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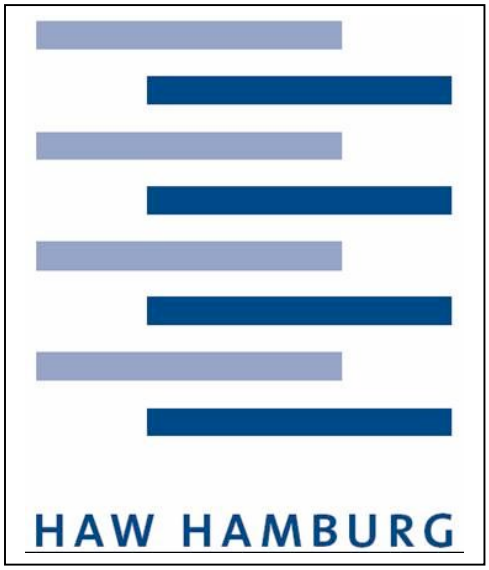

Measles vaccination policies in Europe: better performance at lower costs?

- Master Thesis -

Submitted by

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Abstract

Background: WHO has targeted measles for eradication in the European region by 2007. Some countries have already met this target whereas others are still far from it. Comparative data on the different vaccination policies which determine success or failure of measles control programmes are scarce. In which way are the costs of vaccination influenced by the vaccination procedures in different countries?

Method: Four European countries (SF, D, NL, UK) were compared in terms of strategy and outcome of measles control. A set of variables was collected to describe the different vaccination policies as precisely as possible. The prices of MMR vaccines as well as other vaccination costs were evaluated for each of these countries and the respective outcomes were compared.

Results: Finland, the Netherlands, and the UK have vaccination systems which are centrally planned and organised. Vaccinations are generally performed at statutory child care centres or primary care practices (UK). In Germany most childhood vaccinations are administered by paediatricians at their surgeries. There are remarkable differences in vaccination coverage rates and vaccine prices in the selected countries. Vaccination coverage is still insufficient in Germany (appr. 90%) whereas in Finland more than 97% of all children are vaccinated and thus measles can be considered eliminated there. However vaccination is very expensive in Germany with the price of an MMR vaccine being up to 5 times higher than in Finland.

Conclusion: Successful measles control can be attributed to a state-run national vaccination system with centralised planning and administration. Such a system allows, among others, a negotiation of lower vaccine prices. In addition a vaccination registration system makes precise control of the vaccination status possible and expensive surveys become unnecessary. It also enables the institutions in charge to address unvaccinated individuals directly by using a reminder system and thus allowing the most effective public health prevention strategy to be most successful. The respective vaccination policies also seem to have remarkable influence on the vaccine price. Countries with successful measles control pay the lowest prices for the vaccine. In Germany's case this means that the need for action is accompanied by a considerable saving potential for the national health care system.

Introduction

Measles elimination is defined as absence of indigenous cases in a population. This requires a vaccination coverage rate of more than 95% of the population (1). Sero-prevalence data (2) as well as surveys on vaccination coverage show that this goal is achieved to a very different extent in the individual European countries (3, 4, 5).
In Germany measles are still circulating and in comparison with other European countries incidence is still high. (12). In 2001/02 Germany experienced a measles outbreak in Bavaria when more than 1100 cases were reported in a region with a vaccination coverage below 70% (18).

The treatment of measles and potential complications are a huge cost burden to the health care system of a society. However, vaccinations too have to be paid for by the system and for German health politicians it would be important to know, whether a different vaccination strategy could could improve results. Analysing the methods of effective measles prevention in countries with a high vaccination coverage rate and low measles incidence would be a good way to start. A second question targets the costs of the various policies. An extensive study published in 2003 shows that one single vaccination costs 3.8 times less in Finland than in Germany (17). Germany is one of the countries in Europe (9) where health care is most expensive and it is currently struggling to cut costs by trying to push through important health care reforms. It is therefore of no little importance to know whether a different measles vaccination policy could contribute to this cost–cutting policy not only by preventing future cases but also by reducing the costs of preventive measures.
The aim of this study is to establish which factors are likely to determine the success of a vaccination policy and in which way these factors help to reduce vaccination costs.

Method

The countries compared in this study are Germany, Finland, the Netherlands, and the UK. Their political and economic systems are comparable to the German one. A set of questions was developed to help describe the different vaccination policies in these countries as precisely as possible. The questions were answered on the basis of literature and database research findings as well as discussions with local experts. Their names are listed in the acknowledgement section at the end of this thesis . The questions cover the following areas :

Vaccination system

- Does a national vaccination program exist?
- Who coordinates it?
- Which are the current recommendations for measles vaccinations?

Providers of measles vaccinations

- Who provides vaccinations?
- Which is the density of providers?
- Who is responsible for information about risks and benefits of vaccinations?

Carrying out vaccinations:

- Are measles vaccinations mandatory / voluntary?
- How are parents invited to have their children vaccinated?
- Does a reminder/recall system for recommended vaccinations exist?
- Is it possible to perform MMR vaccinations at home/kindergartens/schools?

Registration and assessment of coverage:

- How are vaccinations recorded?
- Does a vaccination registration system exist (local or national)?
- Which legal instruments are available to judge whether the targeted vaccination coverage rate has been achieved?
- Consequences in case of non-vaccination? (e.g. “no shot – no school”)

Costs of measles vaccinations:

- Who pays for the vaccination?
- What is the price of vaccines?

- Additional costs: per-vaccination fee to be paid to the provider

As measles vaccines are a combination of measles-mumps-rubella vaccines in all four countries, MMR vaccinations are are based on to calculate vaccine prices and any associated parameters.

Success of the strategy

- What is the immunisation rate achieved?
- Which is the current measles incidence?

Results

Vaccination systems

Finland, the Netherlands, and the UK have national vaccination programmes. In Finland it is coordinated by the national Public Health Institute (KTL), in the Netherlands the National Institute for Public Health and the Environment is responsible and in the UK the Department of Health Joint Committee on Vaccination and Immunisation (JCVI) forms the basis of policy decisions made on the use of new and existing vaccines. These decisions are made based on scientific evidence collected by The Immunisation Division of the Health Protection Agency at the Communicable Disease Surveillance Centre (CDSC).
Germany does not have a national vaccination programme. Instead the STIKO (Ständige Impfkommission am Robert Koch-Institut = Permanent Vaccination Committee at the Robert Koch Institute) develops recommended vaccination schedules based on scientific evidence.

In all four countries compared measles vaccinations are administered twice during childhood, usually in the form of a triple MMR vaccine against measles, mumps, and rubella. The schedule is displayed in table 1.

Country	**1st dose of MMR**	**2nd dose of MMR**
FINLAND	14-18 months	6 years
NETHERLANDS	14 months	9 years
UK	12-15 months	3-5 years
GERMANY	11-14 months	15-23 months

Table 1: MMR immunisation schedule

Providers of vaccination

In Finland all childhood vaccinations are administered by public health nurses in municipal well-baby clinics. The Ministry of Health recommends one nurse per 400 children below seven years of age. There are 1,036 of such child health centres located all over the country (density: 1 per 274 children below 5). Each is run by a physician and public health nurses. These professionals are responsible for providing information about the vaccinations. In the Netherlands too there is a net of public health services responsible for childhood vaccinations. About 1,400-1,500 Child Health Centres offer the first dose of MMR to babies (the second dose at 9 years of age is administered at 40 municipal Health Service Centres). In the UK vaccinations are provided by the national Public Health Service and administered by primary care staff or by staff employed by primary care trusts or within the framework of services commissioned by them, such as community paediatric services.
The German system differs completely from the two systems mentioned above. Here about 90 percent of all vaccinations are performed by physicians at their practices, whereby 90 percent of childhood vaccinations are administered by paediatricians. Currently there are about 5,700 paediatricians for 3.7 million children up to 5 years (1 doctor per 650 children (10)).

Carrying out of vaccinations

Measles vaccination is voluntary in all three countries of the study. In Finland nearly every mother makes use of the municipal maternity clinics which are free of charge. Usually a nurse visits mother and baby at home soon after delivery. Mother and child are transferred to a well-baby clinic after birth. The centres offer primary health care as well as vaccinations at scheduled intervals. Reminder or recall systems are based on local practice and are not organised centrally.

In the Netherlands, after the birth certificate has been issued, parents receive written information about vaccinations and neonatal screening. This information is available in many languages. A set of bar code cards is sent to the parents when the baby is two months old. Each card refers to a certain vaccination and explains where it can be obtained. Each vaccination appointment includes consultation and examination. After each vaccination at the well-baby clinic the card is stamped and sent back to

the Provincial Immunisation Administration (PIA). The completed cards are matched with the municipal population register. Parents who do not show up for vaccination with their children receive a reminder and, if required, a second one. If no immunisation follows these reminders, a district nurse will visit the parents. The second dose at the age of nine is given at school, arranged and coordinated by the municipal Health Service.
In the UK primary care practices invite parents for vaccination based on child health registers according to the national immunisation schedule.

Germany's system provides 10 free-of-charge child health examinations. The first one takes place at birth and the last at the age of 14. After birth the parents receive a booklet containing schedules and forms to record the examinations. Usually these are performed by the paediatrician of choice. The paediatricians may take this opportunity to recommend and perform vaccinations when parents take their children to these examinations.
Only a small proportion of vaccinations is performed at public health centres or schools in Germany. The vaccination procedures vary considerably in the German federal states. For example in Hamburg the Impfzentrum (= vaccination centre, part of the federal health authority) distributes flyers at schools which provide information on vaccinations. The names of children whose parents are interested are then taken down and a few weeks later a physician visits the school and carries out all required vaccinations.

Recording, registration and assessment of coverage

In Finland every child receives a personal child health card with vaccination data in the form of a booklet which belongs to the child and the parents respectively. Parallel to that the patient's records are kept at the municipal health centre. Municipal registries at municipal health centres (those with electronic patient record systems) store data on vaccinations performed at individual level. This system does not exist nationwide. National vaccination registration systems are thus planned and piloted.
There is no legal tool available to assess vaccination coverage. The National Institute of Public Health (KTL) carries out surveys at random samples. These surveys are repeated after 2 to 3 years. This is one of the tasks the KTL is in charge of within the framework of the national vaccination programme assigned by the Ministry of Health.

In the Netherlands vaccination coverage is assessed by comparing the national vaccination registry with municipal population registers.
In the UK a national vaccination registry does not exist. Here aggregated data are collated locally and collected by CDSC – the COVER programme.

Germany has not had any national vaccination registers until now. Attempts to establish such registries have been made at district or federal-state level. For example, in Saxony-Anhalt all vaccinations performed by the public health services are recorded at individual level. Also, vaccinations performed by physicians outside of the public service are recorded. The transmission of those data to the registry requires the written consent of the child's parents. The assessment of vaccination coverage has been part of the school entrance health examination until now. This examination usually takes place at the age of 5-6 years. In some federal states ~~require~~ certifications of the vaccination status issued by a physician are mandatory before children are accepted at kindergartens (e.g. Schleswig-Holstein).

In all four countries there are no restrictions for non-immunised children to attend school or day care centres.

Costs of measles vaccinations

In all countries compared in the study MMR vaccinations are free of charge.
It was not possible to identify the current price of an MMR vaccine in the UK, it was, however, comparably easy to do so for Finland and the Netherlands because there vaccines are purchased by one institution only. The price of one dose of MMR vaccine is € 9.00 in Finland and € 18.39 in the Netherlands.

Germany has a decentralised vaccine distribution system. Individual physicians order vaccines for their practices on an as-required basis from local or mail order pharmacies. The price of one dose of MMR varies from € 29.38 to € 45.10. This price depends mainly on the amount of doses ordered, on the type of insurance the child is covered by (public or private health insurance) and the type of pharmacy (local or mail order pharmacy).
For Germany the fee for the doctor's service can be stated, too. This fee is negotiated by 23 different KVs ("Kassenärztliche Vereinigung" = Association of National Health Doctors) and representatives from the public health insurance companies.

Currently doctors charge between € 21.47 (Bavaria) and € 7.16 (South Württemberg) for one MMR vaccination. Private insurance companies pay € 10.77 for the service. About 10% of the German population is covered by private insurances.
In the countries of comparison vaccination is part of the routine work at child health centres. The employees (doctors and nurses) working there are paid fixed salaries. It was therefore not possible to obtain figures on fees for vaccination services only.

Success of strategies

Finland has successfully eliminated measles for several years (6.7). The Netherlands and the UK also have low measles incidence whereas Germany still has a comparatively high incidence as can be seen from table 3. The figures are displayed in table 2.

	FINLAND	**NETHERLANDS**	**UK**	**GERMANY**
Vacc. coverage (1^{st} dose)	97%	95%	90% (19)	90% (13)
Incidence (2002), per 100,000 pop (8)	0	0.02	0.55	5.69

Table 2: measles incidences and vaccination coverage in Finland, the Netherlands, and Germany

The Finnish vaccination system was implemented nationwide in 1982. The implementation was accompanied by a large mass media campaign. Within 12 years this system made elimination of measles possible in the country. Vaccine coverage is reported to be 97%.
The Netherlands also report an overall vaccination coverage of about 96%. Nevertheless there are areas with low coverage, especially among supporters of certain religious opinions who refuse all vaccinations (the so-called “bible belt”). From 1999 to 2000 the country experienced a measles epidemic (11). Most of the cases occurred in areas with low coverage, the transmission chain was interrupted due to herd immunity of the inhabitants of the neighbouring districts.
In Germany vaccine coverage is obviously still too low to stop the transmission of the virus. Current data based on school or kindergarten entrance health examinations show rates of about 90% for the first, below 30% for the second dose of MMR. (13). Often vaccination is delayed (5, 14).

	FINLAND	THE NETHERLANDS	UNITED KINGDOM	GERMANY
Vaccination System				
Does a vaccination programme exist	Yes	Yes	Yes	No, only recommendations
Coordination by	National Institute of Public Health (KTL)	13 provincial vaccination administrations	Department of Health, advised by CDSC	STIKO at RKI recommends immunisation schedule
Payer of vaccination	State (National Board of Health)	State ("Jeugdgezonheidsorg")	National Health System (NHS)	Health insurances, (Public Health Service)
Current recommendation for MMR	1st 14-18 months 2nd 6 years	1st 14 months 2nd 9 years	1st 12-15 months 2nd 3-5 years	1st 11-14 months 2nd 15-23 months
Providers of MMR vaccination				
Who provides	Child health centres	Child health centres	Primary care practices, community paediatric services	Mostly paediatricians (+ Public Health Service)
Density	1 centre per 274 chd. <5	1 centre per 690 chd <5 years	?	1 physician per 650 chd <5 yr.
Risk/benefit information	Physicians and nurses at centres	Public Health Service	Physicians, nurses, Department of Health, persons responsible at CDSC	Paediatricians, Public Health Service
Carrying out of vaccinations				
Mandatory / voluntary?	Voluntary	Voluntary	Voluntary	Voluntary
Invitation of parents	By nurses after births	By postcard system	By GPs per computerised system	By paediatrician during consultation
Reminder system	?	Yes	Yes	No
Vacc. at school or kindergarten	No	Yes, usually the 2nd dose	Possible	Possible
Recording, registration, assessment of coverage				
Recording + registration	Vaccination booklet, records at health centres,	Patient-held certificate	Patient-held booklet + primary care system	Vaccination booklet, physicians' records
Vaccination registration	Not nationwide, only at municipal level	Yes, local and national	No	No
Coverage assessment	By random surveys	By registration	Accumulated data collated locally and collected by CDSC – the COVER programme	By surveys, by school entrance health examination
Vaccination costs				
Price per vaccine dose	€ 9	€ 19	Not available	€ 19 to 45
Provider's fee	Unknown, part of routine work	Unknown, part of routine work	Unknown, part of routine work	€ 7 to 21
Measles epidemiology				
Vaccination coverage	97%	95%	90% (19)	90% (13)
Measles incidence in 2002 (8)	0	0.02	0.55	5.69

Table 3: main characteristics of vaccination systems in Finland, The Netherlands, UK, Germany

Discussion

The comparison of the measles vaccination policies of the selected countries shows remarkable differences. These differences may have an effect on the success as well as the costs of measles control.
First of all Finland's, the Netherlands', and the UK's vaccination systems are centrally organised, in Germany the organisation of vaccinations is decentralised. Recommendations on vaccination schedules are made by a commission (STIKO) based on epidemiological evidence. In 1999 a national programme to eliminate measles was proclaimed. Currently the carrying out of these vaccinations has to be organised and coordinated between the health ministries of 16 federal states, 450 local public health departments, and 5,700 paediatricians. About 23 Associations of National Health Doctors ("Kassenärztliche Vereinigung") and more than 400 different sick funds and health insurances are involved in this process.
The other countries do not show these expanded administrations. It can be assumed that a centrally planned and negotiated vaccination programme saves money.

One of the most striking differences in the countries compared is the price of the vaccine. In Germany all pharmaceutical products which are paid by the health insurances have to be distributed by pharmaceutical wholesalers and pharmacies. Only institutions such as public health services are allowed to buy directly from the wholesalers. If only one or a few purchasers buy vaccine doses in bulk – as opposed to a distribution of maximum 20-dose packages by pharmacies - lower prices can be negotiated. This effect is illustrated by the 30% lower price the public health service in Hamburg (Vaccination Centre of the Institute of Environment and Health) has to pay for the MMR vaccine.
In the countries of comparison the vaccines are purchased by only one institution which makes direct negotiation with the producer possible.

Another important weakness of the German vaccination situation is the lack of data on immunisations performed. Until now there is no vaccination registration at individual level. The procedure applied in the Netherlands - machine-readable confirmation cards for each vaccination - appears admirably simple. In combination with municipal population registers it provides precise information on vaccination coverage at any

point in time and for each region of the country. The data are recorded and registered the moment they are produced. This dispenses with procedures such as assessment of vaccination status at school entrance health examinations. In addition the assessment as performed in Germany is not precise enough because it is based on the records of the patient booklet. Experience shows that about 6 to 7% of the children are not able to present their vaccination booklets at this examination (15, 16).
Another advantage of a vaccination registration system is the possibility to carry out targeted interventions and to intervene on demand. If data on missing coverage exist the respective families can be addressed directly, either by reminder letters or even by phone calls. The current German system does not provide for personal reminders. Technically physicians would be able to implement it in their electronic patient filing systems. Legal restrictions do not allow the physician to personally invite patients to come for the recommended preventive health examinations or the vaccinations. In Germany parents are asked to have their children vaccinated by e.g. leaflets and flyers distributed at schools or institutions without directly targeting the unvaccinated children.

Conclusions

The vaccination systems of Finland and the Netherlands are more successful with regards to vaccination coverage and subsequent disease control. They include procedures and components which are very likely to make measles vaccinations cheaper than it is currently the case in Germany. No statement can be made on the cost-performance ratio of the UK's vaccination system. Data on vaccine prices were not available whereas the epidemiological data show a comparatively low vaccination coverage and low incidence rates.
A more efficient vaccination system for Germany could probably be achieved by:

- Implementing a national vaccination system coordinated centrally or at federal level
- Purchase of vaccine by federal state health authorities
- Vaccinations performed by paediatricians or public health centres
- Confirmation of each vaccination by issuing machine-readable forms
- Central computerised immunisation registration at individual level, run by health authorities or health insurances
- Reminder system targeting unvaccinated children or hard-to-reach groups

The data from the countries of comparison suggest that better performance in measles control may be achieved at lower costs than it is currently the case. Success thus could be accompanied by saving potential for the health care system.

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Statutory declaration

The thesis on hand was prepared by me independently without outside help.
I made use solely of the sources and resources mentioned above. All persons having provided me with data and information, orally or in writing, are mentioned in the acknowledgement section. This thesis – or any variation thereof - has never been submitted to any examination authority.

Wohltorf, August 26th 2004 Antje Gottberg