

Measles, mumps, and rubella: monitoring in Switzerland through a sentinel network, 1986-94

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Abstract

Study objectives - Since 1986, the national sentinel network in Switzerland (Sentinella) has collected reports of measles, mumps, and rubella cases in order to evaluate the impact of the Swiss MMR vaccination campaign (started in 1987) on disease frequency.

Design - Passive surveillance of clinical measles, mumps, and rubella cases through a voluntary physician based sentinel network in Switzerland.

Setting - Each year between June 1986 and May 1994, 150 to 200 general practitioners, specialists in internal medicine, and paediatricians in private practice covering the whole country have reported weekly numbers of consultations.

Patients - Every patient who fulfilled the case definition and consulted a physician participating in the Sentinella network was reported.

Main results - Since 1986, the annual number of reported measles cases per physician has fallen - from 1.3 (95% confidence interval (CI) 1.11, 1.50) in 1986-87 to 0.4 (95% CI 0.30, 0.50) in 1993-94. A decreasing trend, although less pronounced, was also observed for rubella. An initial decrease in mumps cases was reported - from 1.8 (95% CI 1.57, 2.03) annually reported cases per physician in 1986-87 to 0.7 (95% CI 0.55, 0.83) in 1989-90. This was followed, however, by a net and sustained increase. In 1993-94, the mean annual number of reported mumps cases per practitioner reached 4.7 (95% CI 4.34, 5.01) which was the highest level since surveillance had started. Over the whole eight year period, reported mumps cases, in terms of the percentage of consultations, were four times more frequent in the French speaking part of Switzerland than in the rest of the country. The proportion of mumps cases in people reported to have been vaccinated also increased - from 10% in 1986-87 to 60% in 1993-94.

Conclusions - Reductions in cases of measles and rubella but an appreciable increase in mumps cases have been observed in the past three years in Switzerland. This finding, combined with increasing vaccination coverage and the fact that 60% of mumps cases are reported in vaccinated people, suggests that the overall efficacy of the mumps vaccines used in Switzerland is probably below 80%. Under these conditions the goal of elim-

inating mumps will probably not be reached. Further studies are needed to evaluate the efficacy of the different mumps vaccines used.

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The national sentinel network in Switzerland (Sentinella) has collected reports of measles, mumps, and rubella cases since 1986. This surveillance is an important part of the evaluation of the MMR immunisation campaign in Switzerland, which started in 1987¹ with the stated purpose of eliminating measles, mumps, and rubella by improving vaccination coverage in all cantons. A systematic single dose vaccination with a combined MMR vaccine was recommended at the age of 15 to 24 months. All vaccines were free of charge. In general, three different trivalent vaccines were available. In addition, since 1987 unvaccinated children whose parents agree have been systematically vaccinated at school entry (6 to 7 years) and at the age of 15 and 16 at the end of compulsory school. These measures should have led to a homogeneously high vaccination coverage of the population aged 15 months and 20 years by 1995.

The results of the monitoring of measles, mumps, and rubella cases over the past eight years through the Sentinella reporting system are presented and their use for the evaluation of the national MMR vaccination campaign is discussed.

Methods

SENTINELLA

Each year between 1986 and 1994, 150 to 200 private practice physicians have participated in this network. Approximately 70% of the participating volunteers were general practitioners, 15% to 20% were specialists in internal medicine, and 10% to 15% were paediatricians (without subspecialties). Evaluation was limited to those doctors who reported for at least 75% of the period (≥ 39 weeks every year between 1986 and 1993 and ≥ 16 weeks between January 1994 and June 1994). These regularly-reporting physicians, who represent 80% to 90% of the participants, corresponded to approximately 2.7% of all family practitioners of the three specialities in Switzerland. Based on the adjusted total number of consultations and home visits covered by state subsidised insurance companies, we estimate that the participating physicians also covered approximately 2.7% of the total num-

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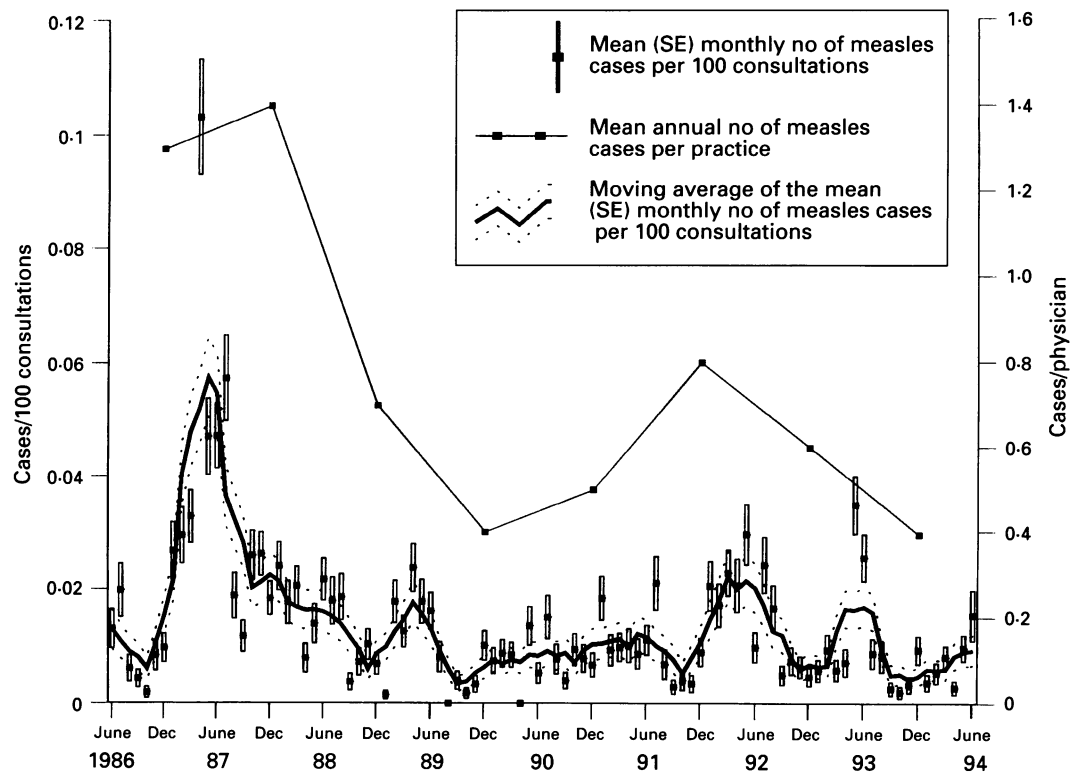


Figure 1 Measles cases reported through the Swiss sentinel network between 1986 and 1994.

ber of annual consultations. About 20% of regularly-reporting participants were replaced by new physicians every year. On average, regularly-reporting physicians participated for 4.1 years in the seven years between 1986 and 1993. Sentinella participants in 1992–93 covered 23 of 26 cantons in Switzerland. The proportions of general practitioners, specialists in internal medicine, and paediatricians in the sample corresponded, within a range of $\pm 5\%$, to that of the whole country. Since 1986, however, physicians from rural areas have been over represented in Sentinella.

MONITORING OF MEASLES, MUMPS, AND RUBELLA THROUGH SENTINELLA

The reporting criteria used in the network followed case definitions published by the Centres of Disease Control (CDC), the World Health Organisation (WHO), and, in the case of mumps, the International Classification of Health Problems in Primary Care.^{2,3} These disorders were defined as follows:

- Measles – a generalised rash lasting three days or more, body temperature of more than 38°C , and cough, coryza, or conjunctivitis.
- Rubella – acute onset of generalised maculopapular rash, arthralgia/arthritis, or lymphadenopathy.
- Mumps – acute onset of unilateral or bilateral tender, self limited swelling of the parotid or other salivary gland or orchitis after mumps exposure.

For every patient fulfilling the case definition, the sex, date of birth, vaccination status, and complications were reported on the official Sentinella report form.

SEROLOGY

Serological examination, which has been offered free of charge since 1986 for measles and rubella and since 1989 for mumps, was carried out in an associated laboratory.

STATISTICAL ANALYSIS

Confidence intervals (95%) of the mean annual number of reported cases per physician were estimated by using a Poisson distribution.

Mean (y) and variance ($\text{var}(y)$) for monthly disease frequencies were estimated by stratified element sampling.⁴ Data were stratified on speciality (general practitioners/specialists in internal medicine and paediatricians) and region (French-speaking part, German-speaking part of Switzerland).

For a rough estimation of the overall efficacy of the MMR vaccines used in Switzerland, a formula described by Orenstein was used.⁵

Results

MEASLES

From 1986–87, the annual number of measles cases reported per physician fell from 1.3 (95% CI 1.11, 1.50) (173 cases, 134 physicians) to 0.4 (95% CI 0.30, 0.50) (63 cases, 160 physicians) in 1993–94 (fig 1). In the Sentinella pilot project in the canton of Berne, 3.7 cases per physician (174 cases, 47 physicians) were reported between November 1984 and October 1985.⁶

On average, 15.7% of reported measles cases were examined serologically between 1986 and 1993. For 48.8% of these the diagnosis was confirmed serologically.

No statistically significant upward shift of the median age of reported cases was observed

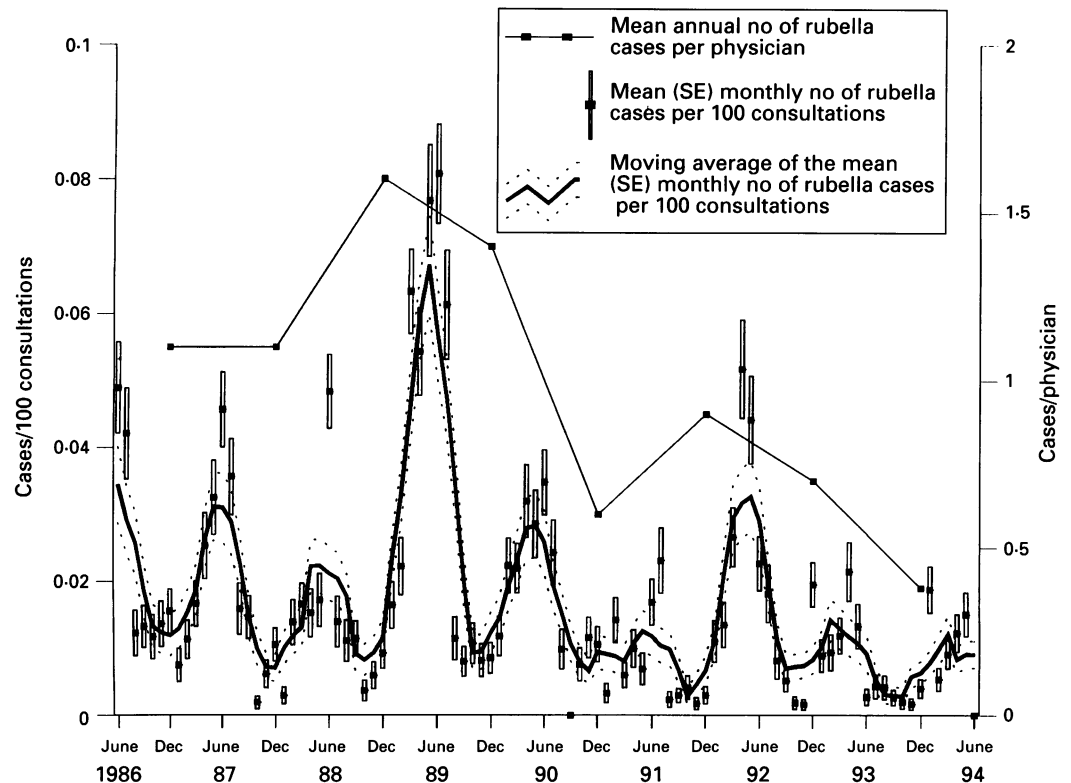


Figure 2 Rubella cases reported through the Swiss sentinel network between 1986 and 1994.

over time. The median age varied between 5 and 6.5 years for cases reported by paediatricians and between 8 and 15 years for patients reported by general practitioners and specialists in internal medicine.

The percentage of cases in children under 16 months of age decreased from 12.4% in 1988–89 to 2.6% in the last 4 years (2.9% in 1990–91; 6.3% in 1991–92, 2.4% in 1992–93, 4.9% in 1993–94). The exact age of measles cases reported in 1986–87 and 1987–88 is not known because only the year of birth was recorded. The percentage of patients of 15 years and older increased from approximately 10% in 1986 to 30.5% in 1991–92, and then decreased to 10.5% in 1992–93 and 13.1% in 1993–94.

From 1990–91, 15% to 21% of cases were reported to have been vaccinated (21.4% in 1990–91, 14.7% in 1991–92, 18.6% in 1992–93, and 20.6% in 1993–94), and in three quarters of these (12% to 17%, depending on the reporting period) the vaccination status was well documented. The overall efficacy of the measles vaccination was estimated to be over 90% (estimated vaccination coverage: 75% to 80% within the age group of 1 to 19 years).

RUBELLA

A constant and marked seasonal pattern, with a maximum in the spring, was observed for the monthly number of cases reported in terms of percentage of consultations whereas the mean annual number of cases per physician indicated an overall decreasing trend, apparently superposed by peaks of a suggested three year cycle (fig 2).

Altogether 19.4% of reported rubella cases were examined serologically between 1986 and 1993, and 47.5% of these gave a positive result.

The median of the age distribution varied between 2 and 12 years for cases reported by paediatricians and between 8 and 17 years for general practitioners with the higher ages occurring more recently. Women of childbearing age represented a steadily increasing proportion between 1986–87 (3.6%, 0.04 cases per physician) and 1991–92 (13.6%, 0.12 cases per physician). In 1992–93 and 1993–94, 3.3% (0.02 cases per physician) and 8.3% (0.03 cases per physician) respectively, occurred in women aged between 16 and 40 years.

The proportion of rubella cases who were reported to have been vaccinated increased from 3.5% in 1986–87 to 25.3% in 1992–93 and 19.4% in 1993–94.

If analysis of data was limited to patients between 1 and 19 years of age with well documented vaccination, the overall efficacy of rubella vaccination was estimated to be around 90%, assuming a vaccination coverage of approximately 70%.

MUMPS

Annually reported cases per physician fell from 1.8 (95% CI 1.57, 2.03) (240 cases, 134 physicians) in 1986–87 to 0.7 (95% CI 0.55, 0.83) in 1989–90 (96 cases, 141 physicians) but increased to 4.7 (95% CI 4.29, 4.95) (747 cases, 160 physicians) in 1993–94 (fig 3). Altogether 21.4% of reported mumps cases were examined serologically between 1989 and 1993. For 59.5% of these, the diagnosis could be confirmed.

The median of the age distribution remained stable over the eight reporting periods. It was between 10 and 12.5 years for patients reported by general practitioners, and between 6 and 7 years for paediatricians.

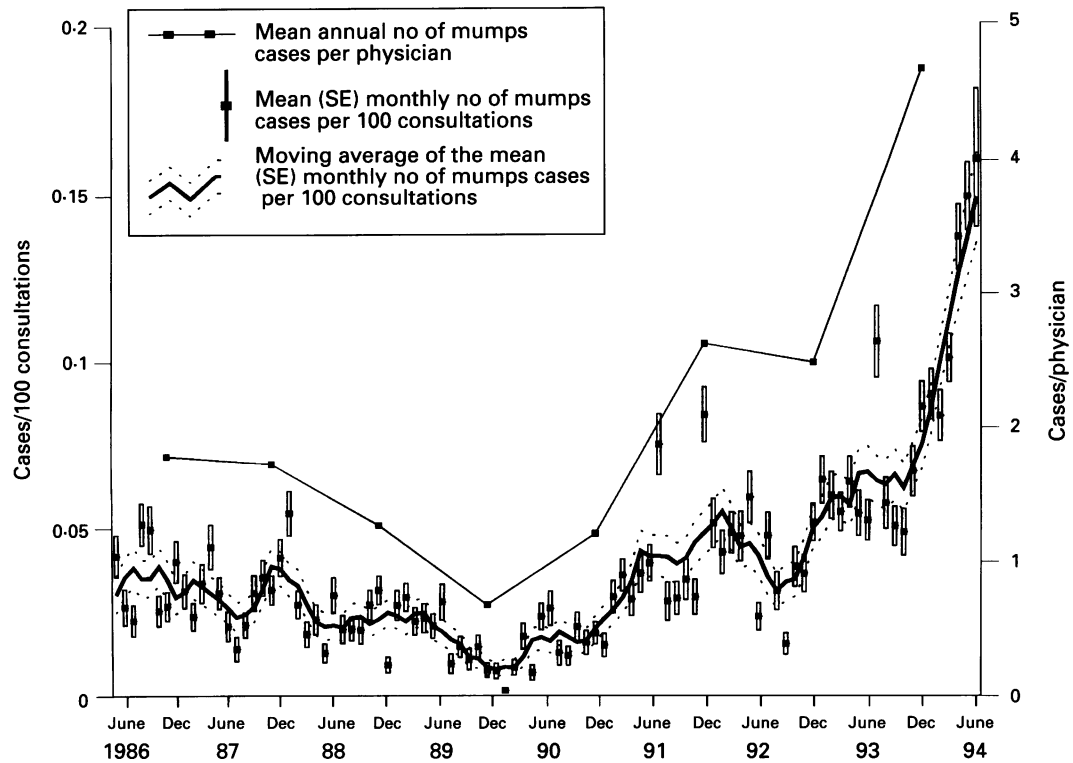


Figure 3 Mumps cases reported through the Swiss sentinel network between 1986 and 1994.

Mumps cases reported in terms of the percentage of consultations over the whole eight year period were four times more frequent in the Romandie, the French-speaking part of Switzerland, than elsewhere. In the Romandie, two peaks of increased reporting frequency occurred in 1987-88 and 1991-92.

In contrast to the situation in the Romandie, the reporting frequency in the rest of the country remained low, showing no periodicity until 1992 when a sustained increase of reported mumps cases was observed. This trend continued into 1994.

The proportion of cases who were reported to have been vaccinated gradually increased from 9.2% in 1986-87 to 59.4% in 1993-94.

The marked increase in cases observed in the last two years combined with an increasing vaccination coverage and the fact that 60% of mumps cases were reported in children aged 1 to 19 years who had been previously vaccinated, indicate that the overall efficacy of the vaccines used in Switzerland is probably lower than 80%.

Discussion

The planning and evaluation of infectious disease control programmes depend heavily upon reliable systems for monitoring disease incidence in the community. In several countries, measles, mumps, and rubella are monitored by sentinel networks.⁷⁻¹⁰ The reporting of cases through sentinel networks is mainly based on clinical symptoms. Nevertheless, these systems have been shown to be suitable for monitoring time trends of disease. Figures for England and Wales for the years 1977-83, suggest that 40 spotter practices distributed throughout the country were approximately 1.5 times more

efficient at notifying measles and 2.5 times more efficient at notifying pertussis to the Royal College of General Practitioners (RCGP) than was the average GP in reporting to the Office of Population Censuses and Surveys.¹¹ Strict clinical case definitions are used in the Swiss sentinel network in order to reduce the effect of different clinicians applying different criteria for diagnosis. In addition, approximately one fifth of all measles, mumps, and rubella cases reported through the Swiss sentinel network were examined serologically. In approximately 50% of cases, the diagnosis was confirmed by detection of specific IgM antibodies. This proportion is satisfactory, as in most cases only one blood sample taken at the beginning of the disease was available. In an immune response study, it was shown that by the second day after the onset of symptoms, IgM ELISA tests were positive in 70% of patients who had serological evidence of mumps and whose clinical symptoms could be attributed to mumps.¹² In Sentinella, 60% of serologically examined mumps cases were confirmed.

As in other countries, measles and rubella incidences in Switzerland have progressively declined since the national vaccination campaign.^{9,10} If this trend continues, however, the sentinel network may no longer be an appropriate monitoring system for measles and rubella, and their inclusion on the list of notifiable diseases should be discussed. In the past few years, the small number of reported cases may be partially responsible for the varying proportion of measles cases in children under 16 months as well as the differences from one year to the other in the proportion of rubella cases among women of childbearing age.

An unexpected increase in mumps cases, characterised by geographic variations and a disproportionately high number of cases among vaccinated children, has occurred in recent years. Laboratory notifications of mumps reported to the Swiss Federal Office of Public Health showed an increase similar to that in Sentinella. Laboratory reports (IgM positive samples) increased from 93 in 1990, to 284 in 1993, and to 854 in 1994 (Swiss Federal Office of Public Health, unpublished data).

The natural periodicity of the disease may have contributed to the increasing number of cases. The geographic differences may be due to the vaccination coverage in the Romandie, which was about 10% lower than that in the German-speaking part of Switzerland. In 1991, a cross sectional study representative of the whole country was carried out by the Institute of Social and Preventive Medicine in Zurich to assess vaccination coverage in 2 to 3 year old children.¹³ Altogether 83% of children included in the study had been vaccinated against measles (one dose) and 80% had documented vaccination against rubella and mumps. Vaccination coverages for measles, rubella, and mumps were 5%, 7%, and 9%, respectively lower in the Romandie than in the German-speaking regions. Other studies in geographically limited areas provided similar data for German speaking cantons and showed significantly lower levels of vaccination coverage in the Romandie.^{14,15} In addition, the proportions of children in the Romandie vaccinated with the different vaccines available in Switzerland differed from the rest of the country.

Vaccinated children with mumps might seek medical care more often than unvaccinated children. Therefore, the proportion of vaccinated cases may be biased. This does not, however, explain the steadily increasing proportion of mumps cases reported in vaccinated children since 1986. Three different trivalent vaccines were used in Switzerland. A vaccine containing the Jeryl Lynn strain has been available since 1971, an Urabe AM/9 vaccine since 1983, and a Rubini vaccine since 1986. The Urabe AM/9 vaccine was withdrawn from the market in autumn 1992 following concerns about the risk of vaccine associated meningitis.^{16,17} Rubini vaccine has accounted for more than 50% of the trivalent vaccine doses sold in Switzerland since 1986 and, consequently, the proportion of children (1 to 19 years old) vaccinated with the Rubini strain increased steadily. Compared with the Jeryl Lynn and Urabe AM/9 vaccine the efficacy of the Rubini vaccine used in Switzerland has probably been lower than expected or its efficacy has decreased during the study period.¹⁸ The use of vaccine of relatively low efficacy in an increasing section of the population might therefore be responsible for the excessive increase in mumps cases among vaccinees. The increasing proportion of vaccinated measles and rubella cases, however, is consistent with an increasing vaccination coverage.

One limitation of the sentinel monitoring

system in Switzerland is that there are few data available on the situation before the onset of the national immunisation programme in 1987. Combined MMR vaccines, available in Switzerland since 1971, were included in the national schedule of recommended vaccinations in 1981. However, only very limited data on vaccination coverage exist until 1987. In addition, eight years of monitoring is still a relatively short time for those relatively rare diseases that are possibly subject to natural periodicities of two to four years. The fact that some patients are never seen by a physician should also be taken into consideration. It is not possible to judge the influence of the different factors on the increasing incidence of reported mumps cases on the basis of sentinel data only. However, our results clearly indicate the need for further studies to evaluate the efficacy of the different mumps vaccines used in Switzerland.

On the basis of the sentinel data, the overall efficacy of measles and rubella vaccines used in Switzerland was estimated to be above 90%. The excessive increase in the proportion of vaccinated mumps cases, on the other hand, indicates that the level of protection in the population is still insufficient. Under these conditions, the goal of mumps elimination is unlikely to be reached.

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