

Public Health

RAPID EFFECT ON ENDEMIC MEASLES, MUMPS, AND RUBELLA OF NATIONWIDE VACCINATION PROGRAMME IN FINLAND

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Summary An immunisation programme to eliminate measles, mumps, and rubella from Finland within 10 years was started in November, 1982. A combined live vaccine is being given twice, at the ages of 14–18 months and 6 years, but at the beginning of the project children between these age limits are also being immunised. Because vaccinations are traditionally done by the public health nurses, special attention was paid to their motivation. 2·5 years after the launch of the project, 80·9% of the target children had been vaccinated. The incidence of measles has fallen by 93% and that of mumps by 87% compared with a normal prevaccination year (1982). A similar fall in incidence was seen for rubella, but only in the vaccinated age groups. Although elimination of measles, mumps, and rubella is not likely to be achieved with the present vaccination coverage, a drastic fall in the incidence of all three target diseases has occurred already. Every effort is being made to improve the coverage and thus to achieve the ultimate goal of the project.

INTRODUCTION

In Finland immunisation against measles (all children) and rubella (girls of 13 years and women post partum) was started in 1975. In addition, inactivated mumps vaccine has been given to army recruits (with considerable success¹) since 1960. The aim of these programmes was not the total elimination of the diseases but a substantial reduction in their incidence.

Despite the very efficient childhood vaccination system in Finland (for example, more than 90% of children receive diphtheria-pertussis-tetanus vaccine²), the coverages of measles and rubella immunisations were, respectively, only 70% and about 60%.³ Obviously, with this coverage it would not be possible to eliminate the diseases. The National Board of Health revised its policy in 1982; the aim⁴ is now to eliminate endemic measles and rubella within a decade by vaccinating all children, mainly at the ages of 14–18 months and 6 years. To reach the goal sooner, for the first few years children aged 19 months to 5 years will also be immunised. Because a mumps component can easily be combined with measles and rubella antigens,^{5,6} elimination of mumps infection was also included in the programme.

The MPR project (M measles, P parotitis or mumps, R rubella) started on Nov 1, 1982.⁴ We describe here the impact of the project on measles, mumps, and rubella during the first 2·5 years. We also describe the organisation and logistics of the project in the hope that our experience will help countries planning similar programmes.

MPR PROJECT

Finland (4·9 million inhabitants; 337 000 km² or 130 082 square miles) is divided into twelve provinces, each subdivided into health centre districts (total 214). Each health centre maintains several child health centres (total 1036). These centres are responsible for the primary health care of the 65 000 children born annually, including routine vaccinations after the neonatal period. These functions are carried out by public health nurses under the supervision of health centre doctors. About 3000 public health nurses are currently practising.

The public health nurse is the key person in childhood vaccinations, and good motivation of these nurses was crucial for the project. Therefore 23 seminars were organised in various parts of the country during August–October, 1982. Each seminar lasted 4 h, during which detailed information was given by a paediatrician (H. P.) and the head public health nurse (V. K.). More than 2500 public health nurses and several health centre doctors attended.

Written Information and Other Material

The following material (in different colours) especially designed for the MPR project, was presented in the seminars: an open letter to parents; a 28-page booklet for the public health nurses, describing the background, practical aspects in great detail, and prospects of the project; and forms for recording vaccinees by name and social security number; monthly cases of measles, mumps, and rubella in the district (this form supplemented the obligatory reporting of these diseases to the National Board of Health); vaccination reactions in twins (results to be published elsewhere); vaccination complications; and vaccinees who later showed signs of measles, mumps, and/or rubella (ie, vaccination failures).

For cases of vaccination failure or complications we asked for paired serum samples, and detailed instructions were given. The nurses were provided with tubes for blood specimens and prestamped, padded envelopes for mailing them. All the material, printed in Finnish and Swedish (the official languages in Finland), was mailed to the child health centres before the beginning of the project. Continuous availability of the forms was guaranteed.

Office Personnel

A central office for the project was established at the National Public Health Institute. Two people, a paediatrician and a nurse, worked (for 8 and 17 months, respectively) to launch the project, and two others were hired on a permanent basis to take care of routine procedures (mailing the forms, making corrections, &c). In addition, a six-person follow-up committee was established. Some special activities, such as packing the material for mailing and data processing, were carried out by auxiliary personnel; otherwise no extra labour was employed except one physician doing civilian work in lieu of his military service who ran the office and answered questions and gave information by telephone after the launching of the project. The existing channels within the National Public Health Institute and the National Board of Health were used for any other functions.

Vaccine

The vaccine ('Virivac', or 'M-M-R_{II}' in the USA⁶) consisted of the Moraten (Enders-Edmonston B) strain as the measles antigen, the Jeryl-Lynn strain as the mumps antigen, and the RA 27/3 strain as the rubella antigen. Each dose of the vaccine also contained 25 µg neomycin. The lyophilised vaccine was reconstituted in sterile water and the final volume (0·5 ml) injected subcutaneously into the left deltoid (or gluteal) region.

Contraindications⁷

Known allergy to neomycin, compromised immune system, high fever (but not mild respiratory symptoms), immunoglobulin treatment or a blood transfusion within the previous 3 months, and active tuberculosis (as well as pregnancy) were contraindications for vaccination. We emphasised that a history of measles, measles immunisation, mumps, rubella, or egg-protein allergy did not

¹ Holding LP. Local recurrence of rectal cancer. *Br J Surg* 1979; 100: 350–60.

² The overall picture. *Br J Surg* 1979; 100: 350–60.

³ Rectal cancer: Local recurrence and distant metastasis. *University of London, Ann R Coll Surg Engl* 1984; 66: 66.

⁴ Mumps component can easily be combined with measles and rubella antigens. *Ann R Coll Surg Engl* 1984; 66: 66.

⁵ Elimination of mumps infection was also included in the programme. *Ann R Coll Surg Engl* 1984; 66: 66.

⁶ The MPR project (M measles, P parotitis or mumps, R rubella) started on Nov 1, 1982. *Ann R Coll Surg Engl* 1984; 66: 66.

⁷ We describe here the impact of the project on measles, mumps, and rubella during the first 2·5 years. *Ann R Coll Surg Engl* 1984; 66: 66.

contraindicate this vaccination, unless the allergy was extreme; the decision on whether to immunise these children was assigned to paediatric allergists.

Data Processing

An extensive data-processing system using a VAX 11/750 computer was established for monitoring the project. Because the vaccinees were entered onto the computer individually, detailed demographic information is available. In addition, it will be possible to identify the children who escaped vaccination; they will be approached and, if possible, vaccinated. We will also be able to analyse vaccination reactions and follow-up the prevalence of measles, mumps, and rubella.

Serological Follow-up

Three child health centres in different parts of the country were selected for serological follow-up. The parents of each child were approached by letter; we described the project and requested permission to include the child in the follow-up study. It was emphasised that a blood sample would be taken yearly for many years and that only long-term participation would substantially benefit the project. No monetary compensation was promised, but information on the long-term antibody titres would be provided to the parents.

Statistical Analysis

Poisson's distribution was used to compare the incidence of the target diseases before and after the programme.

RESULTS

2.5 years after the launch of the project (May 15, 1985) 443 000 vaccinations had been given. The overall vaccination coverage was 80.9% (fig 1) with minor peaks among those immunised at the ages of 14–18 months (mean coverage 84.6%, range 61.2–93.0%) and 6 years (mean 79.6%, range 53.3–85.2%), and a notch between these main target groups (mean 78.2%, range 75.1–85.0%). Only about 10% of the children who were initially in the intermediate age groups (older than 18 months but younger than 6 years) had received vaccination for the second time when 6 years old.

Fig 2 shows the total reported cases of measles, mumps, and rubella in Finland since 1980. Had the MPR project not been launched in November, 1982, the curves would probably have continued in the shaded area.

For measles, a lower monthly level than ever seen before was reached within 12 months of the MPR project starting;

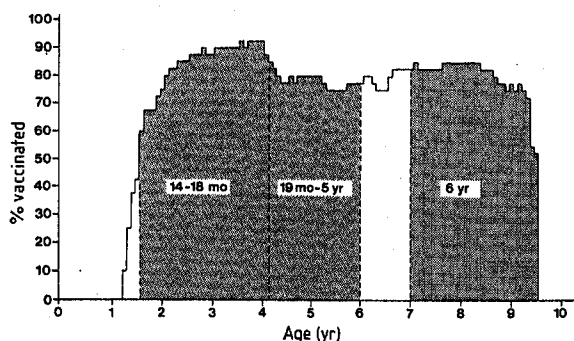


Fig 1—Vaccination coverage of the two main target groups (children aged 14–18 months or 6 years) and of the intermediate group (children between these age limits).

White areas indicate age groups who on May 15, 1985, were passing the scheduled vaccination age.

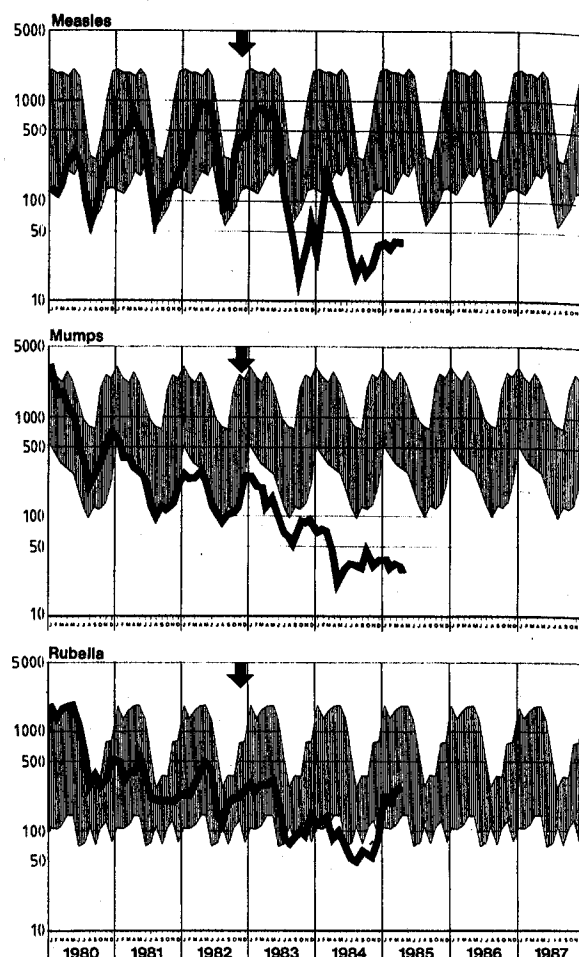


Fig 2—Measles, mumps, and rubella cases reported to National Board of Health between January, 1980, and April, 1985.

Shaded area represents maximum and minimum monthly levels during decade 1972–1981. Arrow shows beginning of MPR project.

only 14 cases were reported in the country in September, 1983. The expected spring peak occurred in 1984 but not in 1985. If we compare January–April 1985 and 1982, we find a 93% reduction in the incidence of measles (152 v 2147 cases, $p < 0.001$).

The number of mumps cases has been falling steadily since 1980 (when a major epidemic occurred in Finland). Nevertheless, the incidence in January–April was 87% lower in 1985 than in 1982 (134 v 1037 cases, $p < 0.001$). If 12-month periods are compared, 83% fewer cases of mumps ($p < 0.001$) were reported in May 1984–April 1985 (394) than in May 1981–April 1982 (2332).

According to fig 2, there have been no substantial changes in the incidence of rubella. However, this curve records all cases of rubella regardless of age, and it reflects the current epidemic in Scandinavia. In the age groups relevant to the MPR project, we are aware of only 3 children who had virology-proven rubella despite the vaccination from an analysis of 450 suspected vaccination failures (Dr M. Valle, unpublished). Moreover, there has been a clear shift in incidence of rubella to older age groups in the Helsinki area (about 1 million inhabitants); the mean age of 74 patients

analysed was 18 years, 75% were aged 12-22 years, and 95% 9 years and over.⁸ Only 3 patients, all unvaccinated, were 6-7-year-old children.

DISCUSSION

Use of live measles,^{9,13} mumps,^{14,15} and rubella¹⁶ vaccines (alone or in combination) has had considerable success in various areas and countries. It was claimed that measles had been virtually eliminated from the German Democratic Republic in the 1970s,¹⁰ but cases have occurred since then (Dr H. Scholz, Institut für Infektionskrankheiten im Kindesalter, Berlin-Buch, unpublished). On the other hand, the goal of measles elimination has nearly been reached in the United States,¹⁷ where the incidence of mumps¹⁵ and rubella¹⁶ has also fallen drastically since large-scale immunisations were started. The elimination of measles, mumps, and rubella seems to be feasible, provided the vaccination coverage is high enough.¹⁸ To eliminate a contagious illness such as measles, vaccination coverage close to 95% (or even higher) is probably needed. However, our data show that 80% coverage of the age groups most prone to measles and mumps greatly reduces the incidence, at least in circumstances where there is a high natural immunity in older age groups.

Good preparation for the MPR project and motivating the personnel carrying out vaccinations was evidently successful. The primary health care system has proved its effectiveness and satisfied the expectations by carrying out 443 000 vaccinations, reaching 44% of the total paediatric population within 30 months without extra visits to child health centres. All this has taken place without a single permanent sequela observed (unpublished). We deem the vaccine safe and this approach to measles, mumps, and rubella appropriate in any country with an advanced primary health care system. We will soon know whether the ultimate goal of the project, elimination of all these diseases, is feasible.

We thank the public health nurses in the 1036 child health centres whose devoted work rendered the MPR project possible; and Dr Kari Cantell, Dr Martti Valle, and the other members of the follow-up committee for their encouragement during the project.

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REFERENCES

- Penttinen K, Cantell K, Somer P, Poikolainen A. Mumps vaccination in the Finnish defence forces. *Am J Epidemiol* 1968; **88**: 234-44.
- Salmi TT, Eerola M, Salminen S, Helminen S-L, Ruuskanen O. Lasten rokotusohjelman toteutuminen. *Suom Lääkäril (J Finn Med Ass)* 1981; **36**: 513-16.
- Weckström P, Vihuri- ja tuhkarokkorokotusten kattavuus. *Suom Lääkäril (J Finn Med Ass)* 1980; **35**: 1559.
- National Board of Health Circular no 1776 on the measles, rubella and mumps vaccination. Apr 21, 1982.
- Buynak EB, Weibel RE, Whitman JE, Stohes J Jr, Hilleman MR. Combined live measles, mumps, and rubella virus vaccines. *JAMA* 1969; **207**: 2259-62.
- Weibel RE, Carlson AJ Jr, Villarejos VM, Buynak EB, McLean AA, Hilleman MR. Clinical and laboratory studies of combined live measles, mumps, and rubella vaccines using the RA 27/3 rubella virus (40979). *Proc Soc Exp Biol Med* 1980; **165**: 323-26.
- Immunization Practices Advisory Committee. Measles prevention. *Morbidity Mortality Weekly Rep* 1982; **31**: 217-31.
- The virological information report, weeks 15-16, Orion Diagnostica, Espoo, Finland, 1985.
- Witte JJ, Axnick NW. The benefits from 10 years of measles immunisation in the United States. *Public Health Rep* 1975; **90**: 205-07.
- Dittman S, Starke G, Ocklitz HW, Grahneis H, Giesecke H. The measles eradication programme in the German Democratic Republic. *Bull WHO* 1976; **53**: 21-24.
- Kakarriqi E, Bifsha A. Nivelii i mbrojtes ndaj fruthit ne vite pas aplikimit të vaksinës së gjallë shumë të dobësuar. *Buletini i Shkencave Mjekësore* 1980; no 2: 65-74.
- Centers for Disease Control. Measles—United States, first 26 weeks, 1982. *Morbidity Mortality Weekly Rep* 1982; **31**: 381-82.
- World Health Organisation. Measles surveillance. Interruption of natural transmission. *Weekly Epidemiol Rec* 1983; **58**: 85-86.
- Koplan JP, Predlund SR. A benefit-cost analysis of mumps vaccine. *Am J Dis Child* 1982; **136**: 362-64.

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Hospital Practice

EVALUATION OF A PROTOCOL FOR SELECTIVE ORDERING OF PREOPERATIVE TESTS

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Summary A protocol for selective ordering of 12 preoperative tests, according to clinical status and type of surgery, was prospectively tested for one year in a teaching hospital. 3866 consecutive surgical patients had an average of about 4 tests each. The possible value of tests that were omitted was assessed in the light of events during and after operation. According to predetermined criteria, 0.4% of non-ordered tests would have been potentially useful; but in the opinion of the anaesthetists, only 0.2% would actually have been useful. The protocol therefore had little adverse effect on patient care and was acceptable to clinicians.

INTRODUCTION

ROUTINE preoperative investigations, when ordered without clinical indication, tend to be uninformative^{1,2} and to have little influence on decision-making.^{3,5}

What would be the consequences of abandoning routine testing? Kaplan et al¹ estimated that, in their hospital where 8600 procedures are done each year, abandonment of routine biological tests would result in one death in 100 years. Roberts et al⁶ showed that, after a substantial reduction in the use of preoperative chest X-rays, there was no increase in perioperative morbidity or mortality. We have developed a protocol for selective ordering of preoperative tests according to clinical status, the nature of scheduled surgery, and their likely yield of information: we report a study of its applicability in a teaching hospital.

MATERIALS AND METHODS

The investigation was conducted at Rothschild Hospital (Paris), a teaching hospital that serves an adult community with 230 beds for general, orthopaedic, plastic, gynaecological, and obstetric surgical procedures.

From published reports and through consultations with knowledgeable practitioners, we compiled a list of indications⁷ for 12 commonly used preoperative tests and devised a protocol for test-ordering that allowed for factors such as age, nature of illness, and severity of proposed operation (table 1). With the agreement of 44 anaesthetists and surgeons, this protocol was assessed in all patients having operations or investigations under general or regional (but

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- Centers for Disease Control. Mumps—United States, 1983-1984. *Morbidity Mortality Weekly Rep* 1984; **33**: 533-35.
- Centers for Disease Control. Rubella and congenital rubella syndrome—United States, 1983-1984. *Morbidity Mortality Weekly Rep* 1984; **33**: 528-31.
- Centers for Disease Control. Measles—United States, first 39 weeks 1984. *Morbidity Mortality Weekly Rep* 1984; **33**: 673-76.
- Hethcote HW. Measles and rubella in the United States. *Am J Epidemiol* 1983; **117**: 2-11.



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