A cluster randomised control trial investigating the effectiveness of personalised letters sent subsequent to school dental screening in increasing dental registration rates in unregistered 12-13 year old children in South-East Scotland.

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Abstract

Background
Historically, school dental screening was primarily to identify treatment need. However the process has also been used to encourage attendance for regular dental care. Studies of school dental screening have differed in their findings. Earlier studies demonstrated improved dental registration rates whereas a recent large-scale study found neither increased attendance rates nor any dental health gain. This study was designed to investigate whether a new National Dental Inspection Programme (NDIP) resulted in improved dental registration compared with the previous school screening system and whether any improvement in registration rates could in fact be obtained by simply sending a letter home urging dental registration of those known to be currently unregistered but without carrying out any clinical examination in the school.

Methods
Clinical Setting: All 65 state Secondary schools in Lothian and Fife.


After stratifying for school size and range of social deprivation, schools were randomly allocated to one of four groups.

1. Traditional screening, letter home to unregistered children only
2. National Dental Inspection Programme (NDIP), letter to all children
3. Letter home only to unregistered children, no inspection
4. Control group

Dental registration status was compared at baseline and 3 months post inspection using multilevel modelling.
Results
For the children who, at baseline had never being registered with a GDP there was no significant change in registration levels associated with any of the study groups. For children who had previously been registered but had lapsed, the most significant predictor of re-registration was the length of time lapsed (P<0.001). After adjusting for this the NDIP group showed a significantly increased re-registration rate compared with the Traditional group (P<0.05). Other predictors tested at pupil level (deprivation score) or school level (region, mean deprivation score, number of pupils in year) were not significant.

Conclusions
Children who had never been registered were unlikely to become registered within three months of an Inspection, and none of the interventions appear to have affected this. Within the lapsed group of children, registration levels significantly increased for the NDIP group compared with the Traditional group.
Background

Historically, school screening was primarily a clinical exercise to identify children in need of dental treatment. However increasingly the school screening process has also been used to try and ensure that children were receiving regular dental care [1] based on the professional and public belief that regular or asymptomatic dental attendance is important for maintaining good dental health [2]

The effectiveness of the school dental screening programme in increasing registration levels has previously been investigated in 3 RCTs [3,4,5] In the earlier two studies a significant improvement in registration levels was demonstrated. More recently, a large scale cluster randomised control trial in the North-west of England, did not show any benefit from the screening process either in reducing the amount of untreated dental disease or increasing levels of dental attendance [6] However none of these studies looked at the effect of a personalised letter sent home alone or to what degree the combination of the two interventions (dental inspection and personalised letter) affected the proportion registered. Jones [7] demonstrated that, in Health Authorities in England, registration levels were significantly associated with social deprivation and that an “inverse dental care law” existed whereby the children in the lowest socio-economic groups, who are known to have the greatest need for dental care [8], are the least likely to register with a general dental practitioner (GDP).

In the academic year 2002/3 a uniform National Dental Inspection Programme (NDIP) was introduced across Scotland [9]. The NDIP involves children in Primary I (around 5 years old) and VII (around 11 years old) being inspected under a national,
standardised protocol. The children are categorised as high, medium or low risk as determined by the clinical findings. Separate letters are sent to the parents of children in each risk group detailing the clinical findings and encouraging registration with a GDP. No attempt is made to identify the registration status of the child at the time of the inspection, however all are also sent a list of local GDPs.

Prior to this, each NHS Board Community Dental Service (CDS) had run differing screening programmes. The national guidance allowed for dental inspections up to three times in the child’s school career. Between NHS Boards there were great variations in inspection frequencies, ages of children inspected, data collection protocols and information sent home. In Lothian and Fife, the CDS had developed links with the local education departments and the Scottish Dental Practice Board in order to electronically match school roles with dental registration data and thus identify primary and secondary school children who were not registered with a GDP. This system is thought to be unusual in being able to identify named individuals and validate their “official” dental registration status rather than relying on anecdotal parental feedback or hand checking of records. After the clinical inspection these unregistered children were then sent a personalised letter urging them to register with a dentist and also a list of local NHS dentists.

To evaluate the relative effect of this traditional Lothian and Fife system in increasing registration rates in General Dental Practice and compare this with the newly introduced NDIP a study was designed to compare changes in registration rates in General Dental Practice in three groups of 12-13 year old children who had been
identified as being unregistered against a control group in order to test the null hypotheses listed below:

a) There is no difference between the two inspection methods (Traditional and NDIP) in terms of changing registration

b) The Traditional school screening programme (inspection plus letter) confers no additional benefit on increasing dental registration to sending a letter alone

c) Sending home letters prompting registration to children confirmed as being unregistered, without conducting a dental inspection, has no effect on dental registration levels

The main outcome was whether or not children who were unregistered at baseline had become registered 3 months later.

**Methods**
The study was designed as a cluster randomised, controlled trial in which the unit of randomisation was the school. In a trial such as this, the power to detect effects of the interventions depends on both the number of schools and the numbers of children per school, and is a complex function of these and the between- and within-school variation in effect sizes. However the relatively large number of children per school, (mean range 86-275) means that the power is likely to be dominated by the number of schools and the variation between schools in the magnitude of the intervention effects. A sample size of approximately 40 schools would be expected to have 80% statistical power to detect a mean difference between intervention and control groups of about
one standard deviation in between-school variation. Good power to detect a true mean difference of 10% in take-up rates would require a variation of less than 10% between schools in mean take-up rates resulting from school-specific factors not explained by measurable factors such as deprivation.

For the purpose of this study, first year students in all state secondary schools (n=61) in Lothian and Fife were identified (12,765 12-13 year old children) in 2004. All the schools in the sample agreed to participate in the study and the study was approved by the local research ethics committee.

After stratifying for size of school and range of social deprivation, using the Scottish Index of Multiple Deprivation [10], the schools were randomly allocated using a computer-generated sequence to one of four groups by the study statistician blinded to the interventions that each would receive which was not revealed until completion of analysis. The four groups and descriptions of the interventions that they received are shown in table 1. Figure 1 illustrates the composition within each arm of the study.

Following accepted standards in Scotland, in both groups where the children were dentally inspected (1&3) pre-inspection letters were sent home to the parents explaining that their child was to be dentally inspected at school and offering the chance for them to request that their child be exempted from inspection. Children were also at liberty to refuse a dental inspection on the day. A team of 4 community dental officers conducted all inspections following protocols according to the allocated group for each school (Traditional or NDIP).
Immediately prior to the interventions, the registration status of each child was identified by electronically matching the school lists files obtained from the Lothian and Fife Education departments against the dental registration database (Management and Dental Accounting System - MiDAS) held by Dental Practitioner Services within the Common Services Agency of the NHS in Scotland.

Each child was categorised as registered, lapsed or never registered. The time since registration had lapsed was also recorded. The relevant CDS treatment databases were searched and any children in the “unregistered group” found to be under treatment with the CDS in Lothian or Fife were excluded from further analysis.

Only those originally identified as being unregistered (i.e. lapsed or never registered) were analysed. Three months following the interventions changes in registration status were investigated. A further analysis was included to investigate for differences in children who had never been listed as registered with an NHS GDP and those whose had been at one time registered (lapsed more than 9 months). This period was chosen to allow for those individuals whose lapse in registration was only “temporary” and who intended to maintain their registration with the GDS. Also those who had been lapsed for more than 9 months would have passed 2 years since their last dental inspection which, according to the NICE guidelines on recall intervals, is the maximum recommended period between routine dental check-ups for adults and twice the period for children under 18. [2]
Significance tests and confidence intervals for effect sizes were calculated by multilevel modelling using MlwinN software, which allowed the inclusion of predictors of registration rates at both the individual subject level and the school level, and also took appropriate account of the different numbers of children in each school.

**Results**

At baseline, of the total S1 population in Lothian and Fife (n=12765) two thirds were registered (n=8448) and, of the remaining third, 394 were receiving treatment from the CDS. Excluding these children left 3923 in the primary analysis.

Table 2 summarises the findings as to whether or not children who were unregistered at baseline had become registered 3 months later. None of the changes in registration level were statistically significant (p>0.05).

In the multi-level modelling, among the children who were unregistered at baseline, but who had previously been registered, the most significant predictor of registration at 3 months was the length of time they had been lapsed (P<0.001), while other predictors tested at pupil level (deprivation score) or school level (region, mean deprivation score, number of pupils in year) were not significant. Figure 2 illustrates the findings for those children who had previously been registered but had lapsed. It shows the downward trend in registration rates with length of time lapsed.
In the 3923 children who were not registered at the start of the study, 1323 had previously registered and had lapsed for less than 9 months; these were treated as registered as previously described. Therefore, the analysis in this study was completed on a total of 2600 children within 61 clusters (schools). Of these, 882 had been lapsed for more than 9 months and 1718 had never been registered.

The final multilevel model included length of time lapsed as a pupil-level predictor together with study group as the school-level predictor, and the following null hypotheses were tested by comparing study groups.

1. There is no difference between the two inspection methods (Traditional and NDIP) in terms of changing registration (Group 1 compared with Group 3)
2. The Traditional school screening programme (inspection plus letter) results in no more dental registration than sending a letter alone (Group 1 compared with Group 2)
3. Simply sending home personalised letters prompting registration (without conducting a dental inspection) has no effect on dental registration levels (Group 2 compared with Group 4)

No statistically significant differences were found to reject the null hypotheses. However, when the unregistered group was split into those who were once registered but lapsed and those who were never registered there was a significant difference, with a higher level of registration in the group who had lapsed. Additionally, within the lapsed children, the NDIP group demonstrated a statistically significant increase in
Discussion
This study found that there was no significant increase in registration among children who were not registered with a GDP at baseline in any of the four groups. Some of these children had never been registered while others registration had lapsed. When compared there was a significant difference in these two groups of children, with a higher level of registration in the group who had lapsed. In these lapsed children, the time since they lapsed was the strongest predictor of re-registration however there was no demonstrable difference in re-registrations between the control group and any of the interventions. There was however a statistically significant increase in registration levels between the NDIP group compared with the Traditional group in those children whose registration had lapsed for more than 9 months.

It is possible that the never registered group had a higher proportion of children who had never had any dental problems and whose parents were therefore not persuaded of the need to register. Additionally, it is not known whether any of the “unregistered” children were under private dental care, though this is unlikely in Scotland. More research would be needed in order to investigate this.

Interestingly the Traditional group showed a lower re-registration rate than the control group, though not statistically significantly different. This result supports the findings reported in a qualitative study into parental attitudes to school screening where the parents were reassured that the children had been seen by a dentist at the school and therefore felt less need to seek any other dental care for their child [11]. However, if
this were the case it would be expected that there would be a similar reassurance within the NDIP group but this group had a higher level of registration. Given that the Traditional and NDIP inspections are very similar further research may be warranted to establish whether differences in the content and delivery of the post-inspection letter contribute towards this finding.

It should be noted that this study was conducted using a cohort of 12-13 year old children and the findings may not be found within other age groups. This age group however has been identified as exhibiting an increase in the proportion of untreated dental decay [12] and it has been suggested that one possible cause of this worrying decline in dental health is some children failing to access dental services once they leave primary school [13]. First year children in secondary school are no longer routinely inspected in Scotland, and it was deemed important therefore to explore possible options to improve registration rates in this group.

Accuracy in determining registration status has been reported to be problematic. Early studies in this area relied either on parental feedback via a questionnaire to determine registration status [3,5], involvement of the GDP in sending lists to the CDS [1] or on a hand search of dental practice records [14]. Tickle et al [15] used an automated system but reported that making the data sets compatible was found to be time consuming and inappropriate for routine use. The current study used a computer programme devised by the Practitioner Services Department of the Scottish Common Services Agency which used the concept of “probability” matching. This compared various fields in the two matched databases (surname, forename and date of birth) while allowing for possible variations in spelling (e.g. McDonald/MacDonald) or
chosen forename e.g. James/Jamie. This system was validated by an internal audit within Fife CDS involving a hand search of GDP records and was shown to be approximately 95% accurate in identifying individual children [16]. Approval was obtained from the relevant data protection officers when this protocol was introduced in Lothian CDS in 1995. It is uncertain however that such approval would now be obtained given the stricter application of data protection guidelines in recent years.

The findings of our study are in line with the recent OHU study in England who also found that none of their similar interventions were successful in increasing registration rates [6]. The previous studies which showed an increased registration rate following school inspections both involved detailed clinical reports to the parents/guardians and intensive follow up of non-responders [3,1]. Neither of these studies discussed any difference between “lapsed” and “never registered” in the unregistered group therefore it is not possible to tell if there was a genuine increase in attendance or if there was a pattern of re-attendance as in the current study.

Not only is it difficult to increase dental registration in this age group, but it has also been suggested that registration with a GDP does not equate with a healthy attendance pattern [17] More importantly perhaps in a study of 8-9 year olds no difference was found in the dental treatment needs of those who were registered or unregistered [18] It is possible however, that these findings may be less relevant given the changes that are taking place nationally to remove financial barriers to the provision of preventive care in general dental practice. For example, within Scotland, since the launch of the Action Plan for Dental Services in Scotland many developments have been put in
place to promote oral health both at a community and practice levels such as the CHILDSMILE programmes [19].

Recent guidance from the National Screening Committee (NSC) states that three questions need to be answered in relation to school-based dental screening programmes [20]. First, can attendance resulting from screening be improved? This study adds to the evidence currently available to suggest that this is unlikely without committing a large investment in resources to following up individuals post screening which may be difficult to justify. Secondly could treatment rates following referral be improved? This is likely to be best addressed at a national policy level relating to the funding and delivery of NHS GDS services. Scotland has chosen a different route than England and Wales and it remains to be seen how this will affect the preventive care and treatment provided to Scottish school children. Finally, what means might be used to maintain surveillance of dental health of children if the programme were to be abandoned? This is a critical question. Scotland has a rich, historical database gathered from 1987 gathered by the Scottish Heath Boards Dental Epidemiological Programme onto which the NDIP data fits seamlessly. Richards suggested in a recent editorial [21] that greater clarity is required on how to improve the health gain from the school inspection programme before a decision is made to abandon the programme.

**Conclusions**

Children who had never been registered were unlikely to become registered within three months of an Inspection, and none of the interventions appear to have affected
this. Within the lapsed group of children, registration levels significantly increased after 3 months for the NDIP group compared with the Traditional group.

**Competing interests**
The authors declare that they have no competing interests.

**Authors' contributions**
CJC conceived of the study, and participated in its design and coordination and drafted the manuscript.

RE participated in the design of the study and performed the statistical analysis.

GVAT participated in the design of the study and helped to draft the manuscript.

All authors read and approved the final manuscript.

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References


9. Scottish Dental Epidemiology Coordinating Committee & Dental Health Services Research Unit: *Scotland’s National Dental Inspection Programme 2003*. Dundee: University of Dundee; 2004


16. Logan J: *Personal communication*


Figures

Figure 1 – Illustration of the composition within each arm of the study
Figure 2: Re-registration rates of those "lapsed more than 9 months" by length of time lapsed at baseline
Figure 3  Increase in registration rate by intervention and previous registration status
## Tables

### Table 1 - Number of schools in each group

<table>
<thead>
<tr>
<th>Group</th>
<th>Intervention</th>
<th>Description of Intervention</th>
<th>No. of schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Traditional</td>
<td>Inspections conducted against a checklist of treatment need criteria. Personalised letter, tailored to the confirmed registration status of the child prompting registration where necessary was sent home via the child in sealed, personally addressed envelopes with a list of local GDPs accepting NHS child patients.</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>Letter only</td>
<td>As above, but no dental inspection conducted.</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>NDIP</td>
<td>Inspections conducted against a checklist of treatment need criteria. Personalised letter - not tailored to the confirmed registration status of the child - was sent home via the child in sealed, personally addressed envelopes with a list of local GDPs accepting NHS child patients.</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>Control</td>
<td>Children in the schools allocated to this group received neither a dental inspection nor a letter home until after the end of the study.</td>
<td>16</td>
</tr>
</tbody>
</table>
Table 2 - Changes in registration levels in children unregistered at baseline

<table>
<thead>
<tr>
<th>Group</th>
<th>No. who registered</th>
<th>No. in group</th>
<th>% registered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>164</td>
<td>1175</td>
<td>14.0</td>
</tr>
<tr>
<td>2</td>
<td>176</td>
<td>971</td>
<td>18.1</td>
</tr>
<tr>
<td>3</td>
<td>151</td>
<td>958</td>
<td>15.8</td>
</tr>
<tr>
<td>4</td>
<td>129</td>
<td>819</td>
<td>15.8</td>
</tr>
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</table>
Table 3 - Changes in registration levels in children who at baseline had lapsed or never registered.

<table>
<thead>
<tr>
<th>Group</th>
<th>Lapsed more than 9 months</th>
<th>Never Registered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. who registered</td>
<td>No. in group</td>
</tr>
<tr>
<td>1</td>
<td>32</td>
<td>280</td>
</tr>
<tr>
<td>2</td>
<td>34</td>
<td>216</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>205</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>181</td>
</tr>
</tbody>
</table>

* p<0.05
Sample population
12,765 children in
61 clusters (schools)

Traditional arm
3422 children
15 clusters

Baseline status
CDS 101
Registered 2146
Lapsed<9mo. 362
Lapsed>9mo. 280
Never reg. 533

NDIP arm
3248 children
16 clusters

Baseline status
CDS 81
Registered 2196
Lapsed<9mo. 359
Lapsed>9mo. 205
Never reg. 407

Letter only arm
3101 children
14 clusters

Baseline status
CDS 116
Registered 2027
Lapsed<9mo. 296
Lapsed>9mo. 216
Never reg. 446

Control group
2994 children
15 clusters

Baseline status
CDS 96
Registered 2079
Lapsed<9mo. 306
Lapsed>9mo. 181
Never reg. 332

Those registered with GDS and CDS excluded from analysis

Study Group
unregistered only
1175 children
(15 clusters)

Study Group
unregistered only
971 children
(16 clusters)

Study Group
unregistered only
958 children
(14 clusters)

Study Group
unregistered only
819 children
(16 clusters)

3923 children due for analysis at 61 schools

Traditional arm
1175 children

NDIP arm
971 children

Letter only arm
958 children

Control group
819 children

3923 children analysed at 3 month post intervention at 61 schools

2600 children (never registered and lapsed>9 months) subjected to secondary analysis

Figure 1
Figure 2

Time registration lapsed at baseline (months)

% of children who re-registered 3 months post study

- Traditional
- Letter only
- NDIP
- Control
Figure 3