

**Psychological Factors Associated with the Uptake of Measles Immunization :
Findings and Implications for Prevention**

Rolf Weitkunat, Andreas Markuzzi, Susanne Vogel, Ursula Schlipkötter, Hans-Joachim Koch,
Gaby Meyer and Dieter Ferring

J Health Psychol 1998 3: 273

DOI: 10.1177/135910539800300210

The online version of this article can be found at:

<http://hpq.sagepub.com/content/3/2/273>

Published by:



<http://www.sagepublications.com>

Additional services and information for *Journal of Health Psychology* can be found at:

Email Alerts: <http://hpq.sagepub.com/cgi/alerts>

Subscriptions: <http://hpq.sagepub.com/subscriptions>

Reprints: <http://www.sagepub.com/journalsReprints.nav>

Permissions: <http://www.sagepub.com/journalsPermissions.nav>

Citations: <http://hpq.sagepub.com/content/3/2/273.refs.html>

Psychological Factors Associated with the Uptake of Measles Immunization

Findings and Implications for Prevention

ROLF WEITKUNAT, ANDREAS MARKUZZI, SUSANNE VOGEL, & URSULA SCHLIPKÖTER
School of Public Health, University of Munich, Germany

HANS-JOACHIM KOCH
Institute of Psychology, University of Munich, Germany

GABY MEYER
Community Health Service, Medical School-Service Department, Munich, Germany

DIETER FERRING
Faculty of Psychology, University of Trier, Germany

ROLF WEITKUNAT, Dipl.-Psych, teaches biostatistics, statistical computing and epidemiology at the School of Public Health at the University of Munich. ANDREAS MARKUZZI, MD, BSc, MPH, is an epidemiologist at the Department of Infectious Diseases and Tropical Medicine of the University of Munich. SUSANNE VOGEL, MD, DTM&H, MPH, currently works at the community health service in the city of Munich. HANS-JOACHIM KOCH, Priv.-Doz., PhD, Dipl.-Psych., is a lecturer in the Department of Clinical Psychology at the Institute of Psychology, University of Munich. GABY MEYER, MD, is a paediatrician and medical director, currently heading the department of paediatrics at the community health service in the city of Munich. DIETER FERRING, Dipl.-Psych., PhD, is a senior lecturer in the Department of Psychology at the University of Trier. URSULA SCHLIPKÖTER, MD, MPH, is currently academic coordinator of the School of Public Health at the University of Munich.

ACKNOWLEDGEMENTS. This research was supported by a grant from the Münchner Forschungsverbund 'Public Health—Öffentliche Gesundheit'. We gratefully acknowledge the participation of the physicians of the community health service of the city of Munich.

ADDRESS. Correspondence should be directed to:
DR ROLF WEITKUNAT, Institut für Medizinische Informationsverarbeitung, Biometrie und Epidemiologie, Marchioninstr. 15, 81377 München, Germany.

Journal of Health Psychology
Copyright © 1998 SAGE Publications
London, Thousand Oaks and New Delhi,
[1359-1053(199804)3:2]
Vol 3(2) 273-284; 003692

Abstract

A cross-sectional study of 8204 children was performed to investigate the prevalence of immunization against measles, mumps and rubella and possible determinants of immunization uptake. The study was approached from a Lewinian perspective on preventive behaviour. Seventy-one questions referring to the guardian of the child, his or her partner, the household and the child, as well as to immunization-related experiences and situational topics were asked. Two psychological variables were studied: health locus of control and subjective relevance concerning measles. The immunization rate was 77.7 percent [95 percent confidence interval 76.8-78.6]. Multiple logistic regression yielded the following odds ratios for non-uptake of measles immunization: natural health orientation 8.74 [6.72-11.37]; advice of paediatrician 6.02 [4.67-7.75]; dangerousness of measles 2.00 [1.53-2.60]; marital status 1.87 [1.31-2.51]; assessed reliability of vaccination 1.57 [1.23-2.01]; smoking 1.55 [1.21-1.98]; and number of siblings 1.55 [1.21-1.98]. Parents or guardians of immunized children were more internal and assessed measles as more relevant than those of non-immunized children.

Keywords

health behaviour, health promotion, immunization, measles, preventive medicine

TRADITIONALLY, IMMUNIZATION against infectious diseases has been the primary field of medical prevention. Measures to be undertaken and outcomes are both easily defined, and cost-effectiveness is fairly simple to determine, at least compared with preventive activities concerned with behaviours leading to chronic diseases. The main difference is that the latter are usually concerned with habitual behaviour whereas the former requires, more or less, one single act to be performed in order to preserve health. Consequently, measles, mumps and rubella are generally considered a sufficiently well-controlled phenomenon in industrialized countries. Immunization against measles, mumps and rubella has even been improved markedly upon the introduction of combined measles, mumps and rubella (MMR) vaccines in the 1980s in Germany. However, within recent years, a steadily decreasing compliance with MMR immunization, which is officially recommended but voluntary in Germany, has been reported. In the literature there is discussion of possible reasons for this changing situation (e.g. Hofmann et al., 1994). One reason is the currently high rate of immunity against these infections, which has made them rare in comparison to other health problems, acute or chronic, currently under discussion. This reduced visibility of MMR may have led to both an underestimation of their relevance and to an overestimation of the risk associated with immunization itself. In fact, present discussion on immunization seems to be more concerned with side-effects of immunization than with the diseases themselves. This change in public perception and attitude is paralleled by a shift of MMR infections to a later age group, when the course of these diseases tends to be more severe than occurs in children. At present we seem to be facing only the beginning of this trend, since reduced immunization rates of current cohorts of children will obviously lead to increases in the unprotected proportion of the population.

To study preventive behaviour, several possible determinants need to be explored. According to Lewin (1936) the *force* (f) associated with a certain behaviour emerges from the combination of the *valence* of the assumed consequence (C) of this behaviour, of the *potency* or, in more modern terms, the (expected) probability (p) of the occurrence of this consequence, and the

psychological distance (d) between the behaviour and its consequence:

$$f = \frac{C \cdot p}{d}$$

As a more modern term for f , not rooted in physics but rather well fitting to current psychological conceptualizations, we suggest the word *subjective relevance*, while the term 'subjective risk' could also be used in the context of health-related behaviour. Obviously, C , p , and d are not coined as physical entities but rather as subjective perceptions and expectations (Tolman, 1955), psychologically linked to physical reality, for example by former experience (i.e. learning [differentiation] and generalization of stimulus-response-consequence contingencies).

For the present study, we adopted the Lewinian concept of 'force' in a rather simple way. Instead of trying to formulate several ($i = n$) forces f_i corresponding to different behaviours and sub-behaviours, we concentrated on the force presumably associated with the dread of infection. The assumed probability of getting infected is linked directly to the above parameter, p . The subjective severity of the (measles) infection in general is, of course, equal to C . Finally, the expected average latency between the present and an eventually occurring infection equals d .

If immunization behaviour is indeed 'forced' by these perceptions, the f values should be associated with increased rates of immunization. The major aim of the present analysis was to explore this presumed relationship. In addition to further analysing the exact role of the three parameters C , p , and d making up f , additional sociodemographic and psychological parameters were investigated.

Methods

The present analysis was conducted as part of the Munich Measles, Mumps and Rubella Study. The aim of the cross-sectional MMR study was to investigate the prevalence of MMR immunization and factors related to the MMR immunization rate in all preschool children in Munich in 1994. The study was conducted in cooperation with the community health service screening all children for their health status prior to school

admission. The examination is mandatory in Bavaria, so the whole 1994 Munich school entry population was assessed.

After the physical examination by one of the 21 paediatricians of the community health service, the adult person accompanying a child (parent or guardian) was asked voluntarily to complete an anonymous questionnaire. After completion or refusal by the accompanying person, the questionnaire was inserted into a sealed cardboard box to maintain confidentiality according to German law. The boxes were then transferred to the data entry facility. Regular monitoring visits were undertaken to control protocol adherence at the examination centres.

Measures

Data were acquired using a questionnaire which was translated into Serbocroat, Greek, English, French, Turkish and German. No Italian version was used, since little immigration from Italy to Germany is currently taking place and most Italians living in Germany are able to read German.

The first page of the questionnaire was to be completed by the physician in charge of the examination. Prior to handing over the questionnaire to the person accompanying the child, the physician reported the vaccination status of the child, either based on the vaccination records or (in cases of missing records) on the information given by the guardian. Pages 2 to 11 were to be filled in by the person accompanying the child. They contained 71 questions referring to the guardian (sex, age, height, weight, marital status, citizenship, health insurance, employment, education, health-related behaviour, health status), his or her partner or spouse (similar questions as with respect to the guardian), the household (domestic situation, household size, monthly income, neighbourhood), the child (sex, age, height, weight, problems during mother's pregnancy, current chronic illnesses or handicaps, current medication, siblings, religion, etc.), and to experience-related (e.g. 'Are you aware of cases of vaccination side-effects?') and situational (e.g. 'How long does it take you to get to your paediatrician?') topics. These were followed by three questions operationalizing the above parameters C , p , and d making up the hypothetical force f being presumably associated with immunization behaviour. Finally, 20 ques-

tions followed which made up the health domain-specific locus of control questionnaire developed by Ferring and Filipp (1989).

The questions operationalizing C , p , and d , being scaled on a discrete 10-level scale were, respectively:

- In your opinion, how dangerous is measles for a six-year-old child? (scarcely dangerous = 1 to very dangerous = 10)
- If a six-year-old unvaccinated child has contact with a child who has the measles, how likely is the child to contract measles? (very unlikely = 1 to very likely = 10)
- How often does a six-year-old child come into contact with measles? (no more than once in his life = 1 to daily = 10).

In order to compute the subjective relevance (f), d was transformed to $11-d$ to yield the highest f values for the shortest psychological distances d .

Data analysis

Returned questionnaires were consecutively numbered on the cover page prior to double data entry. Thorough data checking (including single variable range and plausibility checks as well as cross-checks) was performed according to a preset protocol. Implausible or impossible data underwent source verification by going back to the questionnaire.

All variables were described univariately according to their measurement scale with absolute and relative frequencies or number of cases, number of missing cases, mean, standard deviation, first to third quartile, minimum and maximum. Descriptive analysis included computation of immunization rates with respect to measles, both overall and stratified for other variables. Ninety-five percent confidence intervals were computed for immunization rates and other proportions (based on the binomial distribution) as well as for the means of selected continuous variables (based on the normal distribution). Exploratory data analysis was performed by multiple stratification. The relevance of potential predictor variables (continuous, ordinal and nominal) was assessed by performing stepwise multiple logistic regression analysis (backward selection at level $p < 0.05$) on immunization against measles. Selected vari-

ables were described in terms of odds ratios along with 95 percent confidence intervals.

In addition to this basic analysis, special attention was paid to the relevance of the factors *subjective relevance* and *health locus of control*. According to Ferring and Filipp (1989), nine questions of their health locus of control scale (FEGK) are related to external and 11 to internal control beliefs. To obtain measures of externality (*E*) and internality (*I*), the respective items (each scaled from 1 = very true to 6 = very untrue) were added up and divided by 9 or 11, respectively. In order to combine the two measures, the ratio *INT* (coefficient of internality) was computed:

$$INT = \left(\frac{I}{I + E} - \frac{1}{7} \right) \cdot 1.4 \cdot 100\%$$

By computing the ratio *I*: (*I* + *E*) a standardization of scores controlling for individual responsiveness (not all questions were answered by all respondents) is achieved. Because the minimum possible ratio is 1:7, this number was subtracted as an offset, yielding a new minimum of zero. To extend the maximum from 5:7 to 7:7 (i.e. to unity), the interim result was multiplied by 1.4. Further multiplication of the product by 100 implies that a coefficient of internality between 0 percent and 50 percent represents a more external control orientation, whereas scores of above 50 percent represent a tendency towards internal health control beliefs. All analyses were done with SAS (version 6.08).

Results

General findings

In 1994, 10,029 children underwent preschool examination in Munich. The paediatricians passed 8477 questionnaires to the accompanying parents or guardians, of which 8277 were returned (82.5 percent of 10,029). Of these questionnaires, 73 were not eligible for analysis because they were either empty or completed in a way that made them unusable for data entry. All analyses are based on 8204 questionnaires (81.8 percent), of which 82 (1 percent of 8204) had an empty page 1 (physician's page) and 1207 (14.7 percent) had empty pages 2 to 11 (guardian's pages).

Since the detailed findings of the study will be published elsewhere upon completion of all analyses, only an overview of the general findings is given here. Table 1 contains a description of the study population of 8204 cases.

In 7407 of all 8204 analysed cases, immunization status with respect to measles was documented. A total of 6374 cases of immunization against measles was reported. Depending on whether the 797 cases with no information on measles immunization are considered or not, the rate of immunization was 77.7 percent or 86.1 percent. The present analysis of immunization rates is based on the conservative assumption that missing cases are not immunized, i.e. the lower rates are adopted.

The 95 percent confidence interval of the conservative overall rate of immunization of 77.7 percent extends from 76.8 percent to 78.6 percent. Several factors were found to be associated with immunization rate, some of which are reported here. For example, higher rates were found in children with female (83.5 percent [95 percent confidence interval 82.5–84.4]) compared with male guardians (77.4 percent [74.8–79.9]), in children with married (84.4 percent [83.4–85.4]) compared with unmarried guardians (74.6 percent [72.1–77.0]), in children with German (84.1 percent [83.1–85.1]) compared with non-German guardians (76.0 percent [73.9–78.1]), in children with non-smoking (84.6 percent [83.3–85.7]) compared with smoking guardians (79.1 percent [77.4–80.8]), in Protestant (86.0 percent [83.9–88.0]) or Catholic children (85.4 percent [84.2–86.5]) compared with children without confession (73.6 percent [70.4–76.6]), in children with no or one sibling (84.0 percent [82.8–85.1]) compared with children with two or more siblings (78.3 percent [76.3–80.3]), in first-born (85.3 percent [83.9–86.6]) compared with not first-born children (79.6 percent [78.1–81.0]), in children with guardians who themselves did not experience vaccination side-effects (83.4 percent [82.4–84.3]) compared with children with guardians who did (70.4 percent [64.4–75.9]), in children with guardians who had no natural health reasons against vaccination (87.1 percent [86.2–88.0]) compared with children with guardians who did (46.3 percent [42.6–50.1], *n* = 693), in children

Table 1. Characteristics of the study population

Characteristic	<i>M</i> ± <i>SD</i> (or %)	<i>n</i>
	<i>Parent/Guardian</i>	
Age (years)	35.0 ± 5.5	6537
Gender (% female)	84.4	6695
Marital status		6703
Married	81.5	
Living with a partner	3.3	
Single	5.5	
Separated/divorced	8.9	
Widowed	0.8	
Citizenship (% German)	76.4	6815
Employment (% employed)	49.2	6753
Education (% years)	12.5 ± 3.7	5768
Health care insurance (% yes)	98.9	6728
Body mass index (kg/m ²)		
Male	25.4 ± 3.6	778
Female	22.8 ± 3.9	4282
Sports (% rare or none)	40.1	6567
Smoking (% yes)	35.0	6651
Alcohol intake (% more than once per month)	31.2	6582
Chronic disease or handicap (% yes)	6.3	6606
Medication (% of regular intake)	9.0	6600
	<i>Household</i>	
Size (no. of persons)	4.0 ± 1.0	6558
Size of apartment (m ²)	92.8 ± 39.3	6508
Total monthly income (DM)		5864
<3000	22.5	
≥3000	77.5	
	<i>Child</i>	
Age (years)	6.4 ± 0.4	6446
Gender (% female)	49.4	6515
Height (cm)	120.2 ± 5.7	5912
Weight (kg)	22.5 ± 3.5	6146
Chronic disease or handicap (% yes)	4.2	6543
Medication (% of regular intake)	2.7	6591
Problems during pregnancy, birth, first week	18.8	6314
Siblings (% no)	11.4	5639
Kindergarten before 3 years of age (% yes)	21.2	6555
Experience of vaccination side-effects (% yes)	5.3	6430

First column: mean (*M*) ± standard deviation (*SD*) or relative frequency (%).

Second column: absolute frequency (*n*) of cases with available data.

with parents or guardians who did not have particular difficulties with visiting the paediatrician (83.9 percent [82.9–84.9]) compared with children with parents or guardians who did (78.3 percent [75.5–80.9]), in children who were only slightly afraid to visit the paediatrician (84.1 percent [81.7–86.3]) compared with children who were very afraid (73.0 percent [64.7–80.2]), in children with paediatricians

advising pro-vaccination (88.7 percent [87.8–89.6]) compared with children with paediatricians advising against it (53.7 percent [50.5–57.0], *n* = 921). Of the paediatricians advising pro-vaccination, 81.8 percent were assessed as discussing the vaccination intensively with the parents or guardians. This rate was only 58.8 percent in the paediatricians advising against vaccination.

In addition to the above factors, assessments of dangerousness of measles as well as of reliability of immunization against measles were also associated with immunization rates. Higher rates were found in children with parents or guardians assessing measles as somewhat (84.4 percent [82.8–85.9]) or very dangerous (89.2 percent [87.8–90.4]) compared with children of parents or guardians assessing measles as hardly (71.7 percent [68.4–74.9]) or not at all dangerous (64.6 percent [57.3–71.4]) as well as in children with parents or guardians assessing the reliability of immunization as very high (87.9 percent [86.9–88.9]) compared with children with parents or guardians assessing it as somewhat (74.9 percent [72.3–77.3]), hardly (60.5 percent [52.2–68.5]) and not at all (72.9 percent [59.7–83.6]) reliable. Only marginal associations with immunization rate were found for many variables in the data set, for example, for gender, age, height and weight of the child.

Table 2 contains the final results of the stepwise multiple logistic regression analysis. Originally, the following variables were entered: age (years); marital status (married vs not); body mass index (continuous score); citizenship (German vs other); smoking status (yes vs no/ex); educational level of guardian (high vs low); number of apartments in house (1–4 vs more); total income of household (<3000 vs ≥3000 DM); child's attendance at kindergarten before the age of three years (yes vs no); sex of child; confession of child (yes vs none); number of siblings of child (0–1 vs 2 or more); birth order position (first vs later); natural health attitude of guardian against vaccination (yes vs no); child afraid of paediatrician (yes vs no); physician's or paediatrician's advice for or against vaccination (pro vs con); particular difficulties when visiting the paedia-

trician (yes vs no); guardian's trust in paediatrician (yes vs no); guardian's assessment of dangerousness of measles for children who have not been vaccinated (yes vs no); guardian's assessment of dangerousness of vaccination against measles (yes vs no); guardian's assessment of reliability of vaccination against measles (yes vs no); guardian's attitude towards an eventual combination vaccination against all children's illnesses (pro vs con); guardian's assessment of dangerousness of measles for a six-year-old child (1 = scarcely dangerous to 10 = very dangerous); internal and external health locus of control (continuous scores) according to Ferring and Philipp (1989) as well as coefficient of internality (continuous score). Additionally, selected two-way interactions of these variables were explored. All of them were eliminated during the modelling process, so only main effects are contained in the final model (see Table 2).

As can be seen, the highest effect was observed for natural health orientation: children of parents or guardians with natural health orientations had an almost 10-fold risk of not being vaccinated against measles compared with children of parents or guardians without such orientations. Smaller immunization rates were also associated with paediatricians not advising to have the child vaccinated, with children of second or higher birth order position, with parents or guardians assessing measles as little dangerous, with parents or guardians not being married, with parents or guardians assessing the reliability of the vaccination as small, and with smoking parents or guardians.

Locus of control

Table 3 contains the descriptive statistics of the coefficients of internality, separated for cases

Table 2. Estimated odds ratios for none-uptake of measles immunization after controlling for other factors

<i>Variable</i>	<i>Odds ratio [95 percent confidence interval]</i>
Natural health orientation	9.88 [7.55–12.93]
Advice of paediatrician	6.15 [4.76– 7.95]
Birth order position	2.37 [1.86– 3.02]
Dangerousness of measles	2.15 [1.64– 2.82]
Marital status	1.94 [1.44– 2.61]
Reliability of vaccination	1.58 [1.24– 2.02]
Smoking	1.48 [1.16– 1.90]

Table 3. FEGK scale on health locus of control

Immunization status	Descriptive statistics		
	<i>n</i>	<i>M</i> ± <i>SD</i>	95% confidence interval of <i>M</i>
Immunized	4921	33.16 11.58	32.84–33.48
Not immunized	745	31.21 11.92	30.35–32.07

Coefficient of internality (0–100 percent).

Table 4. Assessments of the dangerousness of measles (*C*), of the likelihood of contracting measles (*p*), of the latency to next exposition (*d*) and subjective relevance (*f*) computed from these parameters by the formula $f = C \cdot p / d$

Immunization status	Descriptive statistics		
	<i>n</i>	<i>M</i> ± <i>SD</i>	95% confidence interval of <i>M</i>
Immunized			
<i>C</i>	4815	5.88 2.42	5.81– 5.95
<i>p</i>	4844	7.83 2.31	7.76– 7.90
<i>d</i>	4665	6.01 2.38	5.94– 6.08
<i>f</i>	4609	12.25 17.51	11.74–12.76
Not immunized			
<i>C</i>	716	4.59 2.33	4.42– 4.76
<i>p</i>	726	7.54 2.26	7.38– 7.70
<i>d</i>	702	6.11 2.25	5.94– 6.28
<i>f</i>	629	9.12 15.46	7.91–10.33

with and without immunization against measles. As can be seen, parents or guardians of immunized children had higher coefficients of internality at an error level of 5 percent. However, the between-group difference of 1.95 points is small compared to the intragroup variation.

Subjective relevance

Table 4 contains the parents’ or guardians’ assessments of the dangerousness of measles, of the likelihood of contracting measles, and of the latency to the next exposition as well as the subjective relevance computed from these parameters. Both the assessed dangerousness of measles and the assessed likelihood of contracting measles as well as the subjective relevance of measles were higher in the group of immunized children. In contrast, only tendentially smaller assessments of latencies to the next exposure were observed in the group of immunized compared with non-immunized children.

In order to further explore the relation of subjective relevance and immunization rate, the

data set was sorted with respect to subjective relevance in ascending order. Then the immunization rates and 95 percent confidence limits were plotted against subjective relevance (Figure 1). For this analysis, only cases with both parameters available could be used ($n = 5301$). Figure 1 also shows the cumulative numbers of cases on which the immunization rates are based along the horizontal axis.

As can be seen, the estimated immunization rate becomes more steady at around a relevance of 0.4, corresponding to a database size of about 1000 cases. Also, the confidence interval becomes reasonably small. Figure 1 shows a strongly increasing immunization rate up to a relevance of about 12. Then the curve gradually becomes asymptotic against a maximum (i.e. overall) immunization rate of 86.95 percent. It must be noted that the degressive course of the immunization rate is paralleled by a considerably declining increase in sample size. Based on the information in Figure 1, it is therefore possible that the immunization rate would have

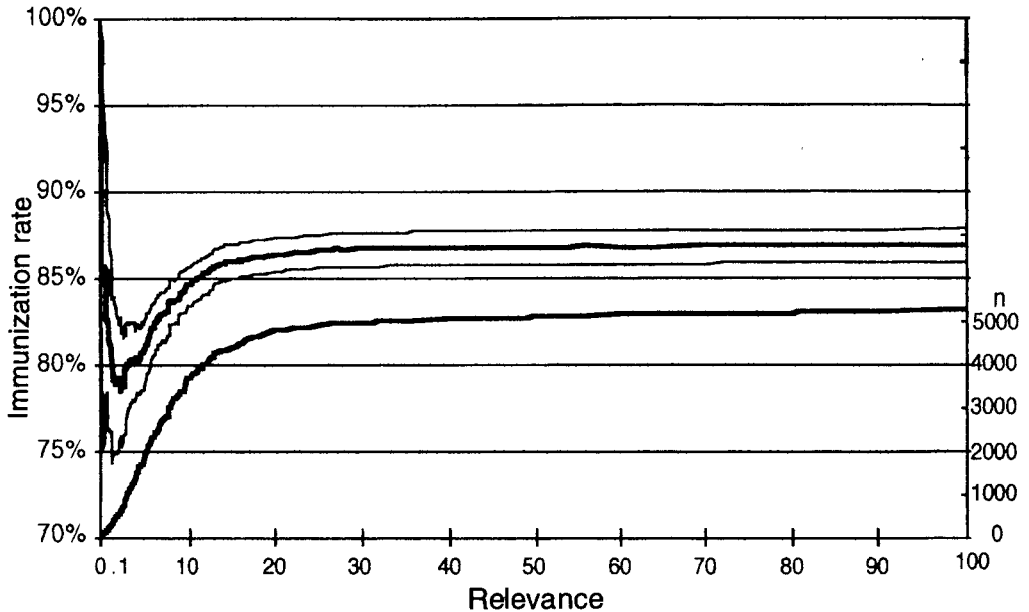


Figure 1. Plot of the immunization rate (vertical axis) and 95 percent confidence limits (upper three curves) against subjective relevance (horizontal axis). With increasing relevance values the immunization rates are based on growing subsamples of a total of 5301 cases with complete data. The cumulative sample size (i.e. the sample available at a given relevance value) is plotted along the horizontal relevance axis (lower curve).

increased more steeply than Figure 1 suggests, if more cases with relevances of above or around 15 would have been available. In order to further investigate this possibility, nine empirical cut-off points were set with respect to the relevance scores in order to obtain 10 equally precise prevalence estimates, by including approximately the same number of individuals per bin. The immunization rates per bin were completed by computing 95 percent confidence intervals. The results are shown in Figure 2.

Overall, the course of immunization rates in Figure 2 supports the information contained in Figure 1. As the curve contained in Figure 2 shows, no further increases of immunization rates occur at the last two relevance deciles. This supports the notion that the positive association of subjective relevance and immunization is limited to relevance scores of little above 12. Below this point, however, increments in subjective relevance are paralleled by strong increases of immunization rate. A cubic regression of relevance on immunization percentage based on the aggregated data of Figure 2 yielded

the following equation, by which 92 percent of the variation in the response rate could be explained:

$$\% \text{ immunized} = 74.6069 + 2.6919 \cdot f - 0.1274 \cdot f^2 + 0.0018 \cdot f^3$$

In order to be able to use the non-classified data set (individual data) to explore the association of subjective relevance and immunization, a logistic regression analysis was performed on all 5301 cases completed with respect to these two variables. Of the cases, 86.9 percent could be correctly classified by the following function, yielding the probability p of a child not being vaccinated, given a subjective relevance f :

$$p = \frac{e^{-1.7383 - 0.0151f}}{1 + e^{-1.7383 - 0.0151f}}$$

The corresponding odds ratio and 95 percent confidence interval is 0.985 [0.978–0.992]. If these values are inverted, an increment of relevance by one is paralleled by an increased 'risk' of 1.02 of a child being vaccinated.

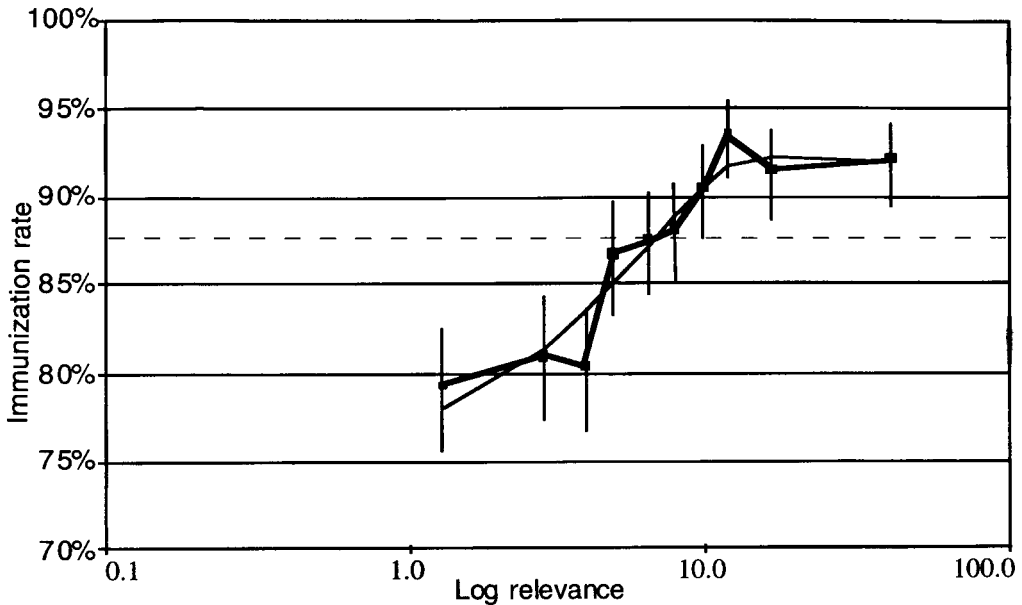


Figure 2. Immunization rates and 95 percent confidence intervals for deciles of subjective relevance f , plotted against log relevance axis at median points of each of the 10 bins (medians 1.3, 2.9, 4.0, 5.0, 6.4, 8.0, 10.0, 12.0, 16.7, 40.0). The broken line denotes the overall immunization rate of 86.95 percent, obtained when using only cases with data on both subjective relevance and immunization status. The fit achieved by cubic regression is plotted as a thin line.

To explore the courses of C , p , and d , the means of these parameters at the above 10 median points were along with 95 percent confidence intervals plotted along the same relevance axis as in Figure 2. The result is shown in Figure 3.

It can be seen that increased relevance is associated with increased mean assessments of dangerousness of measles (C) and of likelihood of contracting measles (p), as well as of decreased latency (corresponding to increasing d values) to the next exposition. The values of C are generally higher than those of p and d . Whereas the slope of the latter parameter increases along the last three relevance bins, both C and p are less steep there, compared with lower relevance bins. The course of the immunization rate with respect to relevance as shown in Figure 2 resembles more the courses of the parameters C and p of Figure 3 compared with the course of parameter d . Since the former are related by a multiplication, this dominance is strongly dependent on the type of modelling of the hypothetical construct of subjective relevance.

To analyse the concurrent importance of these three parameters, a backward eliminating logistic regression was computed on them. Both p and d were removed at the 10 percent significance level. This corresponds well to the values graphed in Figure 3. With parameter C again (as with relevance), 86.9 percent of the cases could be correctly classified. The odds ratio (odds of the child not being vaccinated) associated with C was 0.795 [0.767–0.825].

To analyse how health locus of control and subjective relevance might be interrelated with respect to immunization uptake, the data set was divided at a coefficient of internality value of 32.185, corresponding to the value maximally segregating the groups of immunized and not immunized (see Table 3). Overall immunization rate in individuals with high (>32.185) coefficients of internality was higher (88.3 percent [87.1–89.4]) than in individuals with low (≤ 32.185) coefficients of internality (85.3 [83.9–86.6]). As can be seen from Figure 4, this difference occurred in relevance decile

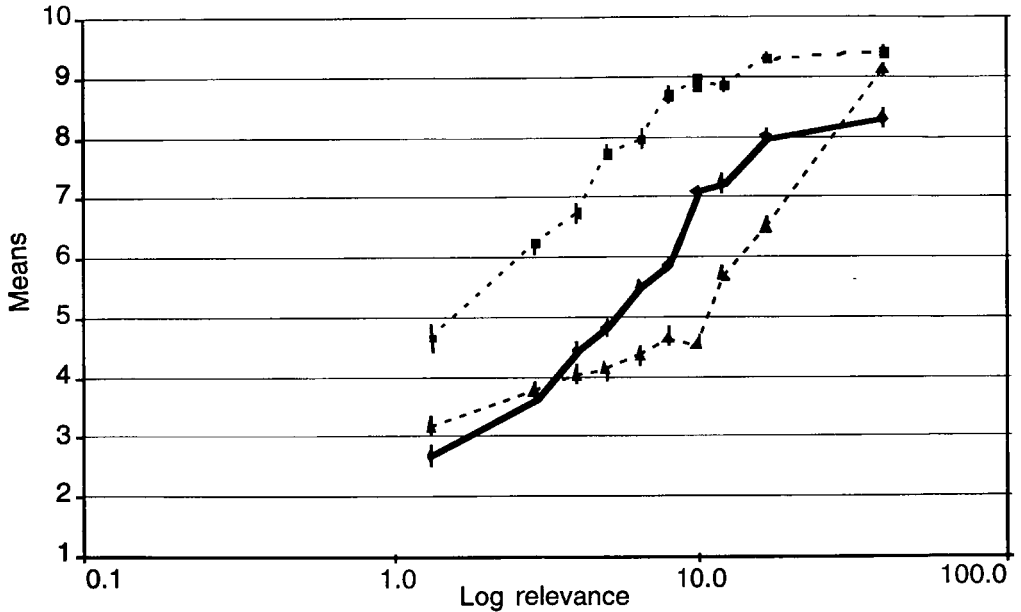


Figure 3. Mean *C* (upper dotted line), *p* (thick line), and *d* (lower dotted line) values and 95 percent confidence intervals (vertical axis). The relevance points (horizontal axis) correspond to the median points of Figure 2.

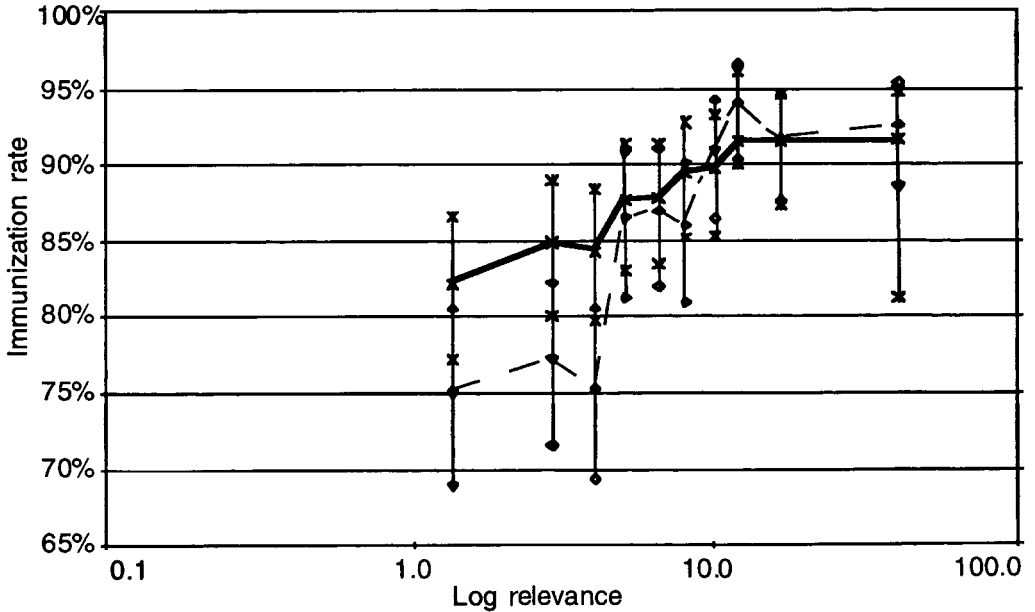


Figure 4. Immunization rate and relevance, separated for individuals with high (>32.185; thick line) vs low (≤ 32.185 ; broken line) coefficients of internality. Vertical bars indicate 95 percent confidence intervals of immunization rates. The analysis is based on data completed with respect to immunization status, subjective relevance and coefficient of internality ($n = 5666$).

groups of individuals with median subjective relevance values of 4.0 and below.

At higher values of subjective relevance (of above about eight to nine) no clear difference in immunization could be found with respect to health locus of control. The small rank correlation of subjective relevance and coefficient of internality (-0.07) suggests an overall independence of the two variables.

Discussion

The results of the present study provide a clearer understanding of some of the factors associated with the uptake of measles vaccination. At first glance, the results revealed a variety of factors related to immunization. Looking closer, however, a rather concise picture emerges. First, only two of the factors were sociodemographic: marital status of the parent or guardian and birth order position of the child. The latter effect was reported previously by Li and Taylor (1993). Children with no or few siblings as well as first-borns were more likely to be immunized than other children. Also, children with married parents were more likely to be immunized than children with unmarried parents. Smoking status of the parent or guardian, a variable often investigated in comparable epidemiologic studies, was also related to having the child vaccinated. The coincidence of increased smoking and reduced immunization might reflect some more general orientation towards prevention: individuals not being concerned too much about the future health status of either themselves or of their children might be prone to both smoking and neglecting immunization schedules. The finding of a more external health locus of control in respondents with non-immunized children seems to be well compatible with this finding. The attitude of being generally less under control of one's future health status might favour making a choice for, and developing behaviours endangering health.

The strongest associations with vaccination uptake were found for natural health orientation and advice of paediatricians, as well as the assessments of dangerousness of measles and reliability of vaccination against measles. Again, these factors might be indicative of one more general set of attitudes, beliefs and knowledge. For example, individuals with natural health

orientations might select physicians with similar attitudes (Byrne, 1969), who might be more likely to advise against immunization, compared with physicians oriented more towards scientific medicine. Also, natural health attitudes seem to be compatible with reduced trust in scientific medical treatment regimens in general and in vaccinations in particular, as well as with the attitude that the natural courses of children's diseases being a good (natural) training of the immunity system after all (there are in fact findings that natural courses might be protective, e.g. with respect to cancer) (Abel, Becker, & Angerer, 1991). Other cognitions might be operative, like, for example, the idea that measles is not dangerous (due to lack of personal experience) and the view that vaccination against measles is therefore unimportant. This belief system would then, in terms of cognitive dissonance theory (Festinger, 1957), be consonant with the notion of vaccinations not being reliable anyway. Of course these speculations are tentative and, after all, the present findings are associations, not causations. On the other hand, the results are consistent and credible due to the considerable sample size of the study.

Looking closer at what we call *subjective relevance* of measles yields interesting additional information. Whereas, again, the assessment of the dangerousness of measles clearly shows a relation to the immunization status of the child, the assessment of the likelihood of contracting measles as well as the assessment of the latency to the next exposition were also related to immunization in the expected way. Individuals assessing the likelihood p as high and the latency d as short were more likely to have their children vaccinated than respondents with opposing assessments. While in the multiple analysis of the present data the latter two parameters were dismissed without loss of explained variation, they might in fact turn out to bear more preventive potential than the subjective assessment of the dangerousness of measles. This is supported by the finding that the absolute values of the former two factors were generally lower than those of the latter one (although the comparability of the scales is yet unclear). This might imply that there is room for improvement here. The critical role of d and p is also supported in the literature (Bonieki, 1980; Weinstein, 1987). Clearly, the question of how

efficient a psychological manipulation of p and d will finally be can only be answered in a prospective intervention study aiming at increasing immunity rates by behavioural intervention measures. Trying to change the parameters associated with subjective relevance should be accompanied by addressing external health control beliefs. This suggestion is based on the coincidence of lower immunization rates on the one hand and lower subjective relevance, as well as lower internality, on the other.

References

- Abel, U., Becker, N. & Angerer, R. (1991). Common infections in the history of cancer patients and controls. *Journal of Cancer Research and Clinical Oncology*, *117*, 339–344.
- Bonieki, G. (1980). What are the limits to man's time and space perspectives? Toward a definition of a realistic planning horizon. *Technological Forecasting and Social Change*, *17*, 161–175.
- Byrne, D. (1969). Attitudes and attraction. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. IV). New York: Academic Press.
- Ferring, D., & Filipp, S. H. (1989). Der Fragebogen zur Erfassung gesundheitsbezogener Kontrollüberzeugungen. *Zeitschrift für Klinische Psychologie*, *18*, 285–289.
- Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston: Row & Peterson.
- Hofmann, F., Schuh, F., Michaelis, M., & Stöbel, U. (1994). Zur Akzeptanz von Schutzimpfungen bei Ärzten und bei der Allgemeinbevölkerung. *Das Gesundheitswesen*, *56*, 371–376.
- Lewin, K. (1936). *Principles of topological psychology*. New York: McGraw-Hill.
- Li, J., & Taylor, B. (1993). Factors affecting uptake of measles, mumps, and rubella immunization. *British Medical Journal*, *307*, 168–171.
- Tolman, E. C. (1955). Principles of performance. *Psychological Review*, *62*, 315–326.
- Weinstein, N. D. (1987). Unrealistic optimism about illness susceptibility: Conclusions from a community-wide sample. *Journal of Behavioral Medicine*, *10*, 481–500.