



Challenges and learning in carrying out an enhanced sample to provide small area data for the dental survey of five-year-old children in England

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Objective: To investigate the method, learning and challenges of using an enhanced sample to provide small area data for the dental survey of five-year-old children in England. **Design:** Pilot in six London local authorities, of increased sample size during a national survey to enable a more precise sample size calculation to deliver information accurate at electoral ward level. Challenges were explored through interviews with the teams who either planned or conducted the survey. **Main outcome measures:** A revised sample size recommendation for the national guidance on carrying out dental surveys of five-year-old children in England, where caries levels are similar to those seen in the pilot areas; the challenges identified were gaining access to schools and consent from parents, making the calculation for the additional sample and securing sufficient workforce. **Conclusion:** This paper has described a method for delivering small area caries data by increasing the size of the sample. Learning, and understanding the outcomes and challenges from this work can inform planning and delivery of future surveys using an enhanced sample at ward level.

Public health competencies being illustrated

Dental public health intelligence

Drawing valid inferences from qualitative and quantitative analysis

Initial impetus

The National Dental Epidemiology Programme (NDEP) is a work stream of Public Health England's Dental Public Health Intelligence Programme. The programme and sampling methods were developed by the British Association for the Study of Community Dentistry (Pine *et al.*, 1997). The surveys have over the years provided consistent, comparable, and locally relevant data. The NDEP reports estimates for dental caries prevalence and severity at national, regional and local authority level.

In England, a national survey of the dental health of five-year-old children is undertaken biennially (PHE, 2017). The survey requires a minimum sample of 250 children examined per local authority area using a two-stage sampling frame. Whilst this minimum sample size provides local authority data for strategic documents and informs the local authority Public Health Outcomes Framework (PHOF) indicator on dental health – 'tooth decay in five-year-old children' – it does not provide local planners with small area data at electoral ward level (DH, 2017). This can mean there are challenges using the data to identify areas for targeted health improvement programmes to reduce health inequalities within the local authority. To provide small area data, local authorities need to draw a larger or enhanced sample. The benefit of an enhanced sample is that it can provide sufficiently robust information for small area reporting and yet avoid the cost of a survey of the whole population of five-year-old children.

This paper describes the methodology and challenges of piloting an enhanced sample to provide small area data at ward level for London local authorities.

Solutions suggested

A pilot enhanced survey method was developed and tested in six local authorities in London in parallel with the national dental survey of five-year-old children. We explored the feasibility and statistical robustness of delivering an enhanced sample, alongside the main sample. Advice from the PHE national DPH intelligence team states that that to produce safer estimates at electoral ward level there needs to be at least 15 children examined in the sample, whilst acknowledging that this number may be too low. Following the enhanced sampling advice in this document, we proposed testing this method using a sample of between 15-30 five-year-old children per electoral ward. The number of schools would need to be increased from 20 as per the national protocol for the minimum sample to ensure inclusion of a minimum of 2 schools per ward. The minimum sample for each local authority was drawn and labelled. An additional sample was then drawn to deliver 15-30 children examined in each ward and these were coded as 'additional sample' at examination.

In-depth one-to-one interviews were conducted with key stakeholders including Community Dental Service (CDS) managers, fieldwork teams and local authority

public health teams. The qualitative interviews sought to provide feedback on organisational issues, consent and access to schools, resources, challenges and general feedback.

Actual outcome and challenges

Sample size calculation

The sample size for such a ward level epidemiological survey was determined in discussion with the Public Health England Knowledge and Intelligence team who provided statistical support. In such surveys, there is a need to balance a sample size to ensure robust data but that is deliverable and practical. A sample of a minimum of 15 examinations per ward was advised (Martinez-Messa *et al.*, 2014).

Five of the six pilot local authorities achieved 15 or more examinations per ward, of whom two achieved around 30 examinations. Following the analysis, reports with ward level data were produced for each pilot local authority. Wards achieving close to 30 children examined had narrower confidence intervals (Figures 1 and 2). On further discussion with the statistician, it was agreed that a sample of 50 children examined per local authority ward would ensure narrower confidence intervals while being logistically feasible.

Figures 1 and 2 demonstrate the confidence intervals for the proportion of children with decayed missing and filled teeth.

Learning from qualitative interviews

Access to schools – fieldwork teams reported increasing difficulty gaining access to schools to deliver the minimum sample survey and in some areas struggled to recruit enough. This was compounded with the additional number of schools required for an enhanced sample. Concern was expressed by CDS managers that there was a lack of understanding of the dental survey within local authority education departments and schools. Possible solutions include involving the local authority education leads during the initial planning stages to enhance understanding and gain support from school health teams.

Funding and timing – to plan and examine a larger sample, additional funding would need to be identified and different funding arrangements may need to be explored. Funding arrangements for the pilot included direct funding, thus reducing clinical activity formed the basis for the calculation of the additional costs for the enhanced sample survey. Local authorities reported that while the enhanced survey was useful and constructive, the main challenge arose from the additional funding required. They also expressed concerns about the length of time it took from providing the funding to conducting the survey and publishing the results, which can be up to two years after the time initial funding was sought. The timely publication of the results would need to account for the length of set up and clinical examination while fitting into their planning cycles. Although early release

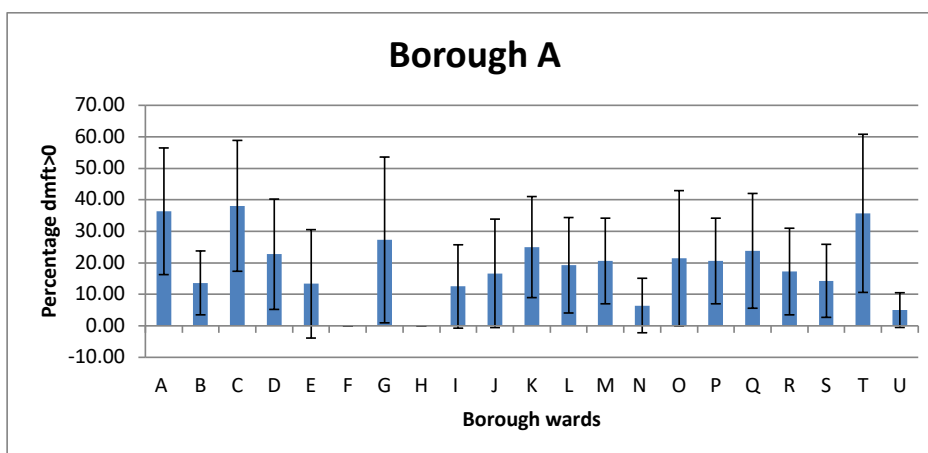


Figure 1: Ward level data and confidence intervals for Borough with around 15 examinations per ward

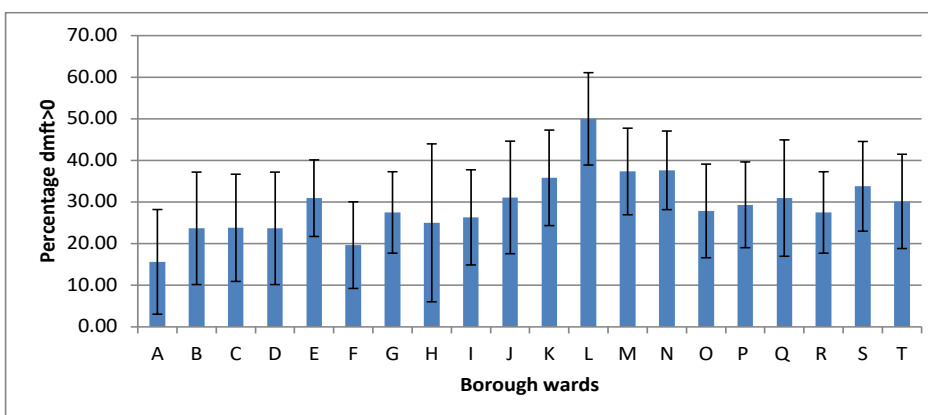


Figure 2: Ward level data and confidence intervals for Borough with close to 30 examinations per ward

of the report would be preferred, the robust analysis with pan-England data and the report writing by PHE both require significant organisation which must be adhered to. A possible solution may be the early release of the checked and cleaned data to the regional teams for local level analysis and reporting, or clearer communication back to the funder, to inform their expectations as to when the results would be ready.

Calculating the sample - Clinical service managers reported that they preferred the enhanced sample to be drawn on their behalf, rather than having to sample themselves and strongly expressed the need for enhanced samples to be available promptly to allow maximum time to engage with schools and local authority education departments. Fieldwork teams noted that they understood the need and process for enhanced sampling, but again expressed a preference for it to be calculated on their behalf by the London dental epidemiology coordinators (DECs). In future, DECs could undertake the sampling for quality assurance and to reduce the burden on the field teams.

Consent – some fieldwork teams reported difficulty gaining consent from parents. The selective uptake may lead to possible bias as there is a discrepancy between the population sampled and that examined, and so engagement with parents and schools to encourage uptake is vital. The PHE document *Commissioning High Quality Information to Support Oral Health Improvement* includes suggestions for improving consent levels (PHE, 2016). There was also a view that asking about ethnicity was challenging and may have led to some parents withholding consent. Further suggestions for improving recruitment included identifying a key contact at each school to encourage parents to participate and simplifying the consent form. Some field teams reported that some schools were reluctant to participate. However, those local authorities with strong links across the clinical teams reported the best outcomes. In future surveys, engagement with local authority directors of education and public health will be vital to encourage schools and parents to take part. This is a challenge familiar to many school programmes, not just dental surveys, and opportunities to combine approaches should be explored. This could include gaining consent at school entry for the various programmes.

Workforce – while some fieldwork and administrative teams reported a good understanding of the need for an enhanced survey, others did not. Those reporting a limited understanding felt that they would have benefitted from more effective communication. Fieldwork teams expressed anxiety that the conduct of the survey was at the expense of clinical duties and that larger samples required additional clinical and administrative staff. They were concerned about clinical posts not being backfilled and reported some frustrations at the lack of administrative support. They felt that there was pressure on nursing and administrative staff arising from the additional consent processes and entry of data. For future surveys CDS clinical directors and commissioners should ensure that adequate staff members are assigned to deliver the survey and relieved of clinical duties to allow for all activities to be undertaken within the prescribed timescale. Additional funding will need to be agreed.

Administration and logistics – Fieldwork teams reported no increased logistical difficulties in delivering the enhanced pilot compared to the standard survey. Some felt it was easier for schools and fieldwork teams where all five-year-old children were examined. Fieldwork teams reported the need to ensure labelling of the enhanced survey sample was simplified to reduce administrative error and burden. Delivery of an enhanced survey across London local authorities would require adequate administrative support with understanding and training to support its delivery.

Cultural change – This was not much of an issue in the pilot, mainly because the selected local authorities were supportive of testing the method. However, this could possibly be the biggest challenge in delivering an enhanced sample survey. Delivery of the minimum sample by the CDS is a familiar part of their work-plan. The change to this new survey method might be difficult for some to accept. Public Health England and NHS England would need to ensure that there is good communication with the fieldwork teams, a good understanding of the need for the survey and the use of the data, and adequate training for those involved. To address this a briefing paper was produced for clinical directors in London. A protocol which includes a step by step guide was also developed for field teams.

Local authority staff – Staff who were interviewed felt a need for oral health data that provides a more accurate picture of their diverse local authorities and a level of granularity to target oral health improvement interventions locally. They highlighted their understanding of the operational side of schools and the importance of engaging with them to encourage participation. They also reported the importance of sharing information on and results of the survey with schools, as partners, including the published data on levels of tooth decay within their local area.

Local authorities stated that carrying out an enhanced survey across a larger proportion of schools in their areas had wider impacts. It enhanced opportunities for schools to engage with the local authority to find out what they could do to support oral health in their populations, as well as boosting engagement with oral health promotion services. They planned to use the data at a senior strategic level to identify why oral health is an important focus, and the links to wider health conditions such as obesity. Linked to this, one local authority expressed a view that carrying out a census survey or including more schools would have been preferred to capitalise on these additional benefits but accepted that there would be significant additional costs in doing so.

Future implications and learning points

London local authorities have diverse heterogeneous populations with wealthy households juxtaposed with those living in poverty. Having more granular data on five-year-olds at ward level, delivered through an enhanced sample, will go some way to highlighting these differences. This will support local authorities to target resources for oral health improvement and support the reduction of oral health and wider health inequalities.

The challenges highlighted by this pilot, including calculating the sample size, access to schools and parental consent need to be considered to deliver future enhanced sample surveys. There is a balance between having a sample sufficient for narrow confidence intervals and logistical practicality. In London, examining more than 50 children per ward was considered impractical. It was therefore proposed that 40 children per ward would provide acceptable confidence intervals. However, this is reliant on joint working across the system i.e. Public Health England, local authorities, NHS England and clinical dental services and schools.

Further work is in progress to continue to refine the method for future enhanced surveys.

Conclusion

This paper has described a method to deliver small area caries data by increasing sample size. It demonstrates the challenges to be overcome by the survey teams involved. Following the pilots in six London local authorities, the calculations were revised, and larger samples were suggested to reduce the confidence intervals appropriate to current caries prevalence levels. Due to the numbers of five-year-old children in London wards, it was agreed that 40 or more children should be examined per ward. The establishment of robust baseline data for individual wards will support the local authorities in London to develop targeted oral health improvement programmes tailored to address local health needs and reduce health inequalities, with the added value of involving more schools and pupils in the survey, further raising the profile of oral health.

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