%	11%	12%	7%	4%	3%	3%	1%	2%	1%	1%	3%	2%	3%	4%
F	3%	5%	4%	3%	5%	6%	4%	2%	2%	3%	1%	2%	1%	1%	3%	2%	5%	8%
P	4%	5%	4%	3%	8%	9%	6%	3%	2%	3%	1%	2%	1%	1%	3%	2%	4%	7%

data for demographic analysis (continued)

	Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	1,700,849	152,560	128,041	115,249	123,860	202,639	208,499	185,882	157,364	110,989	76,712	68,208	47,710	36,371	27,537	20,810	16,340	13,154	8,924
F	1,497,662	144,281	123,079	104,976	115,408	179,056	177,240	146,663	118,843	85,316	63,526	54,026	38,943	32,132	27,560	24,667	22,198	19,927	19,821
P	3,198,511	296,841	251,120	220,225	239,268	381,695	385,739	332,545	276,207	196,305	140,238	122,234	86,653	68,503	55,097	45,477	38,537	33,081	28,745

% of ONC2001																			
Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
M	7%	10%	8%	7%	8%	13%	12%	8%	6%	5%	4%	3%	3%	3%	2%	2%	3%	3%	3%
F	6%	10%	8%	6%	7%	11%	10%	6%	5%	4%	3%	3%	2%	2%	2%	2%	3%	3%	3%
P	6%	10%	8%	6%	7%	12%	11%	8%	5%	4%	3%	3%	3%	2%	2%	2%	3%	3%	3%

5-1. Difference ONC91Rev - C91: Under-enumeration 1991 implied by ONC revision to 1991 population.

	Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	889,337	71,654	59,864	41,854	49,047	164,459	162,034	86,452	47,517	40,999	46,585	14,782	23,659	17,975	15,555	22,542	11,450	7,579	5,330
F	774,726	75,586	61,481	45,018	37,061	97,222	117,079	70,478	34,085	29,154	42,027	14,531	20,748	19,480	13,582	29,569	21,199	19,564	26,862
P	1,664,063	147,240	121,345	86,872	86,108	261,681	279,113	156,930	81,602	70,153	88,612	29,313	44,407	37,455	29,137	52,111	32,649	27,143	32,192

% of ONC91Rev

Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
M	4%	4%	4%	3%	8%	8%	5%	3%	2%	3%	1%	2%	1%	1%	3%	2%	2%	3%	3%
F	3%	5%	4%	3%	5%	6%	4%	2%	2%	3%	1%	2%	1%	1%	3%	2%	3%	5%	4%
P	3%	4%	4%	3%	7%	7%	4%	2%	2%	3%	1%	2%	1%	1%	3%	2%	2%	2%	4%

(4-6.) (aged cohort 3-5.) Net unmonitored emigration 1991-2001, implied by ONC: the 1981-1991 figure subtracted from the 1981-2001 cohorts ten years older.

	Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
M	644,625	16,075	21,714	5,189	24,696	72,208	113,354	139,268	117,223	60,162	29,156	19,361	27,043	-5,399	-3,041	1,217	1,770	769	3,860
F	135,954	14,817	18,033	18,749	16,885	-11,168	-35,260	-7,171	52,070	39,454	12,943	11,458	22,661	-7,424	-8,217	-1,753	-7,523	3,930	3,470
P	780,579	30,892	39,747	23,938	41,581	61,040	78,094	132,097	169,293	99,616	42,099	30,819	49,704	-12,823	-11,258	-536	-5,753	4,699	7,330

% of ONC2001

Total	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
M	3%	1%	1%	0%	2%	5%	7%	6%	3%	2%	1%	2%	0%	0%	0%	0%	0%	1%	1%
F	1%	1%	1%	1%	-1%	-2%	0%	3%	2%	1%	1%	2%	-1%	-1%	0%	-1%	0%	0%	0%
P	1%	1%	1%	1%	2%	2%	3%	4%	3%	1%	1%	2%	-1%	0%	0%	0%	0%	0%	1%

appendix C: household spaces

Source: Population and Housing Research Group, Anglia Polytechnic University

Housing Statistics

ODPM produces estimates of dwelling stock change. A crude comparison can be made with the change in the number of household spaces 1991-2001 as recorded in the Censuses. Household spaces are not directly equivalent to dwellings. However, there are more household spaces than dwellings and speculation about trends 1991-2001 has suggested that household spaces may well have been expected to increase more rapidly than dwellings, because of the recorded increase in student numbers and generally increasing pressure on the housing market. In addition, there is some speculation that increasing numbers of international migrants may have added to the general pressure in some locations. If this were true, then the expectation would be that the increase in household spaces should have exceeded the increase in dwellings.

The ODPM stock change figures are not totally reliable. There are aspects of potential overcount of net stock change in the ODPM estimates (from unrecorded demolitions, and conversions involving net stock loss). However, the general concern throughout the 1990's has been one of potential undercounting of stock increase (through undercounting of completions or positive net gains from conversion or change of use). Census 2001 implies that the net increase of household spaces has been significantly less than recorded stock change. It should be noted that the Census figures below assume no underenumeration of household spaces in 1991. Any such underenumeration would reduce the intercensal increase in household spaces further.

A comparison of 1991-2001 ODPM dwelling stock and Census household spaces increases

	ODPM Stock Change*	Census-based increase in household spaces:			Census minus ODPM
		All	Occupied	All vacant	
GB	1741000	1549209	1955398	-406189	-191791
England	1471000	1324523	1685843	-361320	-146477
Wales	90000	75933	97359	-21426	-14067
Scotland	201000	148753	172196	-23443	-52247

* Source: ODPM Housing Statistics 2001 and 2002

Superficially it looks as though the Census in 2001 may have underestimated household spaces by at least 190,000. However, with the exception of Scotland, the net increase in occupied household spaces is greater than that of the ODPM stock change figures. This may be partly an artefact of the changing definition of usual residence in relation to the student population between the two Censuses, as may be partly the reduction in vacant household spaces (i.e. including those without usual residents). One explanation of the difference between ODPM estimates and the Census could be that the Census missed more vacant household spaces in 2001 than in 1991. A closer analysis of the implications of the "student usual residence" change and sub-national analysis of these figures might shed light on what processes have caused the differences and whether there are grounds for concern.

appendix D: non-response, male and female

ONC Census non-response rates, sex and broad age bands, England and Wales																	
	Type of Authority (urban/rural)							Type of Authority (legal)									
	England and Wales	Inner London	Outer London	Principal cities	Other metropolitan Districts	Large cities	Small cities	Industrial areas	New towns	Resort, port and retirement	Urban and mixed urban-rural	Remoter, mainly rural.	County District	London Borough	Metropolitan District	Unitary Authority	
Male non-response rates	All	6.1	22.0	10.5	8.7	4.8	6.7	6.1	4.4	4.6	4.5	3.6	All	3.7	14.9	6.0	5.6
	All	6.7	23.2	11.2	9.5	5.2	7.6	6.9	4.9	5.2	5.0	4.1	All	4.2	15.9	6.5	6.3
	Age 0-19	7.8	24.2	12.3	11.6	6.8	8.8	6.1	5.8	6.4	4.6	5.0	Age 0-19	4.9	16.7	8.3	7.4
	Age 20-39	10.5	28.0	16.6	13.1	7.7	11.1	10.2	7.2	7.4	8.3	6.7	Age 20-39	6.7	21.7	9.5	9.5
	Age 40-59	4.5	18.7	7.4	6.1	3.4	5.1	5.1	3.4	3.9	3.6	2.9	Age 40-59	3.0	11.3	4.2	4.5
	Age 60+	2.6	13.2	4.4	4.2	2.0	2.6	3.5	2.3	2.1	1.3	1.6	Age 60+	1.6	7.3	2.6	2.4
Female non-response rates	All	5.6	20.9	9.8	7.9	4.5	5.9	5.4	3.9	4.1	4.1	3.2	All	3.3	14.1	5.5	5.0
	Age 0-19	7.7	24.1	11.8	11.6	6.9	8.3	6.5	6.0	5.8	6.0	4.4	Age 0-19	4.7	16.4	8.4	7.2
	Age 20-39	8.4	24.8	14.4	9.9	6.0	8.1	7.4	5.5	5.4	6.5	4.9	Age 20-39	4.9	19.1	7.3	7.0
	Age 40-59	3.6	16.3	6.4	5.2	2.7	3.6	3.8	2.3	2.9	2.8	2.1	Age 40-59	2.1	9.8	3.4	3.2
	Age 60+	2.4	11.6	4.0	3.6	2.0	2.4	2.9	1.8	2.0	2.1	1.5	Age 60+	1.5	6.4	2.4	2.2
Sex ratio of male to female non-response rates (100=equal)	All	119.8	111.0	114.8	120.2	117.7	128.6	129.1	124.3	124.3	123.0	128.7	All	127.3	112.7	118.7	125.8
	Age 0-19	101.6	100.3	104.3	100.2	98.2	105.7	103.8	102.3	99.4	106.3	104.4	Age 0-19	103.3	101.6	99.0	103.8
	Age 20-39	124.9	112.8	115.6	132.3	128.1	136.3	138.1	130.8	137.1	128.2	137.4	Age 20-39	136.8	113.9	130.0	134.6
	Age 40-59	127.7	114.3	116.3	118.6	126.6	143.5	135.3	147.6	134.9	130.2	144.5	Age 40-59	141.6	115.2	123.0	139.3
	Age 60+	108.5	114.4	109.0	117.3	102.1	108.5	120.0	110.9	117.1	99.2	102.1	Age 60+	106.8	113.5	108.5	105.6
Sex ratios compared with national (%)	SR Tot	100.0	92.6	95.8	100.3	98.2	107.3	107.8	103.7	103.7	102.7	107.5	SR Tot	106.3	94.1	99.1	105.0
	SR 0-19	100.0	98.7	102.7	98.7	96.6	104.0	102.1	100.7	97.8	104.6	102.8	SR 0-19	101.7	100.0	97.4	102.2
	SR 20-39	100.0	90.3	92.5	105.9	102.6	109.1	110.6	104.8	109.8	102.6	110.0	SR 20-39	109.5	91.2	104.1	107.7
	SR 40-59	100.0	89.5	91.0	92.9	99.1	112.4	105.9	115.6	105.6	101.9	113.1	SR 40-59	110.9	90.2	96.3	109.1
	SR 60+	100.0	105.5	100.5	108.1	94.2	100.0	110.6	102.3	108.0	91.5	94.1	SR 60+	98.5	104.7	100.1	97.4
Ratio of male age band to male total non-response rate	M0-19M/tot	115.9	104.2	110.0	122.3	129.5	116.7	98.2	112.4	112.4	126.6	113.8	M0-19M/tot	117.2	105.4	126.6	117.9
	M20-29M/tot	155.8	120.6	148.2	138.0	147.4	146.3	147.0	146.3	143.5	164.9	165.8	M20-29M/tot	161.1	136.9	145.5	150.6
	M40-59M/tot	67.5	80.4	66.1	64.5	64.5	67.8	74.3	69.4	76.5	72.0	71.0	M40-59M/tot	71.0	71.5	63.5	71.0
	M60+M/tot	38.7	57.0	39.0	44.4	38.0	34.0	50.6	40.8	44.9	40.7	31.7	M60+M/tot	38.7	46.1	40.3	37.7
Male ratios compared with national (%)	M0-19M/tot	100.0	89.9	94.9	105.5	111.7	100.7	84.7	108.0	96.9	109.2	98.2	M0-19M/tot	101.1	91.0	109.3	101.7
	M20-29M/tot	100.0	77.4	95.1	88.6	94.6	93.9	94.4	93.9	92.1	105.9	106.4	M20-29M/tot	103.4	87.9	93.4	96.7
	M40-59M/tot	100.0	119.0	97.8	95.5	95.5	100.5	110.0	102.8	113.3	106.6	105.1	M40-59M/tot	105.2	105.9	94.0	105.1
	M60+M/tot	100.0	147.4	101.0	115.0	98.2	88.0	130.8	105.5	116.2	105.4	82.1	M60+M/tot	100.2	119.2	104.3	97.5
Ratio of female age band to female total non-response rate	F0-19F/tot	136.6	115.3	121.1	146.6	155.2	141.9	122.2	152.1	140.4	146.5	140.3	F0-19F/tot	144.3	117.0	151.9	142.8
	F20-39F/tot	149.4	118.6	147.3	125.4	135.3	137.9	137.5	138.9	130.0	158.3	155.3	F20-39F/tot	150.0	135.5	132.9	140.8
	F40-59F/tot	63.3	78.1	65.2	65.3	60.0	60.7	70.9	58.5	70.5	68.0	63.3	F40-59F/tot	63.9	70.0	61.2	64.1
	F60+F/tot	42.7	55.3	41.1	45.6	43.7	40.3	54.4	45.7	47.7	50.5	40.0	F60+F/tot	46.2	45.8	44.1	44.9
Female ratios compared with national (%)	F0-19F/tot	100.0	84.4	88.7	107.3	113.6	103.9	89.4	111.3	102.8	107.3	102.7	F0-19F/tot	105.6	85.6	111.2	104.5
	F20-39F/tot	100.0	79.4	98.6	83.9	90.6	92.3	92.0	93.0	87.0	106.0	104.0	F20-39F/tot	100.4	90.7	89.0	94.2
	F40-59F/tot	100.0	123.2	103.0	103.1	94.7	95.9	111.9	92.3	111.2	107.4	99.9	F40-59F/tot	100.8	110.5	96.7	101.2
	F60+F/tot	100.0	129.5	96.3	106.7	102.4	94.5	127.4	107.0	111.7	118.3	93.8	F60+F/tot	108.1	107.2	103.3	105.2

appendix E: types of area where the ONC was below the rolled forward population estimate

Median % excess of 2001 extrapolated population over ONC2001

376 LADs of England and Wales			
Decile	Youth unemployment % of age 16-24	Students % of age 16-24	Not-White Ethnic group % of all
Most 1	1.0	3.5	1.7
2	0.9	1.9	2.8
3	-0.3	3.1	1.0
4	0.5	2.6	1.5
5	0.9	1.9	2.0
6	1.6	0.5	1.2
7	0.6	0.3	1.7
8	2.8	1.1	0.6
9	2.2	0.7	0.4
Least 10	3.0	0.1	0.9

Median over all 376 Districts: 1.3%

Deciles when sorted in descending order of the variable indicated.

appendix F: largest district discrepancies between ONC and rolled forward population estimates

Source: Population and Housing Research Group, Anglia Polytechnic University

Residual net migration estimates 1981-2001; selected "worst case" districts by region (000's)

	1981 Population MYE	Residual Net Migration 1981-2001		Difference Census minus 2000-based	
		2000-based	Census 2001	Nos	% of 1981 pop
C.1 East of England					
Forest Heath	52.7	12.5	-3.4	-15.9	-30%
Cambridge	101.0	22.2	4.8	-17.4	-17%
Southend UA	157.6	26.2	8.8	-17.5	-11%
C.2 East Midlands					
Derby UA	217.4	7.5	-7.8	-15.3	-7%
Nottingham UA	278.2	-8.7	-25.8	-17.1	-6%
Leicester UA	283.1	-18.0	-29.4	-11.4	-4%
C.3 London					
Westminster	188.6	50.8	-17.1	-67.9	-36%
Kensington & Chelsea	140.3	42.1	7.5	-34.5	-25%
Richmond upon Thames	163.8	28.0	1.7	-26.3	-16%
Barnet	295.6	39.2	2.0	-37.2	-13%
Hillingdon	233.3	4.5	-11.5	-16.0	-7%
Harrow	200.0	2.9	-7.1	-10.1	-5%
C.4 North East (none)					
C.5 North West					
Manchester	457.7	-39.9	-86.2	-46.4	-10%
Trafford	223.6	-9.5	-19.8	-10.3	-5%
C.6 South East					
Elmbridge	112.5	20.3	5.5	-14.7	-13%
Oxford	130.4	14.4	-1.6	-16.0	-12%
C.7 South West					
Bristol, City of UA	401.2	-9.5	-36.2	-26.7	-7%
Plymouth UA	253.3	-8.7	-22.7	-14.1	-6%
C.8 West Midlands					
Birmingham	1030.4	-105.9	-139.3	-33.4	-3%
C.9 Yorkshire Humber					
Barnsley	226.5	-2.1	-12.2	-10.1	-4%
Bradford	464.4	-16.5	-36.1	-19.7	-4%
Kingston upon Hull, City of UA		-35.2	-46.1	-10.9	-4%
Sheffield	547.3	-11.4	-28.0	-16.6	-3%
Total of these selected districts	6432.5	5.2	-500.2	-505.3	-8%

N.B. Selected in terms of discrepancies greater than 10,000.

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