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# Vaccination Coverage in Hard to Reach Roma Children in Slovenia

**Alenka Kraigher[1], Maruška Vidovič[1], Tanja Kustec[1] and Alenka Skaza[2]**

[1] Communicable Diseases Center, Institute of Public Health of the Republic of Slovenia, Ljubljana, Slovenia
[2] Regional Institute of Public Health Celje, Celje, Slovenia

**A B S T R A C T**

*The results of the retrospective analysis of data on vaccination coverage in the preschool-aged and school-aged Roma children (436 preschool and 551 schoolchildren) in three geographical regions of Slovenia were analyzed to establish the differences concerning coverage for specific vaccinations: poliomyelitis, diphtheria, tetanus, pertussis, measles, mumps and rubella between the two generation. The data were obtained from health records, immunization records (Vaccination booklet) and National Computerized Immunization System (CEPI 2000®). Vaccination coverage was calculated by comparing the number of children eligible for immunization with the number of vaccinated children. This article performs the log-rank statistical test, also known as the Mantel-Haenszel test. Log rang test is comparing survival curves for two generations. Preschool-aged Roma children showed higher vaccination coverage than the school-aged Roma generation. There was no significance difference in the generations of preschool aged and school aged Roma children fully vaccinated against poliomyelitis, diphtheria, tetanus and pertussis. Rubella vaccination was significantly lower in the school aged Roma generation. Only 33% of school aged Roma population received two doses of measles, mumps and rubella vaccine. Vaccination coverage of preschool Roma children in Slovenia against poliomyelitis, diphtheria, tetanus, pertussis and MMR (measles, mumps, rubella) were significantly lower then the national vaccination coverage for preschool aged Slovenia children. Many joint efforts will have to be made to improve the vaccination coverage in Roma communities.*

***Key words***: *Roma people, vaccination coverage, immunization, communicable diseases, Slovenia*

## Introduction

In 2004, Roma population in Slovenia numbered 8.000 to 10.000. Roma people live in settlements isolated from the rest of the population, mainly in the northeastern and southeastern parts of the country and in the surroundings of Ljubljana[1]. Except in the northwestern region of Slovenia where they have been fully assimilated into the society, lifestyle of the Roma people in Slovenia differs markedly from that of other population. In Slovenia, like elsewhere in the world, a large proportion of Roma are poorly educated; and very few have a regular job[2]. Roma families are usually large and the income per family member is low[3,4].

Their way of life, contemporary society and its rules are directed by culture, habits, customs and tradition, which were shaped by centuries-long nomadic way of life, isolation and cultural influence of different societies where they were stationed for longer periods. Their health culture was shaped the same way and is reflected in their relation toward health, diseases, life, death and health service in general. The health service relations are conditional with the remains of traditional relations towards illness and healing. It is distinctive for Roma that they do not like to visit health services[1]. The Roma seek medical attention only when they are severely ill or injured[5]. They practice various purification rites and other rituals to protect themselves against disease[6]. Although, Roma have settled down and are more or less civilized, accepted habits of surroundings and with that, changed their relation toward health and diseases, they still stayed strongly connected with their tradition. This is confirmed by the fact that living conditions play crucial part in Roma health situation. Because of their social

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isolation they face a number of problems[7]. Because of unsatisfying knowledge about health services they do not attend systematic examinations and regular vaccinations for children, and because of that Roma children are recovering infectious children diseases on untypical manner. Many of them are recovered when they grow up and some of them are never recovered after all. As a result, such children have poor immunity and are not so physically and mentally resistant but are more susceptible for other diseases[1]. Outbreaks of infectious diseases and small-scale family epidemics occur more frequently among Roma people than in the general population[8,9]. Ten years ago, an outbreak of measles in Slovenia occurred in a Roma settlement[10].

The Slovene health care network is well-developed, and health services are easily accessible to all who need them[11]. Immunization programs for preschool and school children are financed with state budget funds, and they are conducted in compliance with the Infectious Diseases Act and Immunoprophylaxis and Chemoprophylaxis program. At birth, children are vaccinated against tuberculosis, and by the time they complete primary school they receive vaccinations against diphtheria, tetanus, pertussis, *Haemophilus influenzae type b*, poliomyelitis, measles, mumps, rubella and hepatitis B[13]. The health status of Roma people is an important indicator of health efficiency in the respective country. At asserting their health protection, Roma have same rights as the rest of citizens; they are treated under the same conditions. They have same health insurance like uninsured citizens under the 15. article of Health Care and Health Insurance Act. Because of poor knowledge, isolation and cultural conditioned points of view, they do not use all rights and possibilities and mostly do not even know the procedures for how to administer them. Therefore they look up for health services much less than other citizens. It is distinctive that they do not use preventional means of health care, such as systematical examinations, consulting and vaccinations.

The aim of this retrospective data analyses was to assess the level of vaccination coverage in Roma children in Slovenia, to determine possible differences in the coverage between preschool-aged (6 years of age) and school-aged (16 years of age) Roma children and to compare this results with the average national coverage level. The proportion of Roma children fully vaccinated against childhood diseases was expected to be lower than the national average which is 87% to 98%. The vaccination coverage in preschool-aged Roma children was expected to be higher than in the school-aged Roma generation. Another issue investigated was further implementation of the prescribed course of vaccinations in school children[12].

Our aim was to use these data to make proposals for improving the existing situation, and to put forward effective measures for raising the level of vaccination coverage in Roma children. In addition, we were interested in whether the vaccination coverage for poliomyelitis, diphtheria, tetanus, pertussis, mumps, measles and rubella has been increasing.

## Materials and Methods

### *Population*

This retrospective data analyses involved a preschool cohort of 436 six year old Roma children and a school aged group comprising 551 Roma children 16 years of age. We compared two generations of Roma children, who were preschool and school aged in year 2001.

The standard of vaccination defined for preschool children generation represented four applications of diphtheria, tetanus, pertussis and poliomyelitis vaccine and one application of measles, mumps and rubella vaccine given before two years of age; and the standard for school aged children generation at 16 years of age comprised four applications of vaccine against pertussis, six applications of vaccine against diphtheria, tetanus and poliomyelitis and two applications of measles, mumps and rubella vaccine. Vaccination programs against hepatitis B and Haemophilus influenzae type b, initiated in 1998 and 2000, were not considered in the data analyses.

### *Data collection*

Data on childhood immunization were collected in two ways: in some areas, data on vaccination-eligible children were obtained from the lists of Roma children living in the region studied, and in other areas, information on eligible children and their vaccination status was provided by primary healthcare givers in health services, and by private doctors and social services knowledgeable about the situation. For each child, the vaccination status was assessed by direct measurement using either the medical record, vaccination record, Vaccination booklet, list of vaccinated school children or database of the National Computerized Immunization System (CEPI 2000®), which supports the national vaccination registry combined with computerized Central population register.

### *Methods*

This article performs the log-rank statistical test. It is also known as the Mantel-Cox (Mantel-Haenszel) test. Log rang test is comparing survival curves for two populations. In , a log-rank test by creating a sequence of kx2 (k survival functions by event observed/event not observed at that time) one at each observed event time, and calculating a statistic based on the observed and expected values for these contingency tables. Survival methods are often used for other end points, like our example. Survival time here is time to end applications of vaccine.

Log-rang test calculates a p-value testing the null hypothesis that the survival curves are identical in the two populations. If that assumption is true, the p-value is the probability of randomly selecting subjects whose survival curves are as different as they were actually observed[13].

The calculations of the log-rank test are tedious and best left to computer (R 2.1.1). For each time interval, compare the observed number of drop out in each group with the expected number of drop out if the null hypothesis were true. Combine all the observed and expected val-

ues into one $\chi^2$ statistic and determine the p-value from that. For large samples, this statistic has an approximate $\chi^2$ distribution with 1 degree of freedom.

## Results

For the calculation of vaccination coverage for specific childhood diseases, a formula was used with the denominator representing the total number of vaccination-eligible children, and the numerator indicating the number of children who had received the prescribed doses of vaccine. Four applications of poliomyelitis vaccine were given to 52% of preschool-aged Roma children and to 51% of school-aged Roma children eligible for poliomyelitis immunization. Four applications of diphtheria and tetanus immunization course was completed in 51% of preschool-aged and to 48% of school-aged Roma children. Four applications of pertussis vaccine were given to 50% of preschool-aged Roma children and in only 38% of school-aged Roma children (Figure 1). No significant difference was found for the initial three doses of vaccine against poliomyelitis, diphtheria, tetanus and pertussis.

Furthermore we use the Mantel-Haenszel procedure to give the log-rank test for our data. First step of that method is calculate the Kaplan-Meier estimate of the survival function, separately for each group and then graphical display of the Kaplan-Meier estimates on the same plot will give an initial indication of whether there is a difference in survival experience for the two groups. The Kaplan Meier survival curve gives us a good estimate of the survival probabilities for each group we are studying. (Figure 2).

In graphs (Figure 2) the differences in survival curves was small.

Second step is formal statistical hypothesis test of whether there is a difference in survival experience for the two groups. Second step be based on the log-rank statistic. The simplest formal test that compares two survival curves is the log rank test.

In all represent vaccination coverage, the p is more then 0.05, hence accept the null hypothesis that the survival curves are identical in the two populations of preschool and school Roma children (Table 1).

One application vaccination against measles and mumps was given to 72% of preschool aged and to 66% of school aged Roma children. In both examples, the p is borderline, indicating a possible trend, but not quite achieving statistical significance. At rubella, 72% of pre-

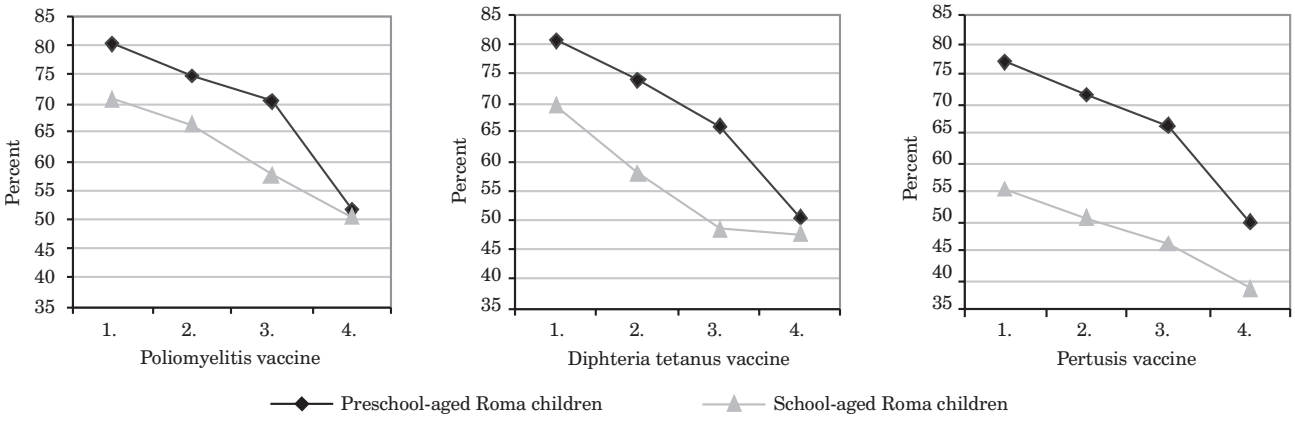


*Fig. 1. The percent of preschool aged and school aged Roma children in Slovenia vaccinated against poliomyelitis, diphtheria, tetanus and pertussis, by number of applications given.*

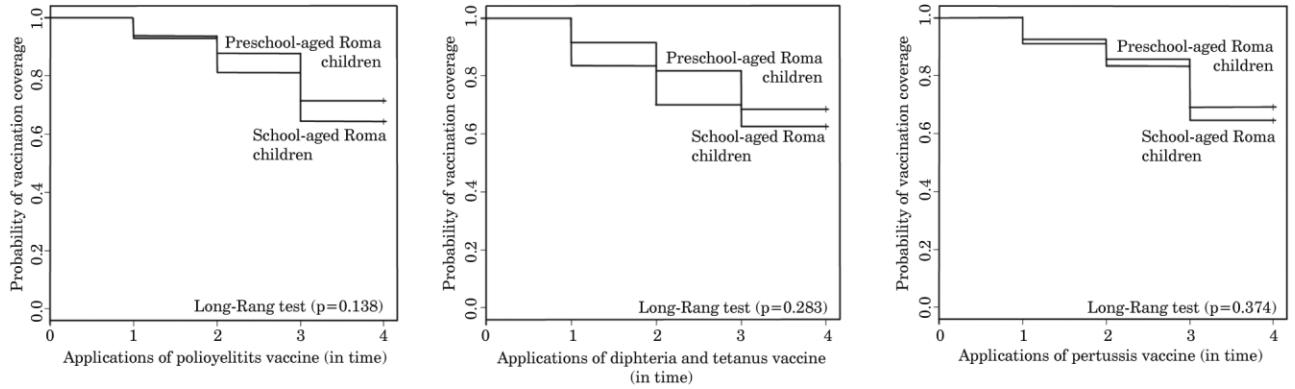


*Fig. 2. Compare two survival curves to compare two generations – preschool aged Roma children and school aged Roma children in Slovenia vaccinated against poliomyelitis, diphtheria and tetanus and pertussis, by number of applications given.*

**TABLE 1**
LOG RANK STATISTICAL TEST (MANTEL-HAENSZEL) FOR SPECIFIC VACCINATIONS: POLIOMYELITIS, DIPHTHERIA, TETANUS AND PERTUSSIS

| Log rank test | Poliomyelitis | Di-Te | Pertussis |
|---|---|---|---|
| $\chi^2$ | 2.2 | 1.2 | 0.8 |
| p | 0.138 | 0.283 | 0.374 |

Di-Te – diphtheria, tetanus

school and 64% of school aged Roma children were given one application of vaccine. Rubella vaccination was significantly lower in the school aged Roma generation (p=0.024) (Table 2). The only 33% of school-aged Roma population received two applications of measles, mumps and rubella vaccine.

In Slovenia, the national vaccination coverage for preschool aged children immunized against diphtheria, tetanus and pertussis was 92%, and against poliomyelitis was 93%. The national coverage for eligible preschool aged children immunized against measles, mumps and rubella was 94% (Table 3). Vaccination coverage of preschool Roma children in Slovenia against poliomyelitis, diphtheria, tetanus, pertussis and MMR were significantly lower then the national vaccination coverage for preschool aged Slovenia children (p=0.000).

## Discussion

The paper presents the level of poliomyelitis, diphtheria, tetanus, pertussis, measles, mumps and rubella vaccination coverage in two generations of Roma children. Data collection was hindered by lack of immunization records, which was due to specific lifestyles of the Roma population.

Analysis of data on immunization status of preschool and school aged Roma children showed that the proportion of fully vaccinated children was low. Preschool aged children showed higher vaccination coverage than the school aged generation. No significant difference was found for the initial three doses of vaccine against poliomyelitis, diphtheria, tetanus and pertussis. The percent of school aged children vaccinated against measles, mumps and rubella was found to be by 6% lower than that of the preschool aged generation. The percent of Roma children vaccinated against childhood diseases was significantly lower then the national average[12]. This finding suggests a relatively high drop out rate in Roma children, and the resulting increase in the proportion of susceptible to infectious diseases in the school aged generation, whose immunization course is practically completed.

Low vaccination coverage levels among hard to reach groups such as Roma children have been documented elsewhere in Europe and in the world[14–21]. Vaccination coverage declining with age was reported in the Spanish study which compared three age groups of children (0–4 years, 5–9 years and 10–16 years) in terms of the prescribed vaccinations received. In Spain, 41% of Roma children were vaccinated against poliomyelitis, diphtheria and tetanus, 24% were immunized against pertussis, and 36% against measles, rubella and mumps. In the oldest age group, only 30 % of children were fully vaccinated[18].

This data analyses confirmed differences in vaccination coverage between the preschool aged and school aged generations of Roma children. The data analyses also point to that the current level of vaccination coverage for specific diseases is not high enough to ensure adequate herd immunity against infectious diseases. Because of poor immunization status of preschool aged and school aged children, Roma settlements represent poten-

**TABLE 2**
COMPARATIVE VACCINATION RATE, 2001: PERCENT OF PRESCHOOL AND SCHOOL AGED ROMA CHILDREN IN SLOVENIA VACCINATED AGAINST MEASLES, RUBELLA AND MUMPS

| Children | Mumps (%) (p=0.060) | Measles (%) (p=0.069) | Rubella (%) (p=0.024*) |
|---|---|---|---|
| Preschool-aged Roma children | 71.6 | 71.6 | 71.6 |
| School-aged Roma children | 65.6 | 65.8 | 64.3 |

*Statistical significance

**TABLE 3**
COMPARATIVE VACCINATION RATE, 2001: PERCENT OF PRESCHOOL AGED ROMA CHILDREN IN SLOVENIA AND PRESCHOOL AGED SLOVENIAN CHILDREN VACCINATED AGAINST POLIOMYELITIS, DIPHTHERIA, TETANUS, PERTUSSIS, MEASLES, MUMPS AND RUBELLA

| Children | Poliomyelitis (%) (p=0.000*) | Di-Te (%) (p=0.000*) | Pertussis (%) (p=0.000*) | MMR (%) (p=0.000*) |
|---|---|---|---|---|
| Preschool-aged Slovenia children | 92.6 | 92.4 | 92.3 | 94.0 |
| Preschool-aged Roma children | 70.3 | 66.1 | 66.1 | 71.6 |

*Statistical significance, Di-Te – diphtheria, tetanus, MMR – measles, mumps and rubella

tial sources of infectious diseases. Once a specific disease is transmitted to a Roma settlement, the conditions there favor the spread of the infection to the rest of the population, which was the case in the measles epidemics of 1995. The established low coverage for tetanus vaccination among preschool and school aged Roma children, including girls, suggests that many women of child-bearing age will not be protected against this disease and that this will put their newborn babies at risk for developing neonatal tetanus.

In the recent years, the immunization status of preschool aged Roma children has markedly improved relative to previous generations. Higher coverage levels in preschool Roma children indicate improved health awareness of their parents. They are more knowledgeable about the importance of vaccination than the previous generations of Roma parents, and they take care that their children receive the prescribed vaccinations. An important role is played by nominated national and regional immunization coordinators and by the CEPI 2000® database on vaccination eligible children. If this trend continues, the likelihood of outbreaks of infectious diseases among the Roma population and in the larger community will be largely reduced.

Many joint efforts will have to be made to improve the vaccination status in dislocated Roma communities. The vaccination coverage among Roma children will have to be improved by reaching out to Roma communities and by adapting immunization schedule to fit their way of life and to respect the fundamental nature of human rights[22]. Effective health care actions and educational activities have succeeded in raising vaccination coverage rate in Spain by an average of 17% in one year[24]. To improve health awareness of Roma parents, broader participation of all Roma communities will have to be encouraged, and appropriate written material comprehensible to Roma people will have to be prepared. Vaccination clinics should be set up closer to Roma settlements, and invitation to attend for immunization should be adapted to meet the specific needs of this community.

In Croatia, in particular case study, the epidemiologists at the Međimurje Country Public Health Institute had a difficult job in implementing the vaccination program among Roma people. The beginning of the Communication Initiative was, when the epidemiologists and the other members of the team started to learn the language of their Roma patients. This achieved a success rate of over 95% in children up to 15 years old – the very group whose vaccinations had previously been impeded by the traditional attitudes and fears of their parents. When the Communication Initiative started, the attitudes of the older generation still prevailed and the influence of traditional behavior continued to be strong. Actions such as the Communication Initiative should be a way of changing attitudes, as well as building trust between the community and health workers. The door to this Initiative was opened when a team of doctors first went into the Roma villages and convinced the people there to vaccinate their children. They did it successfully by learning the language of their patients, recognizing it as a way to overcome barriers to health service delivery. The success rate achieved in immunization during 1997 continues, with Međimurje Country still reporting higher vaccination rates than the national average. A specific intervention helped to ease some of the cultural barriers at the local level, increasing access to essential health services in poor and often isolated communities[23].

Public health programs could be modified to include essential interventions. Health services have a leading role to play in preventing and promoting health, by cooperation with municipal authorities and other social structures that influence health, such as school, social care, public service and nongovernmental organizations. These are especially important among the vulnerable communities, such as those of the Roma children. All of this points the need for special programs, which would inform, educate and approach health care to Roma population. Appropriate programs should be made by professional team from health department and social care on long and direct knowledge over Roma life and their cultural characteristics.

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*A. Kraigher*

*Communicable Diseases Center, Institute of Public Health of the Republic of Slovenia, Trubarjeva 2, 1000 Ljubljana, Slovenia*
*e-mail: alenka.kraigher@ivz-rs.si*

## OBUHVAĆENOST CIJEPLJENJEM TEŠKO DOSTUPNE ROMSKE DJECE U SLOVENIJI

### S A Ž E T A K

Rezultati retrospektivne analize podataka o obuhvaćenosti cijepljenja kod romske djece pretškolske i školske dobi (436 pretškolske i 551 školske djece) na tri geografska područja Slovenije, analizirani su kako bi se utvrdile različitosti koje se odnose na obuhvaćenost specifičnih cijepljenja: protiv dječje paralize, difterije, tetanusa, pertusisa, ospica, zaušnjaka i rubeole između dviju generacija. Podaci su prikupljeni iz zdravstvenih kartona, podataka o cijepljenju (knjižice cijepljenja) i Nacionalnog kompjuteriziranog imunizacijskog sustava (CEPI 2000®). Obuhvaćenost cijepljenjem bila je izračunata usporedbom broja djece koja su pogodna za imunizaciju s brojem djece koja su cijepljena. Ovaj rad je načinio log-rank statistički test, također poznat kao Mantel-Haenszel test. Log rang test je usporedba krivulja preživljenja dviju generacija. Romska djeca pretškolske dobi pokazuju veću obuhvaćenost cijepljenjem, od djece školske dobi. Nije bilo značajne razlike kod romske djece pretškolske i školske dobi u cijepljenju protiv dječje paralize, difterije, tetanusa i pertususa. Cijepljenje protiv rubeole bilo je značajno manje zastupljeno u generaciji romske školske djece. Svega 33% djece školske dobi primilo je dvije doze cijepiva protiv ospica, zaušnjaka i rubeole. Obuhvaćenost cijepljenjem pretškolske romske djece u Sloveniji protiv dječje paralize, difterije, tetanusa, pertusisa, ospica, mumpsa i rubeole značajno je manje nego kod slovenske pretškolske djece. Morat će se poduzeti mnogobrojni zajednički napori kako bi se obuhvaćenost cijepljenjem u romskim zajednicama poboljšala.