uncertain until nephrocalcinosis was diagnosed by the regional nephrology unit.

CONCLUSIONS

Screening with ultrasonography in a low risk population can detect many fetal malformations and may reduce perinatal mortality. The demonstration of a normal fetus can be reassuring to the parents but, as we have discussed above, there are several limitations to such a screening programme, which is available only to women who book early enough. High levels of anxiety can be caused, not only with false positive diagnoses but also after identifying minor (possibly normal) variants. More data need to be collected in low risk populations concerning these normal variants together with the long term prognosis associated with many ultrasonographic findings so that we may counsel parents more accurately.

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Can morbidity associated with untreated asthma in primary school children be reduced?: a controlled intervention study

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Abstract

Objective—To determine whether an intervention programme based on existing school and community resources can reduce school absence and improve participation in games lessons and sport in children with unrecognised or undertreated asthma.

Design—Parallel group controlled intervention study.

Setting—102 primary schools in Nottingham: 49 were randomised to receive the intervention and 53 to be control schools.

Subjects—All children aged 5 to 10 years with parent reported absence from school because of wheezing in the previous year and taking no treatment or β agonists only.

Interventions—Children with asthma were referred to their general practitioner for assessment of symptoms and treatment. Teachers were given education on asthma by the school nurse in 44 of the 49 intervention schools.

Main outcome measures—Changes in school absence and missed games and swimming lessons because of wheezing, and schools' policy towards management of asthma in school.

Results—Of 17 432 children screened, 451 met the entry criteria—228 in intervention schools and 223 in control schools. 152 (67%) children in intervention schools visited their general practitioner, of whom 39 (26%) were given a new diagnosis of asthma and 58 (38%) had treatment for asthma increased or changed. Over the next academic year mean (SE) parent reported school absence due to wheezing fell significantly, but to a similar extent, in both intervention and control schools (0.82 (0.11) and 1.09 (0.21) weeks respectively). There was little change in school recorded absence or participation in games lessons and swimming lessons in either group. At the

end of the study intervention schools were more likely to have improved aspects of management of asthma in school.

Conclusion—The intervention resulted in a majority of children being assessed by their general practitioner and improved teachers' understanding and management of asthma, but it did not result in any appreciable reduction in morbidity.

Introduction

Morbidity attributed to underdiagnosis and under-treatment of asthma in schoolchildren¹⁻⁹ is common and should be preventable. During the early 1980s two uncontrolled studies in Newcastle found a considerable reduction in school absence because of wheezing after children with wheezing had been assessed and, if appropriate, treated for asthma.^{4,7} Since then the recognition of asthma and prescribing of drugs for asthma in children has increased greatly,^{10,11} but children continue to miss school because of apparently untreated or undertreated wheezing.¹⁰

To determine whether improvements can still be achieved in school attendance and participation in school activities of children with asthma and management of asthma in schools we conducted a randomised, controlled study of the effect of a simple intervention programme in 102 primary schools in Nottingham. The intervention was designed specifically to use health care resources already available to most schools so that if successful it would be suitable for more widespread implementation. The intervention entailed medical appraisal of children suspected of having undertreated asthma and, as children spend much of their time at school and staff may not be familiar with asthma and its treatment,^{12,13} it included a programme of education for teachers about asthma.

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Methods

The 102 primary schools in the Nottingham postcode area that were not included in a random sample for a previous study¹⁰ were invited to participate. A screening questionnaire asking about wheezing, use of drugs, and school absence because of wheezing was sent to parents of all children aged 5 to 10 years in these schools in May 1988. Urdu translations were provided where necessary. From the responses to the questionnaire we identified children who were particularly likely to have undiagnosed or undertreated asthma. They included all children who had been absent from school because of wheezing at any time in the past year and who were taking no treatment for asthma; all children who had lost more than five days of schooling because of wheezing and were not taking regular prophylactic drugs for asthma; and all children who had lost more than 10 days' schooling because of wheezing, irrespective of treatment (only three of these children were receiving treatment other than with a B₂ agonist). Children who had attended a hospital outpatient clinic for asthma in the six months before the questionnaire were excluded.

As the intervention involved school nurses, who work in teams covering more than one school, schools were randomised to receive the intervention or to be a control according to their school nurse team.

INTERVENTION

General practitioner assessment

Parents of children with asthma in a school receiving the intervention were sent a letter in June or July 1988 asking them to take their child to see their family doctor for assessment. General practitioners were notified and asked to review the child's diagnosis and treatment according to guidelines for the diagnosis and management of asthma in children that we compiled with advice from two paediatricians and a general practitioner. The guidelines emphasised the use of peak flow meters for diagnosis and assessment of symptoms and the value of prophylaxis and of giving drugs by the inhaled route.

School nurse teaching sessions

School nurses in the intervention schools were invited to an asthma study afternoon in September 1988. The nurses were given teaching materials, including the text of a 30 minute talk on asthma and visual aids, and asked to hold a teaching session for teachers in their schools during the next school term. They were also asked to identify children who brought inhalers to school and to check that they were using them correctly and appropriately.

ASSESSMENT

Outcome of visits to general practitioners

General practitioners and parents were asked to complete a brief questionnaire after the child had been seen to summarise any change in diagnosis or treatment and any other advice given by the general practitioner.

Changes in school attendance and participation

Questionnaire for parents—Parents were asked to estimate the number of days lost from school, the number of games lessons and swimming lessons missed because of wheezing, and details of diagnosis and treatment during the previous school year in May 1988 and again in May 1989. Absence from school was measured in school weeks (five days). Children were grouped according to how many games lessons and swimming lessons they had missed (see table I).

Class registers of school attendance—Absence from school for each term (for all causes) was taken from

class registers for the school years 1987-8 and 1988-9. Data from matched non-wheezy children (the child whose name was on the class register after each study child) were used to provide an estimate of usual school absence for the year 1987-8.

Questionnaire for teachers—Teachers were asked to record the number of games lessons and swimming lessons, school outings, and outside play sessions missed by the child in the summer term preceding the intervention and for each term over the study year at the end of each term.

Changes in school practices and teachers' knowledge

Questionnaire for head teachers—Head teachers were asked about the number of children before and after the study taking drugs for asthma to school, policies towards children taking drugs for asthma, and parents' communication with the school regarding asthma.

Questionnaire for parents—All parents who reported that their child took drugs for asthma in May 1988 were asked about the child's access to such drugs in school and before sport one year later.

Questionnaire for teachers—Teachers' experience and knowledge of asthma was assessed by a questionnaire and multiple choice test at the end of the study.

Questionnaire on asthma teaching sessions—Nurses and teachers were asked to comment on the asthma teaching sessions.

STATISTICAL ANALYSIS

The power of the study was estimated from knowledge of the time lost from school by wheezy children in Nottingham in 1985¹⁰; the sample size of 150 children in each group was adequate to provide 95% power to detect a difference of two days (0.4 weeks) in school absence because of wheezing over the previous school year at a 5% significance level. The statistical package for social sciences (SPSS) was used to provide descrip-

TABLE I—Details of the 451 children in intervention and control schools for the year before the study. Figures are numbers (percentages) of children unless otherwise stated

	Intervention group (n=228) No (%)	Control group (n=223) No (%)
Sex:		
Male	130 (57)	104 (47)
Female	98 (43)	119 (53)
Asthma diagnosed	92 (40)	88 (39)
Currently using drugs for asthma	51 (22)	50 (22)
No of wheezing episodes in previous year:		
1-4	152 (67)	136 (61)
5-10	40 (18)	43 (19)
>10	25 (11)	31 (14)
Unspecified	11 (5)	13 (6)
No of weeks absent from school because of wheezing in previous year (from parent report):		
0		
1	88 (39)	77 (35)
2	80 (35)	77 (35)
3	32 (14)	33 (15)
4	17 (8)	20 (9)
5	11 (5)	16 (7)
Mean (SE) No of weeks	1.55 (0.07)	1.69 (0.08)
Mean (SE) No of days' absence per term because of any cause (from class registers)	5.57 (0.28)	6.01 (0.34)
No of games lessons missed in previous year (from parent report)*:		
0 (Category 1)	152 (67)	148 (66)
1-2 (Category 2)	37 (16)	27 (12)
3-5 (Category 3)	25 (11)	37 (17)
6-10 (Category 4)	11 (5)	5 (2)
>10 (Category 5)	3 (1)	6 (3)
Mean (SE) category	1.57 (0.07)	1.63 (0.07)
No of missed swimming lessons in previous year (from parent report):		
0 (Category 1)	84 (37)	64 (34)
1-2 (Category 2)	62 (27)	72 (32)
3-5 (Category 3)	31 (14)	41 (18)
6-10 (Category 4)	12 (3)	14 (6)
No swimming	39 (17)	32 (14)
Mean (SE) category	1.85 (0.06)	2.03 (0.06)

*Refers to lessons lost when in school.

tive statistics and for baseline comparisons, by using Students' *t* test and χ^2 analyses.¹⁴ Changes in measures of morbidity between groups were compared by analysis of variance by using the generalised linear interactive modelling (GLIM) program.¹⁵ Inspection of the distributions of changes in the variables between groups showed no appreciable departures from normality, so untransformed means and error distributions were used for all comparisons between groups. Where possible the analyses dealt with changes over the academic years. As complete data from school attendance registers were not provided for all children for all three school terms these data were analysed as averages for each term. A conversion factor of 1.7 was used to compare school absence measured in weeks each year (from parent reports) with absence in days each term (from school registers).

Results

RESPONSE RATES, RESPONDENTS, AND COMPLIANCE

All of the 102 schools invited to take part in the study agreed to do so.

The screening questionnaire

Of 17 432 screening questionnaires sent to parents, replies were received for 13 585 (77.9%) children. Of these, 1738 (12.8%) reported wheezing in the past year, 1201 (8.9%) a diagnosis of asthma, and 1026 (7.6%) absence from school because of wheezing in the previous year.

The study group

In all, 451 children fulfilled the entry criteria for the study. The mean (SE) parent reported absence from school because of wheezing in these children in the previous year was 1.62 (1.17) weeks (2.7 days each term). Mean absence due to all causes recorded in school registers for these children was twice as high at 5.73 (0.26) days each term (3.4 weeks each year); this was 1.89 (0.24) days each term more than matched non-wheezy children ($p < 0.001$, data provided for 69% of matched children).

Forty nine schools from 15 school nurse teams were randomised to receive the intervention and 53 schools from 17 nurse teams to be controls. As a result 228 of the 451 children were allocated to the intervention group and 223 to the control group. There was little difference between the two groups in the year before

the study with respect to frequency of wheezing, diagnosis, drugs, absence from school, and the number of games lessons and swimming lessons missed (table I). The ratio of boys to girls in the two groups differed slightly but not significantly.

Compliance

Completion of study—Of the 451 children, 296 were successfully followed up over the next year (fig 1).

FIG 1—Number of children entered into and completing study

Respondents and non-respondents did not differ significantly in terms of sex, age, frequency of symptoms, use of drugs, and morbidity associated with wheezing. Almost identical proportions were followed up in intervention and control groups.

General practitioner assessment—Of the 228 children in the intervention group, 152 (67%) consulted their doctor as requested, 20 (9%) declined to do so, and 56 (25%) failed to respond to this or any further request (fig 2).

FIG 2—Number of children in intervention schools taken to family doctor

School nurse teaching session—Sixty three teaching sessions were delivered in 44 intervention schools. The sessions lasted up to one hour and were held during lunch breaks or after school. Nurses checked the inhaler technique of two thirds of the children known to take inhalers to school.

OUTCOME OF VISIT TO GENERAL PRACTITIONER

Of the 152 children who visited their general practitioner, 39 (26%) were given a new diagnosis of asthma, 60 (39%) were told they did not have asthma, and 53 (35%) had a diagnosis of asthma confirmed (fig 2). Treatment for asthma was started in 20 children, 22 children had prophylactic drugs (inhaled steroid or sodium cromoglycate) added to their previous treatment, and the route of delivery of β agonists and the

TABLE II—Changes in morbidity associated with wheezing from 1988 (before intervention) to 1989 (after intervention). Comparison of control children with all intervention children, those who attended the general practitioner, and those for whom the general practitioner changed or introduced treatment for asthma

	Intervention group			
	Whole group	Those who visited their doctor	Those whose treatment was changed	Control group
<i>School absence because of wheeze (weeks)†</i>				
No of children	145	126	49	147
Mean (SE) decrease	0.82 (0.11)*	0.58 (0.17)	0.58 (0.25)	1.09 (0.21)*
95% Confidence interval	(-0.82 to 0.26)	(-1.1 to 0.08)	(-1.2 to 0.19)	
<i>School absence due to all causes (day/term)‡</i>				
No of children	211	128	51	193
Mean (SE) decrease	0.14 (0.49)	0.49 (0.4)	0.44 (0.55)	-0.22 (0.73)
95% Confidence interval	(-1.53 to 2.25)	(-1.16 to 2.58)	(-1.31 to 2.63)	
<i>Missed games lessons (category)§</i>				
No of children	145	126	47	147
Mean (SE) decrease	0.08 (0.11)	0.09 (0.11)	0.11 (0.15)	0.01 (0.15)
95% Confidence interval	(-0.34 to 0.48)	(-0.33 to 0.49)	(-0.19 to 0.39)	
<i>Missed swimming lessons (category)¶</i>				
No of children	107	86	40	106
Mean (SE) decrease	0.25 (0.23)	0.3 (0.25)	0.5 (0.36)	0.29 (0.16)
95% Confidence interval	(-0.6 to 0.52)	(-0.58 to 0.6)	(-0.52 to 0.94)	

* $p < 0.05$.

†From parent reports.

‡From school registers.

§Mean decrease in category. For the five categories see table I.

¶Mean decrease in category. For the four categories see table I.

mode of delivery was changed for 16 (11%) children. Antibiotics were prescribed for 16 and antihistamines for five. Peak flow was recorded for 36 (24%) children; seven were referred to a hospital specialist.

EFFECT OF THE INTERVENTION

School attendance and participation in activities

There was a pronounced and significant reduction in parent reported absence from school because of wheezing in 1988-9 compared with the previous school year, but this occurred to a similar extent in children in both intervention and control schools (mean (SE) changes 0.82 (0.11) and 1.09 (0.21) weeks respectively, table II). Similar results were also seen in the children reported as losing more than two weeks from school in the initial survey (76 in intervention schools and 78 in control schools), with parent reported absence decreasing from 3.7 weeks each year in both groups by a mean (SE) of 1.6 (0.3) weeks in the intervention schools and 1.8 (0.23) weeks in the control schools. There was, however, little change in absence due to all causes obtained from school registers for either group of children over the study period (table II), and no significant changes in participation in the school activities assessed (table III). Nor was there any measurable

TABLE III—Number (percentage of respondents) of children missing school activities because of wheezing in the previous term (from teachers' reports) in intervention and control schools

	Before intervention	Intervention year			
	Summer 1988	Winter 1988	Spring 1989	Summer 1989	
No (%) of children for whom a reply was obtained:					
Intervention	178 (78)	165 (72)	179 (79)	171 (75)	
Control	154 (69)	167 (75)	151 (68)	137 (61)	
Missing school outings:					
Intervention	4 (2)	6 (4)	1 (<1)	1 (<1)	
Control	6 (4)	3 (2)	1 (<1)		
Missing swimming lessons:					
Intervention	22 (12)	18 (11)	30 (17)	20 (12)	
Control	17 (11)	34 (20)	23 (15)	10 (7)	
Missing games lessons:					
Intervention	9 (5)	17 (10)	19 (11)	16 (9)	
Control	7 (5)	21 (13)	7 (5)	8 (6)	
Discontinuing games:					
Intervention	8 (4)	8 (5)	9 (5)	11 (6)	
Control	13 (8)	9 (5)	11 (7)	11 (8)	
Spending playtime inside school:					
Intervention	9 (5)	17 (10)	17 (9)	10 (6)	
Control	11 (7)	21 (13)	17 (11)	13 (9)	

improvement in any measure of morbidity when the analysis was restricted to the 152 children in intervention schools who consulted their family doctor or the 58 children who had treatment for asthma introduced or changed (table II). There was no evidence of differential effects of the intervention between the sexes.

Diagnosed asthma and current drugs for asthma

Between 1988 and 1989 there was an increase in both groups in the number of children for whom parents reported a diagnosis of asthma (from 61 to 81 in children in intervention schools and from 69 to 80 in children in control schools). There was a similar increase in use of drugs, both for β agonists (from 35 to 44 and from 42 to 62 respectively), and of prophylaxis (from 2 to 23 and from 2 to 22). None of these changes differed significantly between the two groups.

School practices and teachers' knowledge

Head teachers reported a slight increase in the number of children taking inhalers to school in the intervention year compared with the previous year (table IV). Class teachers reported similar figures (between one and two children in each class) in 1989. At the end of the study children in intervention schools

were more likely to keep their inhalers with them during school hours than those in control schools (42% v 34%, $p<0.05$), and according to their class teacher were more likely to use their inhaler before games (44% v 38%, $p<0.05$). This was corroborated by parents (table V) and by head teachers, who confirmed that the schools were allowing more children access to their inhalers (that is, all children or older children were allowed to keep inhalers with them at all times) and that more intervention schools had introduced a central list of asthmatic children (table IV).

TABLE IV—Management of asthma in schools (from head teacher questionnaires)

	Intervention schools		Control schools		p Value*
	1988	1989	1988	1989	
No of children with an inhaler in school	8.2	8.6	7.1	7.8	NS
No of schools where all children kept own inhalers	18	35	21	18	<0.001
No of schools with central list of asthmatic children	14	25	22	24	<0.01
No of schools where parent usually/always indicated on admission form if child had asthma	38	41	42	43	NS
No of schools where parent usually/always informed school of asthma drugs to be taken in school	42	46	48	47	NS
No of schools where parent usually/always sent written instructions for asthma drugs	18	24	15	21	NS

*Based on χ^2 analysis for difference in change between intervention and control schools.

TABLE V—Children's access to drugs for asthma in school (from parent reports, 1989*). Figures are numbers (percentages) of children

	Intervention schools	Control schools	p Value†
	No (%)	No (%)	
Children who were currently taking asthma drugs to school	271	205	
Children who kept inhalers with them	131 (48)	57 (28)	<0.0001
Children whose parents preferred them to keep their inhalers	173 (64)	116 (57)	NS
Children to whom advice was given in school to use inhaler before games lessons	156 (58)	106 (52)	NS
Children who used inhaler before games lessons	111 (41)	56 (27)	<0.003
Children whose parents sent written instructions to school about asthma treatment	87 (32)	54 (26)	NS

*Based on 708 replies from 840 questionnaires in 1989.

†Based on χ^2 analysis of those taking drugs to school.

At the end of the study teachers in intervention schools were more likely to feel adequately prepared to supervise a child with asthma than teachers from control schools (135/241 (56%) v 47/276 (17%)). Those who had attended the talk given by the school nurse on asthma gave more correct responses to a multiple choice test on asthma ($p<0.001$).

Teacher evaluation of school nurse talk

Of the 241 teachers from intervention schools who returned a questionnaire, 172 had attended a nurse teaching session on asthma. Most welcomed the teaching session and thought it should be repeated at least once a year.

Discussion

The intervention assessed in this study was designed as a practical response to reports that underdiagnosis and undertreatment of asthma is an important problem in schoolchildren.^{1,9} Our objective was to improve the diagnosis and management of children with potentially treatable morbidity by using resources that are currently available to most schools, so that, if successful, the intervention could be implemented widely.

We found that 67% of parents responded to the advice given to the intervention group and took their child to their general practitioner for assessment. Treatment for asthma was introduced or changed as a result of this assessment in a third of these children. The teaching on asthma delivered by school nurses to schoolteachers was well received and led to measurable improvements in the practical management of asthma at school. As in previous intervention studies,^{4,7} parent reported absence from school because of asthma fell substantially in the intervention group over the study year. A similar fall, however, also occurred in the control group, and there was no significant difference in either this or any other measure of morbidity between the two groups. We might have been able to achieve greater compliance from parents with the general practitioners' assessments by more intensive coercion but we specifically wished to assess the effect of an intervention that was within the resources available to most schools. We did, however, assess whether the intervention was more effective in those who complied fully with it by looking at the subgroups of children who attended the general practitioner, or in whom the general practitioner instigated some change in treatment. We found no evidence that the intervention was appreciably more effective in these groups.

Some of the fall in parent reported school absence over the study period was probably due to initial overreporting by parents. In the year before the intervention parent reported school absence because of wheezing accounted for about half of the total absence recorded by schools. However, the reductions in parent reported asthma that subsequently occurred in both groups during the study period were not accompanied by equivalent falls in school registered absence. The simplest explanation for this discrepancy is that parents initially overestimated time lost from school because of wheezing. The apparent effectiveness of previous interventions^{4,7} may therefore be attributable in part to similar overreporting by parents at the outset of the study, and this point emphasises the need for a control group in studies such as this.

Although the visit to the general practitioner led to a new diagnosis of asthma in 39 children and a change in treatment in 58, similar changes also occurred in children in control schools. The large increase in treatment for asthma in children in control schools during the study may have been a study effect, possibly arising from increased parental awareness of respiratory problems as a result of completing the initial questionnaire. The general practitioners may also have become more aware of asthma in children as a result of this study and our previous study and have been more inclined to start prophylactic treatment. We are not aware of any other local external factors in Nottingham during the study period that could account for the change in both groups. Alternatively our findings may have been due to a more general trend of increased awareness of asthma and its associated morbidity, to which our study contributed relatively little. There is evidence for a fairly pronounced temporal increase in the use of asthma as a diagnostic label for wheezing illness in Nottingham primary school children between 1985 and 1998,¹¹ which is likely to have continued and to have affected both groups during the study period.

The finding that our intervention was unsuccessful in terms of affecting the primary end points of change in school absence and time lost from sport and other school activities is unlikely to be due to a lack of statistical power as our study was sufficiently large to detect a difference of two days' school absence between the two groups. We conclude that our intervention programme did not make an appreciable difference to morbidity associated with asthma when assessed as time lost from school or games lessons. This is

probably in part because the extent of underdiagnosis and undertreatment in 1988 was less than that shown previously,³ and the capacity for improvement was therefore reduced. The prevalence of diagnosed asthma in Nottingham schoolchildren in 1988 was 8.9%,¹¹ which is considerably higher than the 1.2% recorded in Newcastle in 1979.³ Some of this increase might have been due to a true increase in the prevalence or severity of asthma,¹⁶⁻²⁰ but as the prevalence of wheezing has changed relatively little in recent years^{10,11,20} most of the change is likely to have been due to greater recognition and labelling of wheezy children as a result of the early studies.²⁻⁵ The amount of time lost from school because of wheezing was also considerably less in our study than in the two previous intervention studies,^{4,7} again suggesting that asthma is now causing less morbidity in asthmatic children.

The teacher education programme was successful in increasing teachers' knowledge and confidence and in improving certain aspects of management of asthma in schools—for example, by having a central list of asthmatic children, allowing better access to inhalers, and enabling inhalers to be used more often before sport. Benefits from health education are difficult to evaluate objectively as changes in knowledge may take time to translate into detectable changes in behaviour. The participation of school nurses should enable continuing support and advice to be available to teachers, with the potential for further education on a regular basis.

Although we were unable to show benefit from our intervention in this study, this finding may apply only in the context of relatively high prevalences of diagnosed asthma and relatively low levels of school absence because of the disease. The intervention may be more effective in areas where the prevalence of diagnosed asthma is lower. It is easy to introduce a screening questionnaire for asthma for all children on school entry, and this should ensure that schools are aware of children with asthma and those taking drugs for asthma. School nurses can deliver teaching programmes that are effective in improving some aspects of management of asthma in schools.

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Surveillance of antibody to rubella virus in Grampian: closing the immunity gap

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Abstract

Objectives—To identify causes for the continuing deficit of rubella immunity in women of childbearing age with a view to further reducing the risk of the congenital rubella syndrome.

Design—A questionnaire was sent to the general practitioner and a laboratory follow up study conducted in a one year cohort of women found on screening to have inadequate protection against rubella.

Setting—Virus laboratory of the department of medical microbiology, Aberdeen, serving the health board areas of Grampian, Orkney, and Shetland.

Patients—239 women whose concentration of antibodies to rubella virus was either absent or below standard (15 000 IU/l) and whose general practitioner could be contacted to supply a history of infection, immunisation, pregnancy, and antibody testing.

Main outcome measures—Whether rubella vaccination was given and whether those vaccinated were tested for seroconversion.

Results—Only 122 (55%) of the women for whom information was available received the recommended vaccine; only 74 (61%) of these were tested for seroconversion. Oversight was the reason given for not vaccinating 64 (65%) of the women who remained at risk. Women who were pregnant when tested were significantly less likely to receive vaccine (odds ratio 3.36) than women who were not pregnant, and even if vaccinated were less likely to have a follow up antibody test (odds ratio 1.94).

Conclusion—Once women are identified as being unprotected against rubella they are often overlooked and not vaccinated. Prompting mechanisms aimed at general practitioners, such as the one recently set up in Grampian, should reduce the immunity gap and help to eradicate rubella in pregnancy.

Introduction

The aim of the selective immunisation policy for schoolgirls and women was to control and ultimately eliminate rubella in pregnancy.^{1,2} As a result, the susceptibility of antenatal women to rubella has declined to less than 2% in most areas of the United Kingdom.³ Further reduction is thought to be unlikely owing to women missing vaccination or the failure to mount or maintain a detectable antibody response.⁴ This means that in Grampian, for example, at least 100 women each year continue to be at risk of contracting rubella in pregnancy. The measles, mumps, and rubella vaccination programme should reduce the chance of infection,⁵ but increased efforts must still be made to vaccinate susceptible women if congenital rubella is to be eradicated from the United Kingdom.

We investigated a group of women identified in 1987 as having rubella antibody levels below 15 000 IU/l to find out why they were still susceptible to rubella and what action had been taken as a result of the laboratory report.

Subjects and methods

During 1987 blood samples from 8357 women from general practice, hospital, and occupational health clinics in Grampian, Orkney, and Shetland were screened for antibody to rubella virus at the virus laboratory of the University of Aberdeen by the single radial haemolysis method. In all, 149 women were seronegative (no antibody zone on testing) and 108 had equivocal results (antibody was present, but less than the Public Health Laboratory Service's standard of 15 IU/ml), giving a total of 257 "unprotected" women. All women with equivocal results were included in the unprotected group to ensure that vaccine was recommended in the laboratory report for all those with doubtful levels. The report also carried a recommendation for a follow up antibody test six weeks after vaccination (if this test was negative a further sample was requested to allow for delayed antibody response).

Of the 257 unprotected women, 239 were available for study. A questionnaire was sent to the general practitioner of each woman to obtain demographic and rubella related data.

Results

Of the 239 questionnaires sent to general practitioners, 233 were returned, giving a response rate of 97% (91% of all unprotected women identified in 1987). Data from the laboratory reports were available for the six women whose questionnaire was not returned and for a further 12 women whose questionnaire was returned incomplete. Table I gives the sources of the blood samples with reasons for testing as stated on the laboratory request forms. Eleven women

TABLE I—Source of blood samples and reason for testing in women with rubella antibody level <15 000 IU/l

Source	Reason	No of samples
General practitioner	Routine	52
	Antenatal—routine	114
	Antenatal—rubella contact	1
	Suspected rubella infection	7
	Rubella in pregnancy	2
	Infertility	1
Hospital	Pregnancy	21
	Routine screening	2
	Termination of pregnancy	17
	Infertility clinic	13
Occupational health service	Screening test	9
Total		239

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