

Factors influencing the uptake of childhood immunisation in rural areas

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SUMMARY

Background: Childhood vaccination has been vigorously debated in recent years. Professional and parental confidence in the measles, mumps and rubella (MMR) vaccine in particular has been shaken, as reflected by its decreased uptake.

Aim: To investigate the influence of practice type and the method of vaccination call/recall on childhood immunisation coverage.

Design: Analysis of childhood immunisation uptake rates.

Setting: General practices in the Highland NHS Health Board area in Scotland.

Method: Data on the immunisation uptake of individual practices in the region were obtained from the Information and Statistics Division of NHS Scotland.

Results: Uptake of all vaccines in children reaching the age of 2 years was lower in practices using their own call/recall system than those engaged with the national system. Inducement practices achieved lower uptake than non-inducement practices for every immunisation studied, with the differences ranging from 4.7% to 7.8%. Compared with group practices, uptake of all vaccines was less for single-handed practices, with the differences ranging from 2.4% to 11.4%. A logistic regression analysis found that high uptake of the diphtheria and meningococcus group C vaccines by the age of 24 months was significantly associated with use of the national call/recall system. Only inducement practice status was significantly associated with reduced uptake in children aged 12 months.

Conclusions: Engagement with the national call/recall system was associated with higher immunisation coverage for children reaching the age of 2 years. Inducement status was associated with low uptake of vaccinations in children reaching the age of 1 year.

Keywords: immunisation; immunisation coverage; primary health care.

Introduction

CHILDHOOD immunisation has been the subject of debate in the medical and lay press in recent years.^{1,2} Following the publication of research suggesting a link between the measles, mumps and rubella (MMR) vaccine and Crohn's disease and autism,³ parental and professional confidence in this particular vaccine has been affected.⁴⁻⁶ This has been reflected in the declining uptake of the vaccine across the country, raising the possibility of measles outbreaks.

Incomplete capture of immunisation data has been previously shown to have a profound effect on reported uptake rates.⁷ However, the effect of practice type and the method of immunisation call/recall on immunisation uptake are unclear.

In Scotland, general practitioners (GPs) working in remote areas receive an inducement allowance that guarantees them a minimum salary. The income generated from vaccination target payments is deducted from this allowance. As a consequence, such GPs have no financial incentive to undertake and report vaccinations. In the Highland NHS Health Board area, 41.8% (33/74) of practices receive an inducement payment (M MacDonald, unpublished data, 2002), compared with 7.5% (79/1058) nationally (J McNally, personal communication, 2002). In addition, the Highland NHS Health Board area (hereafter referred to as Highland) has a higher percentage of single-handed practices than the Scottish average, with 32% (24/74) of Highland practices being single-handed (M MacDonald, unpublished data, 2002), compared with the national figure of 18% (191/1058) (J McNally, personal communication, 2002).

Vaccination activity can be coordinated using either practice-based or national/regional call/recall systems. In Highland, 10.8% (8/74) of practices use their own system (B Harrison, unpublished data, 2002), which is comparable to the proportion nationally (K Barton, personal communication, 2002).

The characteristics of practices in Highland are summarised in Table 1.

Work was undertaken to assess the contribution of practice type and method of call/recall to the uptake of childhood immunisation in Highland.

Method

Immunisation against nine separate infectious agents are offered to children during their first 2 years of life (Table 2). Immunisation against diphtheria is commonly administered in a combined vaccine that also protects children against tetanus, pertussis, and haemophilus influenzae type B (DTP-Hib). This is given at the same time as polio drops.

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Submitted: 11 April 2003; Editor's response: 28 July 2003; final acceptance: 14 November 2003.

©British Journal of General Practice, 2004, 54, 114-118.

HOW THIS FITS IN*What do we know?*

Concerns about the measles, mumps and rubella (MMR) vaccine are known to exist among professionals and parents, as reflected by its decreased uptake over recent years.

What does this paper add?

This work has shown the differential uptake rates of childhood immunisation by practice type. This is the first published study to demonstrate that inducement status is associated with low uptake of childhood immunisation. The finding of a positive association between the use of the national immunisation call/recall system and vaccination coverage has not been previously reported.

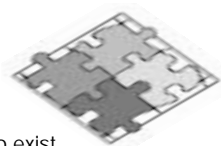


Table 1. Characteristics of GP practices in Highland.

Type of practice	% (n)
Inducement practices	44.6 (33/74)
Non-inducement practices	55.4 (41/74)
Single-handed practices	32.4 (24/74)
Group practices	67.6 (50/74)
Non-SIRS participating practices	10.8 (8/74)
SIRS participating practices	89.2 (66/74)

SIRS = standard immunisation recall system.

Table 2. Childhood immunisation schedule in Great Britain during the first 2 years.^a

Vaccination	Age at administration (months)
DTwP vaccine	2, 3, 4
Hib vaccine	2, 3, 4
Men C vaccine	2, 3, 4
Poliomyelitis vaccine.	2, 3, 4
MMR vaccine	12–15

^aSource: British National Formulary.⁸ DTwP = absorbed diphtheria, tetanus and whole cell pertussis; Hib = haemophilus influenzae type B; Men C = meningococcal group C; MMR = measles, mumps and rubella.

Table 3. Percentage of fully vaccinated children: inducement and non-inducement practices.

	Inducement practices (% [n/total])	Non-inducement practices (% [n/total])	Difference (%) (95% CI)	P-value
Diphtheria by the age of 1 year	90 (315/350)	96.2 (1745/1813)	6.2 (3.0 to 9.5)	0.001
Men C by the age of 1 year	89.1 (312/350)	95.1 (1724/1813)	6.0 (2.5 to 9.4)	0.001
Diphtheria by the age of 2 years	89.3 (291/326)	94.0 (1675/1782)	4.7 (1.2 to 8.3)	0.02
Men C by the age of 2 years	82.8 (270/326)	90.6 (1614/1782)	7.8 (3.4 to 12.1)	0.001
MMR by the age of 2 years (First dose only)	74.8 (244/326)	81.7 (1456/1782)	6.9 (1.8 to 11.9)	0.004

Men C = meningococcal group C; MMR = measles, mumps and rubella.

Immunisation coverage against diphtheria is used as a proxy for immunisation coverage against these other organisms. As vaccination against meningococcus group C is relatively new and is less established, it was studied separately. Likewise, in view of the particular circumstances associated with the MMR vaccine, its uptake was also considered separately.

The Information and Statistics Division (ISD) of NHS Scotland collate and publish, on a quarterly basis, information on the uptake of childhood immunisation across Scotland. Much of their data are extracted from the national Standard Immunisation Recall System (SIRS) database. SIRS is used by the majority of practices in Highland to coordinate the vaccination of children, and these practices are termed 'SIRS participating'; that is, they use the SIRS database for their call/recall. In addition, the immunisation status of all children registered with both SIRS participating and non-participating practices in the region are recorded on the database.

Before investigating the impact of practice type on immunisation uptake, a process of data validation was undertaken to ensure the accuracy of the information used by ISD to calculate immunisation uptake.

During February 2002, an analysis of the accuracy of the immunisation records for children in the region was undertaken. The names of children in Highland reaching the ages of 12 and 24 months during the final quarter of 2001 who appeared to have defaulted on recommended immunisations were obtained from the SIRS database. An enquiry form was sent to the GP of each child requesting details of all the vaccinations they had received. The information provided was used to amend the appropriate records on the SIRS database.

A comparison of the recorded immunisation coverage before and after this data validation process was then undertaken. For each vaccine a statistically significant increase in coverage was found.⁹ Incomplete data capture appeared to be a feature of the region's immunisation recording arrangements, and the data validation measures were therefore continued for subsequent quarters as a quality assurance mechanism.

Based on validated data, the Child Health Information Team at the ISD provided details of the immunisation uptake achieved by each practice in Highland for the four quarters 1 October 2001 to 30 September 2002. This was used to cal-

Table 4. Percentage of fully vaccinated children: single-handed and group practices.

	Single-handed practices (% [n/total])	Group practices (% [n/total])	Difference (%) (95% CI)	P-value
Diphtheria by the age of 1 year	92.4 (207/224)	95.6 (1853/1939)	3.2 (0.2 to 7.5)	0.036
Men C by the age of 1 year	92.0 (206/224)	94.4 (1830/1939)	2.4 (-1.3 to 6.1)	0.146
Diphtheria by the age of 2 years	88.6 (178/201)	93.8 (1788/1907)	5.2 (0.7 to 9.7)	0.005
Men C by the age of 2 years	79.1 (159/201)	90.5 (1725/1907)	11.4 (5.6 to 17.1)	0.001
MMR by the age of 2 years (first dose only)	72.1 (145/201)	81.5 (1555/1907)	9.4 (3.0 to 15.8)	0.001

Men C = meningococcal group C; MMR = measles, mumps and rubella.

Table 5. Percentage of fully vaccinated children: SIRS participating and non-participating practices.

	Non-SIRS participating practices (% [n/total])	SIRS participating practices (% [n/total])	Difference (%) (95% CI)	P-value
Diphtheria by the age of 1 year	95.4 (209/219)	95.2 (1851/1944)	-0.2 (-2.7 to 3.1)	0.886
Men C by the age of 1 year	95.4 (209/219)	94.0 (1827/1944)	-1.4 (-1.5 to 4.4)	0.408
Diphtheria by the age of 2 years	87.5 (175/200)	93.9 (1791/1908)	6.4 (1.7 to 11.1)	0.001
Men C by the age of 2 years	82.5 (165/200)	90.1 (1719/1908)	7.6 (2.7 to 13.0)	0.001
MMR by the age of 2 years (first dose only)	77.0 (154/200)	81.0 (1546/1908)	4.0 (-2.1 to 10.1)	0.170

SIRS = standard immunisation recall system; Men C = meningococcal group C; MMR = measles, mumps and rubella.

culate and compare vaccination coverage by practice type (single-handed versus group, inducement versus non-inducement, SIRS participating versus non-participating practices).

Descriptive statistics are presented as proportions, differences, and odds ratios along with confidence intervals. The proportions of children vaccinated by the different practices were compared using χ^2 tests. Unconditional logistic regression analysis was performed to assess the association between each practice characteristic and vaccination uptake. P-values below 0.05 were considered significant. All analyses were carried out using the statistical package Strata 7.0.

Results

Inducement and non-inducement practices

For children reaching the ages of 1 and 2 years during the period 1 October 2001 to 30 September 2002, the vaccination uptake achieved by inducement practices was less than that achieved by non-inducement surgeries for all the immunisations studied. For each vaccination the reduced uptake was found to be statistically significant (Table 3).

Single-handed and group practices

Uptake of immunisations by the ages of 1 and 2 years in single-handed and group practices was compared. For all

the vaccinations studied, the uptake achieved by single-handed practices was lower than group practices. The difference in the proportions of 1 year-olds fully vaccinated against diphtheria and 2 year-olds fully vaccinated against diphtheria, meningococcus group C, and MMR was statistically significant (Table 4).

SIRS participating and non-participating practices

For children reaching the age of 12 months, the immunisation uptake achieved by non-participating practices was slightly higher than that of SIRS participating practices. The differences were not statistically significant.

For the proportion of children reaching the age of 2 years however, SIRS participating practices achieved a higher coverage than practices using their own call/recall systems. For the proportion of 2 year-olds fully vaccinated against diphtheria and meningococcus group C, the reduced uptake achieved by non-participating practices was found to be statistically significant (Table 5).

Logistic regression analysis

A logistic regression analysis was undertaken to assess the relative contribution of each practice type to immunisation coverage (Table 6).

With respect to completed courses of vaccination against diphtheria and meningococcus group C by the age of

Table 6. Logistic regression analysis on the factors influencing non-immunisation coverage.

	12 months Odds ratio (95% CI)	24 months Odds ratio (95% CI)
Completed courses of immunisation against diphtheria		
Non-inducement practices	1.00	1.00
Inducement practices	2.87 (1.8 to 4.57)	1.53 (0.99 to 2.34)
Non-SIRS participating practices		
SIRS participating practices	1.37 (0.69 to 2.73)	0.52 (0.32 to 0.83)
Group practices		
Single-handed practices	1.13 (0.63 to 2.03)	1.63 (1.00 to 2.68)
Completed courses of immunisation against meningococcus group C		
Non-inducement practices	1.00	1.00
Inducement practice	2.52 (1.63 to 3.90)	1.56 (1.10 to 2.22)
Non-SIRS participating practices		
SIRS participating practices	1.69 (0.86 to 3.33)	0.60 (0.40 to 0.90)
Group practices		
Single-handed practices	0.99 (0.57 to 1.74)	2.12 (1.44 to 3.14)
Uptake of the MMR vaccine		
Non-inducement practices	NA	1.00
Inducement practices	NA	1.34 (1.00 to 1.79)
Non-SIRS participating practices		
SIRS participating practices	NA	0.86 (0.60 to 1.22)
Group practices		
Single-handed practices	NA	1.55 (1.10 to 2.19)

SIRS = standard immunisation recall system; MMR = measles, mumps and rubella; NA = not applicable.

1 year, only inducement practice status was significantly associated with low uptake.

For completed courses of vaccination against diphtheria received by 24 months old, higher coverage was significantly associated with use of SIRS. This was also true for completed courses of vaccination against meningococcus group C received by the age of 2 years.

Inducement and single-handed practices were both found to be independently associated with low coverage against meningococcus group C for children reaching the age of 2 years.

For MMR received by 24 months old, single-handed practices were found to be significantly associated with low uptake.

Discussion

This study has shown the differential uptake of childhood immunisations by practice type and method of immunisation call/recall.

As the vast majority of childhood vaccinations in the region are carried out in primary care, GP records are a valid source of immunisation information. All GPs who were contacted regarding the immunisation status of children registered with them replied. Consequently, the vaccination records held on the SIRS database for children in Highland reaching the ages of 1 and 2 years during the period 1 October 2001 to 30 September 2002 provide an accurate picture of the immunisation uptake among children aged 2 years and under in the region.

Only children registered with GPs were included in this study. Therefore, the actual immunisation coverage in the region may differ from that reported. However, as this study aimed to examine the influence of practice type and method

of immunisation call/recall on vaccination uptake, the population studied was appropriate.

Tables 3–5 show that immunisation coverage is lower in 2 year-olds compared with 1 year-olds. These children belong to different cohorts. Eligible children should have been fully vaccinated against diphtheria and meningococcus group C by the age of 1 year. Children who remain incompletely immunised by then should be invited to complete the course during their second year.

However, due to difficulties with recruiting and retaining GPs in Highland over recent years and the impact that this has had on continuity of care,¹⁰ such children may have been lost to follow-up.

By contrast, children reaching the age of 1 year would have been routinely invited to receive their immunisations during the period of this research. It is possible that the study has raised the profile of childhood vaccination within the region, acting as a catalyst to promote immunisation activity in this group.

By comparing the performance of inducement and non-inducement practices, it was found that uptake of all of the vaccines studied was lower for inducement practices. For every immunisation the deficit was found to be statistically significant. Logistic regression analysis demonstrated that only inducement status was significantly associated with lower uptake of vaccination by the age of 12 months. For completed courses of immunisation against meningococcus group C received by 24 months of age, inducement status was also found to be independently associated with low uptake.

This finding has not previously been described and this is the first published study to report this observation.

The reasons for this discrepancy are unclear. It may be

due to practical difficulties, such as reduced access to transport for parents living in remote areas that are frequently served by inducement surgeries. However, it may also reflect the previously described difficulties encountered in attempting to provide primary care in remote areas compared with urban areas. A local report has highlighted the extensive use of short-term locum GPs to ensure service provision in a number of rural areas in recent years.¹⁰ The significantly reduced uptake found among children registered with inducement practices may reflect the disruption in service provision during the period when these children would have received their primary immunisations.

The importance of the GP's role in childhood vaccination in Highland was highlighted by a questionnaire survey of GPs in the region undertaken in connection with this study. GPs administered immunisations in 72.3% (149/206) of respondents' surgeries. Health visitors were said by 35.4% of doctors to immunise children.⁹

Another possible explanation is the lack of financial incentives offered to inducement practices to undertake immunisation activity. Previous work has shown that vaccination activity can be encouraged by financial rewards.¹¹ However, qualitative research undertaken along with this analysis suggested that inducement practitioners undertake vaccination because they perceive it to be an effective intervention, irrespective of monetary considerations.⁹ Therefore, the contribution made by lack of financial incentives is uncertain.

Single-handed GPs were also found to have reduced uptake of all immunisations when compared to group practices. However, the regression analysis revealed that single-handed status was only independently associated with low uptake of the MMR vaccine and completed courses of immunisation against meningococcus group C by the age of 2 years.

Further work is required to clarify the factors contributing to these findings. It is appreciated that the proportion of inducement and single-handed practices in Highland is greater than the national average. Therefore, these findings will be of interest and value to colleagues working in rural settings and for health service planners with responsibility for organising primary care services in remote areas.

For children reaching the age of 2 years, the call/recall arrangements of surgeries using their own systems were less effective in achieving high uptake for MMR as well as diphtheria and meningococcus group C, when compared to practices participating in the national system. This is the first published study to demonstrate across a range of immunisations that GPs using practice-based measures achieve lower uptake rates than those using national systems.

The finding that participation in SIRS was only positively associated with immunisation coverage for children reaching the age of 2 years is interesting. This suggests that the value of national and regional call/recall arrangements may lie in their ability to ensure that children 'missed' during their first year are not lost to follow-up. Given the previously described problems of recruitment and retention in Highland, this finding is consistent with the national system acting as a 'safety net'.

Levels of engagement with the national immunisation call/recall system in Highland mirror that found across

Scotland. Consequently, the positive association between immunisation coverage among children reaching the age of 2 years and participation in the national system is of relevance to GPs across the country.

It is recognised, however, that practices can engage with SIRS in a number of ways. Further work is required to identify the most effective means of engagement.

In conclusion, this study has provided evidence of the differential uptake of childhood immunisation achieved by different practice types. Further work, however, is required to delineate the reasons behind this observation and identify possible solutions. In view of the positive association between immunisation coverage and use of the national call/recall system, consideration should be given by practices using their own call/recall arrangements to explore the potential benefits for them and their patients of engaging with regional or national systems.

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Acknowledgements

Support was provided from Brenda Harrison and Kenny Oliver, Highland Primary Care Trust, and Blair Smith, Aberdeen University. We also appreciate the assistance of David Baird, Child Health Information Team at ISD. Special thanks to all the practice staff who contributed to the data validation exercise.