

For Debate . . .

Immunisation before school entry: should there be a law?

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Compulsory vaccination is not new. Edward Jenner's "Inquiry into the causes and effects of variolae vaccinae," published in 1798, rapidly made vaccination acceptable and variolation obsolete. Vaccination first became compulsory in Bavaria in 1807, less than 10 years later, and France and Denmark followed in 1809 and 1810. In England, the country of Jenner, vaccination did not become compulsory until 1853,¹ although variolation had become illegal in 1840. In the United States the first statewide law compelling vaccination for school entry was passed in 1855 in Massachusetts.

In England, as in the USA, the compulsory vaccination acts were never very successful in enforcing vaccination, mainly because of apathy and, in many instances, strong opposition. Compulsory vaccination was abolished in England in 1948, and no form of immunisation has since been compulsory here, although there is a law that may be invoked to enforce immunisation in schoolchildren in the event of an outbreak of disease in school. In the USA, however, the constitutionality of compulsory immunisation laws for schoolchildren was upheld by the Supreme Court in 1922 and has subsequently been reaffirmed. Indeed, laws were extended to other vaccines, first to poliomyelitis and DTP (diphtheria, tetanus, pertussis) in the 1950s, then to measles in the 1960s, and mumps and rubella in the 1970s. By 1972, 28 states and territories had laws for measles immunisation of schoolchildren, and by 1976 this number had increased to 46.² All these are state laws; there are no federal laws.

Originally these laws applied to first entry to school at kindergarten or first grade. At present all states have such laws, but the trend recently has been to require documentation of immunisation before allowing children of any age to attend school.³ In 1986 five states had laws that applied only to "new enterers"—that is, kindergarten or first grade; one state has laws that apply to those entering up to the 5th grade; and all the other states have laws applying to children up to grade 12. Three states have, in addition, laws that apply to college students.

Of the countries that have compulsory immunisation laws, about half are Eastern European countries: Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, USSR, and Yugoslavia. The other countries are the USA, the Bahamas, Bolivia, Brazil, Costa Rica, Ecuador, Grenada, Mexico, and Peru. Only in the USA, however, has the achievement of these laws been well documented. Such information as there is from Czechoslovakia indicates that the enforcement of measles vaccination has been highly successful, with only 25 cases of measles in 1982, most of which were imported.⁴

In considering whether immunisation before school entry should be made compulsory in Britain I will discuss mainly measles vaccine, the use of which has probably been best documented. I

compare the effect of state laws in the USA regarding measles vaccine with the case in European countries where high vaccination rates have been achieved without such laws.

Measles immunisation school entry laws

Laws requiring compulsory vaccination against smallpox were not only generally unsuccessful in obtaining high vaccination rates, but smallpox eradication was also achieved without such laws or indeed without the need to attain universally high vaccination rates. Why then should laws be considered necessary to enforce measles immunisation in the first place? The main reason lies in the extremely high population immunity rates required to eliminate measles. Various models predict that 93.5% to 96% of children need to be immune to eliminate measles transmission.^{5,6} A simple calculation shows that 95% coverage with a 95% effective vaccine will produce an immunity rate of 90%. Assuming 93.5% immunity as the target, a vaccine of 95% efficacy would need to cover 98% of the population; even a vaccine with 98% efficacy would need a coverage rate of 95%. Higher coverage rates will be necessary in densely populated areas and lower rates in sparsely populated areas. Such high rates may be difficult to attain in many countries. These high rates would need to be achieved before school entry because appreciable measles transmission takes place in schools. In the USA in 1977, 81% of cases of measles (as well as 70% of cases of rubella and 79% of mumps) were reported in children and young adults aged 5-19 years. In England and Wales, on the other hand, of 62 079 cases of measles notified in 1984, 26 416 (43%) were in children aged 5-14 years and 2449 (4%) in those over 15.

Measles and measles vaccine uptake in selected countries

USA—In the USA it has been estimated that "routine" childhood immunisation has reached a coverage rate of 80% by the second birthday (A Hinman, personal communication, 1986), and the improvement by the time of school entry, currently 15%, is therefore wholly or partially attributable to school immunisation laws. In 1977-8, 13 areas with low measles incidence were compared with 10 areas with high rates.² The demographic characteristics, vaccine uptake in children under 2 years, and surveillance systems were generally similar in both groups. The only difference noted was that school immunisation laws were more strictly enforced and more comprehensive in the "low incidence" areas. Nevertheless, even with the comprehensiveness of the state laws which have already been described, the USA has not yet succeeded in eliminating measles. The high immunisation rates achieved, supplemented by an aggressive strategy of measures to control outbreaks, have led to a 99% reduction in the rate of measles from the prevaccine era, with only 1500-6000 cases now occurring annually. Such an achievement would be judged a success by most standards. The marginal cost of preventing the last few cases is extremely high.⁷

Norway—Measles immunisation was first introduced to Norway in 1969 (table) and rapidly covered the whole country. It was not made compulsory. The aim at the outset was eradication. The uptake rate, however, remained well below that of the quadruple vaccine primarily because of "opposition from single doctors" (S Aasen, personal communication, 1986), "single" presumably meaning single handed. On 1 July 1983 a two dose schedule of measles, mumps, and rubella vaccine was introduced. A campaign to promote the uptake of measles, mumps, and rubella vaccine was also begun. This was so successful that the available stocks of the vaccine were depleted,

causing a temporary setback. Nevertheless, measles vaccine uptake improved from under 80% in 1978 to "close to 90%" at present. It is thought that the campaign improved the uptake rate not so much by changing the public attitude to the vaccine as by increasing the motivation among the vaccinators. The reported incidence of measles fell from $67.3-393.6/10^5$ between 1975 and 1979 to 43.0 and $31.6/10^5$ in 1984 and 1985.

Use of measles vaccine in northern European countries

	Vaccination			Measles, mumps, rubella	Doses	Uptake (%)	
	Started	Eradication	Compulsory			Before MMR vaccine	After MMR vaccine
Norway	1969	1969	No	1983	2	<80	90
Netherlands	1976	—	No	1987	2	93	—
Sweden	1971	1982	No	1982	2	56	92
Finland	1975	1982	No	1982	2	70	81

Netherlands—Mass measles immunisation began in the Netherlands only on 1 January 1976 (table). The vaccine was not compulsory. An uptake rate of 82% was achieved with the first cohort and 93% with the 1983 cohort. The incidence of notified measles in the Netherlands is $0.16-3.35/10^5$ (1983-5). A two dose schedule of measles, mumps, and rubella vaccine was introduced on 1 January 1987, but it is thought that this will not substantially increase the measles vaccine uptake rate. "The success of the Dutch immunisation programme must be attributed to its organisation and to the optimal involvement of the children's parents or guardians in the programme." (H Bijkerk, personal communication, 1986). Rubella vaccination of girls at 11 years will be stopped when measles, mumps, and rubella vaccine is introduced. At the core of the Dutch immunisation system is the Provincial Vaccination Administration in every province. Each one is responsible for carrying out the national immunisation programme through local vaccination centres. These local centres collaborate with the municipalities, general practitioners, and various organisations. Each Provincial Vaccination Administration has automated records for births, transfers in and out, and deaths. Vaccination appointment and information cards are sent out, followed if necessary by two reminders and a final visit by the district nurse.

Sweden—Measles vaccine was introduced in Sweden in 1971 and is not compulsory (table). The uptake was low—between 46% and 63% before 1981—although it steadily improved.³ A two dose schedule of measles, mumps, and rubella vaccine was introduced in 1982 with the ultimate aim of eliminating these three virus diseases. There was a concomitant campaign to promote the triple vaccine. Coverage in 1985 averaged 93%, although in some districts it is still 70-80%. As coverage for diphtheria, tetanus, and polio vaccines is 98-99%, the "shortfall" for measles vaccine is about 5-6%. The high coverage is attributed to the awareness among the population of the efficacy of measles vaccine, the monitoring of performance by surveillance of morbidity, and serum antibody studies. It is obligatory to report severe side effects of vaccines in Sweden.

Finland—In Finland measles vaccination began in 1975 (table) and an eradication programme using two doses of measles, mumps, and rubella vaccine in November 1982.³ Unlike the other European countries mentioned above, the second dose of measles, mumps, and rubella vaccine is given at 6 years of age. Before measles, mumps, and rubella vaccine the uptake rates were only 70% for measles and about 60% for rubella. After measles, mumps, and rubella vaccine was introduced the uptake rates increased to 81%, but it should be noted that the introduction of the combined vaccine was accompanied by a campaign to improve the motivation of the public health nurses, who traditionally administer the vaccines in Finland and were seen as the key figures in the successful introduction of measles, mumps, and rubella vaccine.

England and Wales—From 1940 when measles was first made notifiable until 1968 when the vaccine was introduced notifications of measles averaged 400 000-500 000 cases a year. Since then the measles vaccine uptake of around 50% has reduced this to about 100 000 notified cases a year. In 1984 and 1985 the vaccine uptake rate increased to 63% and 68% respectively. These rates clearly are inadequate both in comparison with the Nordic countries and the Netherlands and to control the infection. The distribution

of uptake rates by district in 1984, however, shows that of 189 districts 20 achieved uptake rates of 80% or more and two of these districts reached over 90%: 30-39% uptake, six districts; 40-49%, 18; 50-59%, 42; 60-69%, 55; 70-79%, 48; 80-89%, 18; 90-100%, two.

Conclusions

The achievement of high measles vaccine uptake rates in Sweden, Norway, Finland, and the Netherlands without the need for compulsory immunisation laws shows that an efficient administration system backed up by motivation and education of medical and paramedical personnel and the involvement of parents may be sufficient for the containment of measles. The social homogeneity of the three Nordic countries relative to England and Wales has undoubtedly helped their programme, but high measles vaccine uptake rates can indeed be attained in England and Wales, as shown by 20 districts achieving over 80% coverage rates, and two of them over 90%, in 1984. Thus there is probably no need for laws in Britain, at least for the containment of measles. Moreover, legislation can produce a "snowball" effect. In the USA vaccination at day centres and at school entry was found to be insufficient. Most states now have laws to ensure vaccination before entry to all grades at school, and in some states there are laws governing entry to colleges as well. Much, however, depends on strategy. If elimination is the goal enforcement may need to be considered more carefully, although Sweden, Norway, and Finland have set out to eliminate measles using a two dose schedule of measles, mumps, and rubella vaccine without enforcement laws.

The case for introducing measles, mumps, and rubella vaccine is possibly stronger, although the Netherlands achieved a 93% coverage rate for measles vaccine before the use of measles, mumps, and rubella vaccine, and in Sweden, Finland, and Norway the introduction of measles, mumps, and rubella vaccine was accompanied by extensive health education and public relations campaigns to increase uptake of the vaccine. This makes it difficult to estimate how much of the increase in uptake in the Nordic countries was due to the attractiveness of the vaccine (three for the price of one) and how much to the promotional campaigns. Therefore a case for introducing measles, mumps, and rubella vaccine should be made in its own right, with careful consideration of the effects of the rubella and mumps components as well as that of measles. It should not be introduced in the hope that it might boost the use of measles vaccine, the poor uptake of which in Britain can almost certainly be improved by more efficient organisation.

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