

The caries experience of 5 year-old children in Scotland, Wales and England in 2007-2008 and the impact of consent arrangements. Reports of co-ordinated surveys using BASCD criteria

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Objective: This paper brings together summarised findings and comment on surveys of young children undertaken in Scotland, Wales and England in 2007-08. These surveys are the latest in a series using common criteria for measurement but changes in the consent arrangements for Wales and England mean that these datasets are no longer directly comparable with Scottish data. **Method:** Representative samples were drawn within the geographies of primary care organisations in the three countries, and in England within Local Authorities also, according to BASCD criteria. Consent was sought in three different ways. Children aged five were examined in England and those in Primary 1 (rising 6) were examined in Wales and Scotland. Examinations were conducted in schools by trained and calibrated examiners and caries was diagnosed at the dentinal threshold using visual criteria. **Results:** The impact of seeking positive consent appeared to depress the caries severity and prevalence in Wales and England whilst the reduced caries levels in Scotland may be attributed to the pro-active health improvement measures affecting this cohort. The results for positive consent suggest bias against participation of children with higher levels of tooth decay. **Conclusion:** Caries prevalence surveys of children at the start of formal education have been conducted in Great Britain. Those carried out with the need for positive parental consent have produced new baseline data. Data presented after 2007-08 should be annotated to show the participation rate and the inappropriateness of comparing data collected using different types of consent.

Key words: epidemiology, dental caries, caries prevalence, national surveys, consent

Introduction

This paper reports on the surveys of children at the start of formal education carried out in Scotland, Wales and England during the 2007-08 school year. These were carried out by the National Health Service using criteria for training, calibration, sampling and caries measurement that have been long established by the British Association for the Study of Community Dentistry (BASCD) (Pine *et al*, 1997a, 1997b, Pitts *et al*, 1997).

In all countries examinations were carried out in schools using standardised portable equipment, techniques and conventions. Dental caries was diagnosed at the caries into dentine (d₃) level using a visual method only. Radiography, transillumination or compressed air were not used.

In England national training was provided by BASCD for Regional Coordinators, trainers and standard examiners according to a national protocol provided by The Dental Observatory (TDO) (TDO, 1997) and encompassing the standards laid down by BASCD (*op cit*). Following national calibration of benchmark examiners these standards were passed to local field examiners via regional training and calibration. Analogous training was provided for examiners in 14 NHS Boards in Scotland through the National Dental Inspection Programme (NDIP) and for 22 Local Health Boards in Wales.

Following devolution of Wales and Scotland, and the introduction of a requirement for positive parental consent in England and Wales, limits for direct comparison of results have been introduced. The details of the impact of the variations between the countries are described in this paper, along with overviews of the results and signposts to the complete results.

Scotland

Method

Training and calibration of the 44 fieldwork teams was carried out in November 2007, following UK training and calibration in September 2007. Each of the 14 NHS Boards in Scotland identified the number of children needed to obtain a representative sample from their Primary 1 population following BASCD guidelines. The sample sizes were designed to have adequate numbers to allow meaningful comparisons between NHS Boards to be drawn. In the course of the survey 10% of the children in the sample were re-inspected in order to assess the consistency of the examination decisions of the dentists who were undertaking the inspections and thus check for diagnostic reliability during the fieldwork.

Results

All of the 44 dental teams taking part in the survey achieved satisfactory calibration and also showed very good reliability throughout the survey. 12,442 children across Scotland were inspected, representing 24.9% of the state sector Primary 1 population (Merrett *et al*, 2008). Across the fourteen NHS Boards the percentage inspected ranged from 9% to 93%. The average age of the children examined was 5.54 years – this was similar to the 2006 survey result of 5.49 years and the 2004 figure of 5.51 years (Pitts *et al*, 2007).

In 2008, the population weighted mean d_3mft in Scotland has decreased to 1.86 (from 2.16 in 2006), with the percentage of P1 children across Scotland having obvious decay experience reducing to 42.3%, compared

to 45.9% in 2006. Across the 14 Health Boards the range of mean d_3mft was from 1.24 teeth in Orkney, to 2.14 teeth in Lanarkshire. The range in prevalence of tooth decay experience was from the lowest of 29.2% in Borders, to 47.8% in Lanarkshire. The changes over time in the Scottish mean number of decayed, missing and filled deciduous teeth are shown in Figure 1, and illustrate the steady decline over the last three surveys.

In 2008 for the first time the residential postcode was used to allocate each child to a datazone allowing stratification of the national sample by the Scottish Index of Multiple Deprivation (SIMD) (Scottish Government, 2006). It was possible to attribute SIMD values to data for 96% of the 12,442 children who were examined. Figure 2 shows dental decay inequalities gradient across Scotland based on the prevalence of children free from

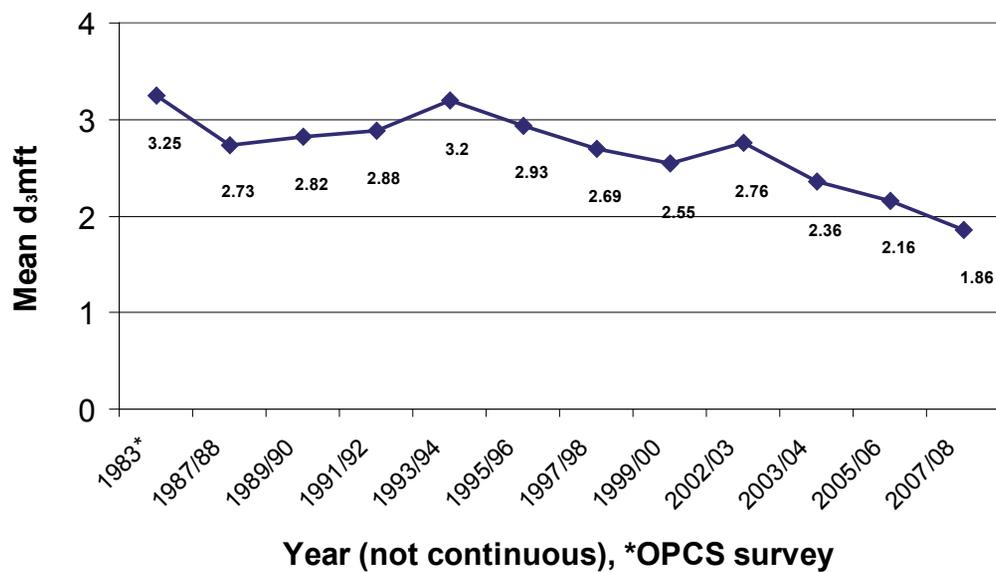


Figure 1. Twenty-five year trends in the mean d_3mft of P1 Children in Scotland

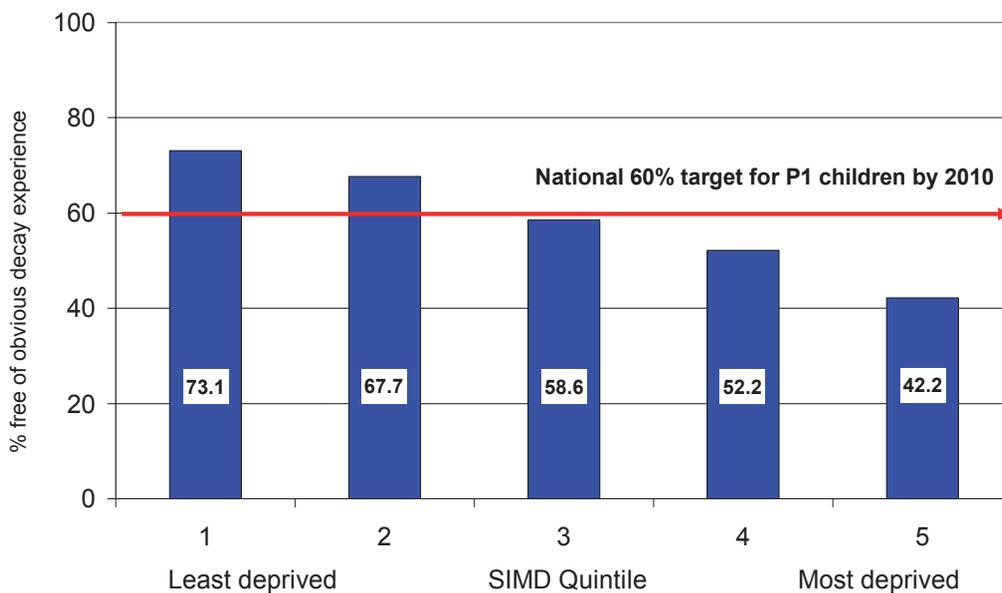


Figure 2. Percentage of Scottish Primary 1 Children free of obvious tooth decay experience 2008, by SIMD quintile.

obvious decay experience. It is hoped that this new analysis will act as a possible baseline for the future measurement of dental decay inequalities in P1 children across Scotland.

Comment

Surveys of the epidemiology of tooth decay at the level of Health Boards in Scotland have been in place since 1987 and inclusion of the 1983 OPCS survey results allow a national trend to be charted for the last 25 years (see figure 1). Both the mean d_3mft and the percentage of children with obvious decay experience reflect a steady oral health improvement since 2003. This is largely credited to the national Childsmile programme which provides a range of interventions which include free toothbrushes and fluoride toothpaste for all children aged 1 to 5, plus universal nursery toothbrushing. The 2008 mean d_3mft value of 1.86 is the lowest since national data began to be collected in 1983.

It is noteworthy to review the survey of P7 (12-year-old) children carried out in 2000/2001 which was a transition year before the Scottish NDIP was introduced. This system is based on the specific Scottish legislation around health inspections and a link back to individuals on the results of basic inspections was established. The method of gaining parental consent across Scotland in that school year used two methods. In this natural experiment, of the then 15 Health Boards, 5 used positive consent and the rest negative consent. Few Health Boards submitted complete results for this survey, but the data from four Health Boards were complete and of good quality. The overall response rates in the positive consent areas (42% to 55%) were roughly half of that in the negative consent areas (88% to 92%). The profile of Deprivation Category (DepCat) changed between the two surveys in the two Boards using positive consent; with the shift favouring children from more affluent areas (Carstairs and Morris, 1991). This shift in DepCat was not seen in the two Boards using negative consent. In those Boards which used positive consent, the mean d_3mft stayed the same or improved compared to the previous survey of 12-year-olds in 1996-97; while those using negative consent remained similar or became worse. These changes in mean d_3mft did not reach statistical significance. These results confirmed the broad effect of apparently better dental health outcomes when moving from negative to positive consent. In 2001 the incomplete data from Health Boards precluded a national result from being calculated. Since 2002-03 negative consent has again been used for the National Dental Inspection Programme surveys in Scotland.

Web link results of 2007/08 survey in Scotland: <http://www.scottishdental.org/index.aspx?o=2153>

England

Method

Following the UK training and calibration Regional Coordinators cascaded training to Primary Care Trust fieldwork teams and organised regional calibration exercises to ensure that all fieldwork teams were aware

of the essential aspects of the protocol and examiners were standardised.

For the first time in this series of caries prevalence surveys representative samples were required for all Local Authorities and for all Primary Care Trust geographies. In the majority of cases these organisational boundaries were the same, but in others additional samples were needed and results had to be weighted to allow valid collation from one geography to another.

Guidance from the Department of Health issued in 2006 demands that parental consent is now required for dental epidemiological surveys of young children in England. The 2007-08 survey was therefore the first that required this from the start. Standard letters of invitation with consent forms for return to school were set out in the national protocol and PCT teams amended these to show local details. After sampling of schools and sampling of children from within the sampled schools these letters were either posted to parents or were taken home by the sampled children. The return of consent forms to school was recorded and second letters were sent to parents who did not respond to the first. Again, the return of the second forms was recorded, along with parent's agreement or refusal for their child to take part. Only children for whom positive, written consent was provided were examined.

For the first time not only summarised data but also cleaned, raw data were collated centrally at TDO. This allowed investigation of the impact of consent and more in-depth analysis of the data than had previously been possible.

Results

According to the appropriate guidance sufficiently sized samples to provide estimates of caries levels were examined in 335 out of 354 Local Authorities, leaving 19 with no estimates. Out of 152 Primary Care Trust areas estimates were provided for all but 5. This level of compliance is better than in recent previous surveys.

A total of 139,727 children were examined, representing 66.8% of those sampled and 25% of this age group in mainstream state schools. This total is 35% lower than the previous survey of 5 year-olds (Pitts *et al*, 2007). In the majority of cases caries estimates at both LA and PCT were lower than in previous surveys. Bias introduced by the need for positive consent is one of a number of possible contributing factors.

The positive consent return level varied between and within regions with 74.9% of parents who were sent a consent letter sending positive returns in the South East Coast Region and 58.4% doing likewise in London. Across England the Local Authority with the lowest return level of 31.7% was Bath and North East Somerset, the highest, 96.5% was in Rushcliffe, East Midlands. Within regions there was also a range of returns, the largest disparity being in South West Region which includes Bath and NE Somerset contrasting with a 95.4% return level in Purbeck. Only 5% of parents sent back forms saying that they did not want their child to be involved in the survey. A far higher proportion of forms (23%) were simply not returned to school at all, after two requests.

Within the North West Region it was possible to compare, for each PCT, the level of positive consent return to the apparent reduction of caries levels with the previous survey (Fig 3). Where consent return levels were lowest the difference between the previous survey estimate and this one are greatest. The correlation coefficient suggests that 33% of the drop in reported caries levels can be explained by the drop in participation. This illustrates that some bias has been introduced by the need for positive consent.

Weighting of the responses by deprivation quintile to allow for shortfalls or over-representation of particular quintiles in specific LAs or PCTs was undertaken to produce improved estimates of caries levels. This had only limited effect on apparent caries levels and suggests that the consent return levels were related to factors over and above deprivation related differences in participation. These factors could be associated with known caries levels or behaviours that are linked to caries risk. In the absence of more details about the non-responders no further reweighting to allow comparison with data collected in previous years seems feasible.

Despite the challenges posed by positive consent, the same variations as previously noted across the country, between and within regions and between and within PCTs are still present. The weighted estimate of mean severity for South East Coast was 0.7 d₃mft, the lowest, and compares with a weighted estimate of 1.52 d₃mft in the North West and 1.11 for England as a whole. The prevalence of obvious caries experience for the country was 30.9%, with South East coast having the lowest proportion affected (23.5%) and North East Region the highest (39.8%).

Within regions the variation is more marked; In East of England the LA with the lowest estimate of caries levels is found in East Hertfordshire (0.27 d₃mft, 8.8% with obvious caries experience) and this compares with Luton which has the highest estimate within the region (1.94 d₃mft, 43.9% with obvious caries experience). The

PCT with the highest estimate is Brent in the London Region (2.50 d₃mft, 44.7% with obvious caries experience). Within the same region Bromley PCT has an estimate of 0.57 d₃mft and obvious caries experience of 18.8%.

Comment

Despite varying consent return levels the majority of samples were fairly representative of the populations from which they were drawn with regard to deprivation levels. There does not appear to be a discernible, directly linking factor between deprivation and consent return levels. Modelling with deprivation quintiles made only a small difference to the estimates and we have no information about the disease levels among non-consenters so currently there is no method of applying a correction factor to overcome the bias introduced by the need for positive consent. The estimates therefore represent a new baseline for England and cannot be used for backwards comparison.

Web links for tables of results <http://www.nwph.info/dentalhealth/> http://www.bascd.org/annual_survey_results.php

Wales

Method

Immediately following the UK training and calibration exercise the Wales training and calibration exercise was held to train the fieldwork teams in the new consent arrangements and the examination criteria. At the time of the survey the 22 Local Health Boards in Wales were coterminous with the Unitary Authorities. As Local Health Board boundaries have since changed in Wales but Unitary Authority boundaries have not, the data in this report are referred to by Unitary Authority.

Guidance from the Welsh Assembly Government issued in 2005 required dental epidemiological surveys in Wales to use positive parental consent (Welsh Assembly

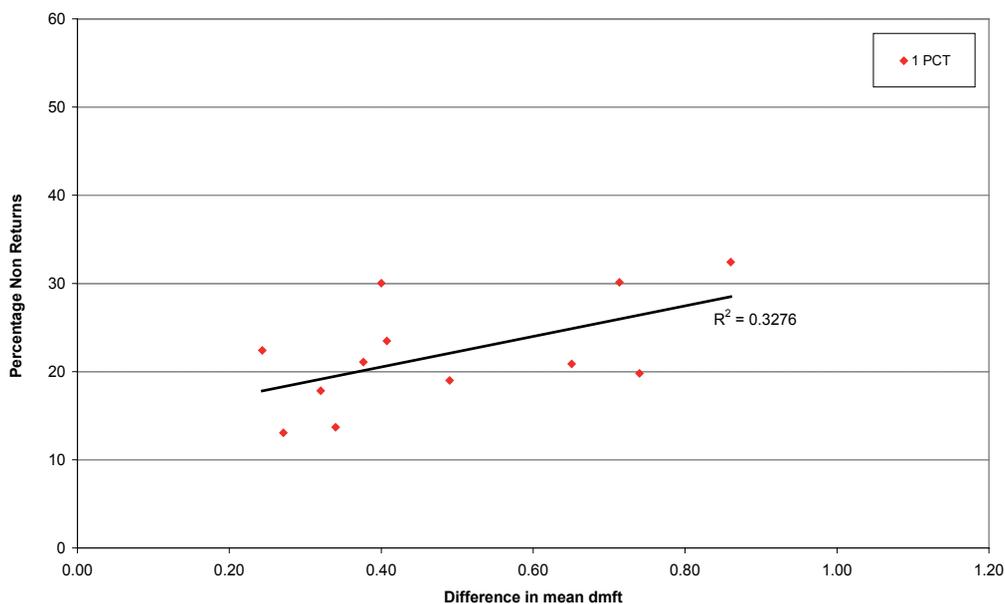


Figure 3. Difference in mean d₃mft between 2005/06 and 2007/08 surveys by consent return level among North West PCTs

Government, 2006). The 2007-08 protocol for Wales included standard letters inviting participation and response slips which were adapted by the fieldwork teams with local contact details. These letters were sent to parents with a stamped addressed envelope on a single occasion. Examiners were informed that they should only examine those children:

- who had been sampled for the survey, and
- whose parents had returned a positive consent, and
- who were willing to co-operate with the examination.

Data collected by fieldwork teams were subject to initial cleaning locally before forwarding to the Welsh Oral Health Information Unit for further data cleaning and analysis.

Results

The samples examined provided estimates of caries levels in all 22 Unitary Authorities in Wales. In total 12,662 children were sampled and 7,100 examined (56% of those sampled).

Across the Unitary Authorities in Wales the participation rate varied from 36% in Newport to 83% in Flintshire. In 2005/06 the participation rate using negative consent method in Unitary Authorities in Wales ranged from 73% in Newport to 95% in Anglesey, with a Welsh average of 87%.

The introduction of positive consent was associated with a large drop in reported caries prevalence in Wales compared with previous surveys as shown in Table 1. Table 2 shows the change in reported d_3mft indices for the whole of Wales and compares them with those reported for Scotland and England. While a large preventive programme called Childsmile was being introduced across Scotland there were no similarly large preventive

programmes running in Wales or England between 2005 and 2008.

The changed approach to consent in Wales is associated with a reduction in participation among those sampled. The data included in Figure 4 suggest that there was a larger reduction of participation of children with caries compared with peers free of obvious decay. In surveys prior to and including 2005-06 participation rates of those sampled in Wales were consistently above 95% across Unitary Authorities. There is some correlation between the proportion of children not examined in Unitary Authorities in Wales in 2007/8 and the reduction in reported caries prevalence in 2007-08 compared with 2005-06 ($r=0.63$ $r^2= 0.4$) (Figure 5).

Comment

The drop in reported caries indices in Wales over 2 years, associated with a change in consent arrangements, was larger than that which would be expected even if large preventive programmes had been in place.

Further analysis of the Welsh data demonstrated that the drop in participation was present in similar degrees across all quintiles of deprivation. Participation in past surveys in Wales using negative consent was at consistently similar high levels. Participation rates fell when positive consent was used.

Compared with previous surveys in Wales there was a small reduction in the proportion of children examined and found to be free of obvious caries. In contrast there was a large reduction in the proportion of children examined and found to have teeth affected by dentine caries (Monaghan *et al*, 2011).

In the absence of actual data on caries status of children who did not participate it is not possible to either reweight data to allow for the change in consent method or to fully explain biases which the use of positive consent may have introduced. However the analysis

Table 1. Caries indices for Wales 2005/6 and 2007/8

Index	2005/6 (-ve consent)			2007/8 (+ve consent)		
	95% LCI	95% UCI		95% LCI	95% UCI	
Mean d_3mft	2.38	2.31	2.45	1.98	1.89	2.07
% $d_3mft = 0$	47.2	46.2	48.1	52.4	53.6	51.3
Mean d_3mft ($d_3mft > 0$)	4.51	4.42	4.60	4.16	4.02	4.29

Table 2. Changes in d_3mft indices in England, Wales and Scotland 2005/06 to 2007/08

Year	Mean d_3mft			% $d_3mft > 0$ Those with obvious caries		
	England	Wales	Scotland	England	Wales	Scotland
2005/06	1.47	2.38	2.18	38	53	46
2007/08 – positive consent required in Wales and England	1.11	1.98	1.86	31	48	42
Difference	0.36	0.40	0.32	7	5	4

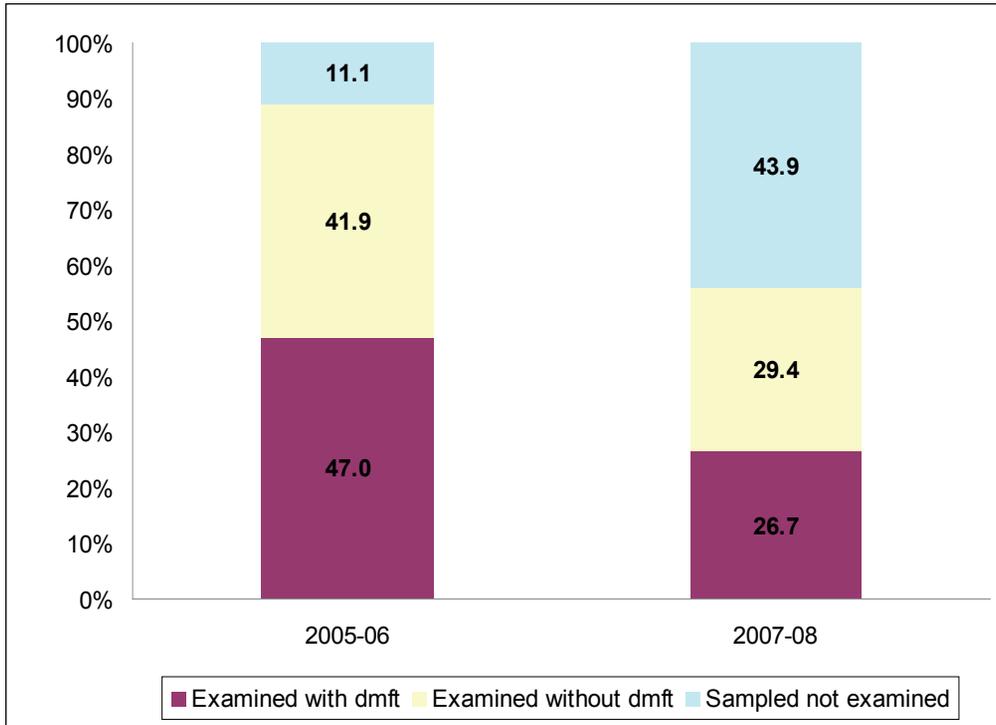


Figure 4. Proportion of sampled children examined, with and without d_3mft , and not examined for the 2005-06 and 2007-08 surveys in Wales

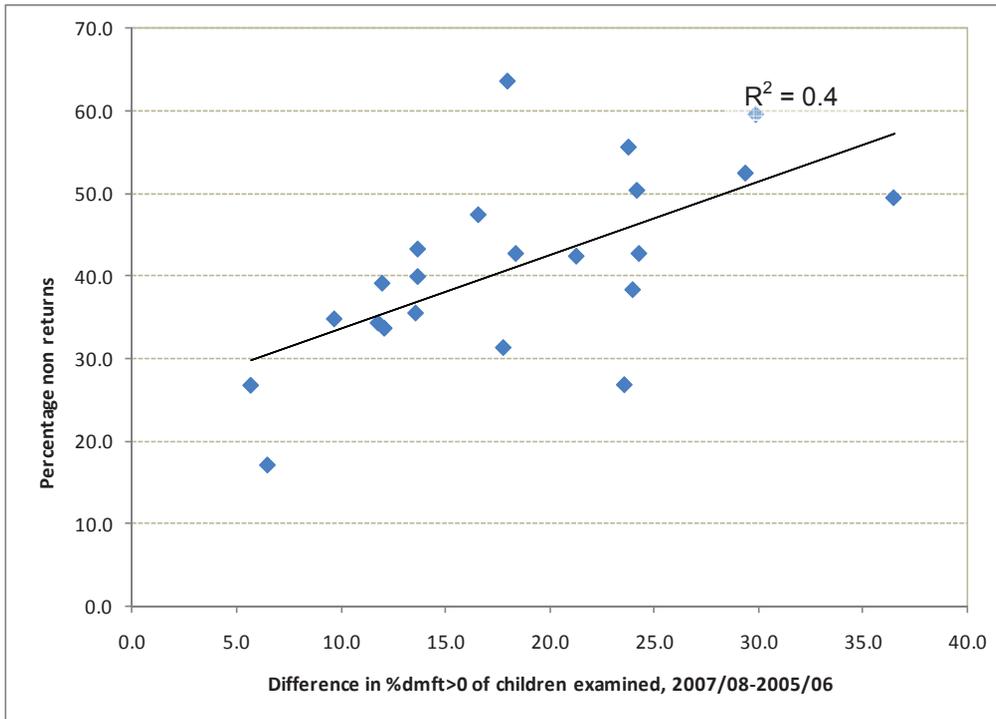


Figure 5. Difference in % $d_3mft > 0$ between 2005/06 and 2007/08 surveys by consent return level among Welsh Local Health Boards

in Wales suggests that positive consent of parents is less likely to be provided if the parents are aware that their child has or is at risk of decay, irrespective of socio-economic background. Further research such as focus group work with parents not providing consent might be able to confirm whether this is a factor. Differential participation between children free of obvious decay and those with caries might account for much of the reported drop in caries incidence.

Web link: <http://www.cardiff.ac.uk/dentl/research/themes/appliedclinicalresearch/epidemiology/oralhealth/index.html>

Discussion

The changed consent arrangements in England and Wales, but not Scotland, present an unplanned natural experiment exploring the impact of changed consent arrangements on reported caries incidence. The Scottish data provides a partial control, using the same consent arrangements as previously, but with widespread prevention initiatives targeting young children under 5-years of age. In England and Wales the changed consent arrangements were similar and are associated with large apparent reductions in caries increments not associated with any new nationwide prevention initiatives.

Comparing findings in the various countries demonstrates that the large reported apparent improvements in decay levels in England and Wales are unlikely to be real, and at least partially result from response bias. A significant proportion of this bias is likely to arise from differential participation of children with and without obviously decayed teeth. Because the actual status of the teeth of children not examined is not known it is not possible to weight data to correct for the differential participation. The magnitude of the change is sufficient to make comparisons of oral health data collected in England and in Wales before and after the changed consent arrangements invalid. For the same reasons data collected in England and in Wales in 2007/8 cannot be compared directly with data collected in Scotland.

Recommendations

Given that the form of consent appears to result in differential participation rates of children with and without dentine caries it is recommended that data collected from surveys from 2007-08 onwards are annotated to demonstrate the consent arrangements used and the resulting participation rates. Warnings should also be provided about the inappropriate comparison of English and Welsh data collected after 2007-08 with data collected before then or data collected in Scotland.

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