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TIMELINESS AND LEVEL OF PRIMARY IMMUNIZATION COVERAGE AGAINST MEASLES AND RUBELLA IN MONTENEGROGORI

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The aim of the paper was to determine the timeliness and level of primary immunization coverage against measles and rubella in Montenegro in the cohort born from January 1 to December 31, 2006.

Cross-sectional study was conducted in the period from October to December 2008. All immunization points in Montenegro were visited and immunization records of the entire cohort born in 2006 were reviewed.

Timeliness of primary immunization coverage with MMR was 91.4% at the level of Montenegro, but in seven (33,3%) municipalities timeliness of primary immunization coverage was less than 90%, including one municipality even with less than 80%. After the additional activities on the vaccination of previously unvaccinated children, primary immunization coverage with MMR reached the value of 96.1% at the level of Montenegro, and in the majority of municipalities exceeded the value of 95%. However, after additional immunization activities in six out of 21 municipalities (28.6%), primary immunization coverage with MMR was below 95% of which in one municipality below 90%.

In the cohort born during 2006, timely primary immunization with MMR was performed in one third of Montenegrin municipalities with the value less than 90%. Supplemental immunization activities related to unvaccinated children significantly increased the primary immunization coverage with MMR in the cohort born in 2006. Yet, in a certain number of municipalities even after additional immunization activities, the primary immunization coverage did not reach the required 95%. In comparison with routine administrative reporting on immunization coverage, the surveys which involve the review of immunization records after additional immunization activities provide more realistic rate of completeness and timeliness of primary immunization coverage. *Acta Medica Medianae 2009; 48(3):9-14.*

Key words: *vaccine preventable diseases, measles, rubella, MMR, timeliness of immunization, primary immunization coverage, immunization records*

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Introduction

The World Health Organization European Region strategic plan is to eliminate measles by 2010, and to reduce the incidence of congenital rubella to the value lower than 1 per 100.000 live births. In order to obtain such results, it is necessary to reach high coverage (>95%) with two doses of vaccine containing the component against measles, and at least one dose of the vaccine having the component of rubella (1).

The degree of successfulness and control of vaccine-preventable diseases depends not only on the level of collective immunity, i.e. obtaining and maintaining the high immunization coverage rates related to the target population groups, but also on the timeliness of conducted immunization aiming to shorten the time period for possible exposure of the target population to infectious agents (2,3).

Using routine administrative methods of reporting on compulsory immunization coverage it is not possible to determine the timeliness of immunization as well as the influence of additional immunization activities on the total rate of primary immunization coverage (2,4-6). In order to perform the analysis of vaccine application timeliness it is necessary to undertake special field investigations by means of which we could obtain data on the time of vaccine application in respect to the age of eligibles included into compulsory immunization, or to establish more complex systems for monitoring and evaluation of compulsory immunization programmes' implementation (7-13).

The aim of the paper was to determine the timeliness and completeness of primary immunization coverage against measles and rubella within the implementation of compulsory immunization programme in Montenegro in the cohort born from January 1 to December 31, 2006.

Method

The cross-sectional study was conducted in the period from October to December 2008 by visiting all immunization points in Montenegro, when immunization records of the whole cohort born in 2006 were reviewed. At the time of the research the children of the cohort were aged 22-34 months, which means that all the eligibles, excluding those with permanent contraindications, should have underwent the primary immunization with combined vaccine against measles, epidemic mumps and rubella (MMR). For the purposes of investigation, a special questionnaire was designed, into which we inserted the data on the age-appropriate vaccination, recommended time interval for vaccination, and the date of the applied MMR vaccine. The timeliness of primary immunization with MMR vaccine means that the vaccination is conducted in the period between 12 and 18 months of age (14).

Results

By field visiting all immunization points at the territory of Montenegro, out of 6.974 eligibles born during 2006, as was presented in the official reports on primary immunization with MMR vaccine, the valid data were collected for 6.890 (98.8%) eligibles. A slightly smaller number of reviewed immunization records compared to the number of eligibles from the official reports was the consequence of the fact that this investigation did not include the data on immunization status of the children who, after the split between Montene-gro and Serbia in 2006, moved out of Montenegro.

In the official report on primary immunization in Montenegro for 2007, the primary immunization coverage with MMR vaccine in the cohort born in 2006 was 91.6% (15). The review of immunization records during the investigation conducted after additional activities directed to the immunization of previously unvaccinated subjects showed that primary immunization coverage, almost in all municipalities, exceeded 95%, and reached 96.1% at the state level (Table 1). Yet, even after additional immunization activities in six out of 21 (28.6%) municipalities in total, the primary immunization coverage with MMR vaccine was below 95%, of which below 90% in one municipality.

Table 1. MMR immunization in Montenegro in the cohort born in 2006: comparison between the investigation results from 2008 and the official immunization reports from 2007

Municipality	Number of immunization records of eligibles born in 2006 reviewed in the investigation conducted in 2008	MMR1 (coverage in %) Results of the investigation from 2008 on completeness of coverage of the cohort born in 2006 by MMR primary immunization	MMR1 (coverage in %)Official reports from 2007 on coverage of the cohort born in 2006 by MMR primary immunization
Herceg Novi	329	98,8	88,0
Kotor	198	94,9	99,2
Tivat	133	99,3	97,3
Budva	225	92,4	93,2
Bar	379	98,7	98,3
Ulcinj	213	91,5	88,7
Podgorica	2329	96,1	90,4
Cetinje	150	96,0	77,0
Danilovgrad	157	92,4	91,9
Nikšić	770	94,0	85,8
Plužine	24	100,0	100,0
Šavnik	19	100,0	100,0
Pljevlja	282	98,6	100,0
Žabljak	31	100,0	100,0
Bijelo Polje	537	98,7	98,1
Mojkovac	88	100,0	100,0
Kolašin	70	100,0	98,7
Andrijevica	47	100,0	98,1
Plav	143	96,5	99,4
Rožaje	373	99,2	98,7
Berane	393	89,6	75,3
Montenegro	6890	96,1 %	91,6%

Table 2. Timeliness of primary immunization with MMR in the cohort born in 2006 at the level of municipalities and Montenegro

Municipality	Primary immunization coverage (%) with MMR vaccine in respect to the age of eligibles					
	MMR $_{(12-13)}$ [1] %	MMR $_{(12-16)}$ [2] %	MMR$_{(12-18)}$ [3] %	MMR $_{(12-24)}$ [4] %	MMR $_{(24+)}$ [5] %	MMR ukupno %
Herceg Novi	67,2	92,4	94,8	97,6	1,2	98,8
Kotor	60,6	86,4	87,4	93,4	1,5	94,9
Tivat	66,9	94,0	98,5	99,2	0,0	99,2
Budva	31,1	79,5	85,8	91,1	1,3	92,4
Bar	84,7	96,6	97,6	98,7	0,0	98,7
Ulcinj	55,9	82,6	86,4	90,6	0,9	91,5
Podgorica	58,9	86,4	90,4	94,9	1,2	96,1
Cetinje	14,7	78,7	86,7	94,7	1,3	96,0
Danilovgrad	44,6	75,8	84,7	90,4	1,9	92,3
Nikšić	63,6	84,5	88,6	92,7	1,3	94,0
Plužine	83,3	100,0	100,0	100,0	0,0	100,0
Šavnik	73,7	100,0	100,0	100,0	0,0	100,0
Pljevlja	83,7	97,9	98,2	98,6	0,0	98,6
Žabljak	80,6	100,0	100,0	100,0	0,0	100,0
Bijelo Polje	79,3	94,6	96,8	98,3	0,4	98,7
Mojkovac	94,3	100,0	100,0	100,0	0,0	100,0
Kolašin	82,8	100,0	100,0	100,0	0,0	100,0
Andrijevica	57,4	91,5	95,7	97,9	2,1	100,0
Plav	81,8	95,8	96,5	96,5	0,0	96,5
Rožaje	92,8	97,6	98,1	98,9	0,3	99,2
Berane	48,1	71,0	77,3	85,5	4,1	89,6
Montenegro	64,4	87,9	91,4	95,0	1,1	96,1

1 MMR $_{(12-13)}$ – primary immunization coverage with MMR in % obtained in children aged 12 to 13 months
2 MMR $_{(12-16)}$ - primary immunization coverage with MMR in % obtained in children aged 12 to 16 months
3 MMR $_{(12-18)}$ - primary immunization coverage with MMR in % obtained in children aged 12 to 18 months
4 MMR $_{(12-24)}$ - primary immunization coverage with MMR in % obtained in children aged 12 to 24 months
5 MMR $_{(24)}$ - primary immunization coverage with MMR in % after 24 months of age

Timeliness of primary immunization coverage with MMR vaccine (MMR given to children aged 12 to 18 months) at the level of Montenegro was carried out in 91.4% of eligibles). In nine (42.8%) out of 21 municipalities in Montenegro, the percentage of primary immunization did not reach the required 95%. In seven (33.3%) municipalities, the timely primary immunization was carried out in less than 90% of eligibles, in one municipality of which in less than 80% of eligibles (Table 2).

In five (23.8%) municipalities, timely primary immunization with MMR was carried out in all the eligibles (100%); in three (14.3%) municipalities in more than 98% of eligibles, and in four municipalities in more than 95% and less than 98% of eligibles.

In nine (42.9%) municipalities, mostly from the north of Montenegro, the primary immunization with MMR was carried out in more than 95% of eligibles up to 16 months of age, while in two municipalities primary immunization over 90% was conducted in children aged 13 months.

There were no data obtained in this investigation that primary immunization with MMR started before the children turned 12 months of age.

Discussion

Compulsory immunization against measles in Montenegro was introduced in 1972 in the form of a single vaccine. In 1986, morbilli vaccine was added by a component of epidemic mumps, and since 1995, a combined vaccine against measles, epidemic mumps and rubella (MMR) with the application of two doses has been included in the vaccination programme. The immunization programme proscribes that the first MMR dose be given after 12 months of age, and the second in the school age (till 2006 in the sixth grade of elementary school, but since 2006 on enrolment into the first grade of elementary school). Such schedule provides the second possibility for primary immunization to eligibles who have missed primary immunization in the early age, as well as more efficient coverage of the target population. Based on such immunization calendar, the largest portion of the current population up to 26 years of age should have received two doses of vaccine against measles and epidemic mumps, and one vaccine dose against rubella.

Cases of measles and rubella have not been registered in Montenegro since 2005 and 2006, respectively (16). Still, experiences of a considerable number of European countries, among which even the most developed (Great Britain, Italy, Germany, France, Spain, etc.), have shown that after longer periods of absence of diseases, resurgences are quite possible, especially of measles whose virus very easily attacks individuals and vulnerable populations, causing occasionally minor

or greater epidemics during which death cases have been reported (17-26). A resurgence of measles in the European countries will definitively have negative influence on the implementation dynamics of strategic plan for the elimination of the aforesaid diseases in the WHO European Region. According to official reports on conducted compulsory immunizations in Montenegro, the average primary immunization coverage with MMR for the last ten years at the level of the state as a whole was 90.8%, while the average coverage with the second dose given in the school age was 98.1% (16). Because of the lower rate of primary immunization coverage, providing that additional activities on primary immunization of unvaccinated subjects have not been conducted, a considerable number of unvaccinated children could be found in the population between three and six years of age. That is why it is indispensable to carry out supplemental investigations to ascertain a real degree of coverage and timeliness of primary immunization.

The investigation into the immunization status of the cohort born in 2006 showed that the Healthcare Service of Montenegro conducted significant supplemental activities on the immunization of eligibles not having received the MMR vaccine on time, after which the official coverage (91.6%) of the said cohort of eligibles rose to 96.1% at the level of Montenegro, reaching thus the required 95%. However, even besides the official reports on the coverage of eligibles, the investigation pointed to two possible risk factors which could contribute to resurgences of measles and rubella to some extents. The first risk factor refers to the fact that, even though primary immunization coverage with MMR after supplemental immunization activities reached the required percentage at the level of Montenegro, there was a considerable number of municipalities (6 or 28.6%) in which the coverage of 95% was not reached. Similar results can be found in other countries as well that have not conducted the supplemental investigations on immunization coverage (27-29).

Another risk factor refers to untimely primary immunization with MMR i.e. delay in its application, which poses the greater risk for exposure of unvaccinated subjects to viral infections with measles and rubella. The fact that 91.4% of the cohort from 2006, at the level of Montenegro, underwent primary immunization up to the age of 18 months, points to relatively good timeliness of the MMR vaccine application at the level of the state as a whole. On the other hand, if we analyze the timeliness of coverage at subnational level, i.e. the level of municipalities, the obtained results show that in seven (33.3%) municipalities the timely primary immunization was carried out in less than 90% of eligibles (in one municipality in less than 80% of eligibles), which questions the timely development of collective immunity in these municipalities. Supplemental immunization activities significantly improve the total immunization coverage; however, they cannot improve the immunization timeliness (timely immunity development) i.e. they cannot entirely make up for the consequences of primary immunization delay. Besides drawing the conclusion that it is necessary to improve the timeliness of primary immunization with MMR, the results of the investigation showed that it was really possible in almost half of the Montenegrin municipalities in which primary immunization with MMR was conducted in more than 95% of eligibles up to 16 months of age. Generally, the problem of primary immunization delay has been in the focus of interest of a growing number of researchers who are trying to explain the reasons of measles resurgence in their highly vaccinated populations or who have been for preventive reasons warned about the resurgence of measles in other countries (2,30-34).

It is not possible to identify all the reasons of untimely MMR application without conducting additional investigations, even though, based on certain field experiences, there are suppositions that parents do not stick to the vaccination calendar, as they are poorly informed about the importance of primary immunization timeliness, or there is vaccination delay because of the health workers' assessments related to temporary contraindications.

Conclusion

In the cohort born during 2006, timely primary immunization with MMR was carried out in 1/3 of the Montenegrin municipalities with the coverage less than 90%, which points to the problem of primary immunization delay.

Supplemental activities on the immunization of unvaccinated children from the cohort born in 2006 considerably improved the percentage of primary immunization with MMR. Still, in a number of Montenegrin municipalities, even after the supplemental immunization activities, the required coverage of 95% was not obtained.

Compared to routine administrative reports on conducted immunizations, the surveys which include the review of immunization records of certain cohorts after additional immunization activities provide more realistic rate of primary immunization coverage of eligibles as well as the data on its timeliness, which is very helpful for creators of immunization programmes and health workers who are to implement the immunization.

With the aim of identifying the reasons of untimely vaccination and incomplete primary immunization coverage of the target populations, it is necessary to conduct the appropriate surveys among health workers and parents. To provide more accurate insight into collective immunity it is necessary to conduct seroepidemiological studies which would determine the rate of seroconversion among the immunized populations i.e. the real percentage of the immune population.

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PRAVOVREMENOST I NIVO OBUHVATA PRIMOVAKCINACIJOM PROTIV MALIH BOGINJA I RUBELE U CRNOJ GORI

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Cilj rada bio je da se utvrdi pravovremenost i nivo obuhvata primoimunizacijom protiv malih boginja i rubele u sklopu sprovođenja programa obaveznih imunizacija u Crnoj Gori u kohorti rođenih od 01. januara do 31. decembra 2006. godine.

U istraživanju je korišćena studija presjeka koja je sprovedena u periodu od oktobra do decembra 2008. godine obilaskom svih imunizacionih punktova u Crnoj Gori, tokom kojih su pregledani vakcinalni kartoni cjelokupne kohorte rođene u 2006. godini.

Pravovremena primoimunizacija sa kombinovanom vakcinom protiv malih boginja, epidemijskih zaušaka i rubele MMR-om sprovedena je kod 91,4% obveznika na nivou države kao cjeline, s tim da je u sedam opština (33,3%) pravovremena primoimunizacija sprovedena kod manje od 90% obveznika, među kojima u jednoj opštini, čak, kod manje od 80% obveznika. Nakon dopunskih aktivnosti na vakcinacijama prethodno nevakcinisanih osoba, obuhvat obveznika kohorte rođene 2006. godine primoimunizacijom sa MMR-om dostigao je 96,1% na nivou Crne Gore, a u najvećem broju opština premašio je vrijednost od 95%. Ipak, i nakon dopunskih imunizacionih aktivnosti, u šest od ukupno 21 opštine (28,6%) obuhvat primovakcinacijom sa MMR iznosio je manje od zahtijevanih 95%, od čega u jednoj opštini i ispod 90%.

U kohorti rođenih tokom 2006. godine pravovremena primovakcinacija sa MMR-om sprovedena je u jednoj trećini crnogorskih opština u obimu manjem od 90%. Dopunske aktivnosti na imunizaciji nevakcinisane djece iz navedene kohorte u značajnoj mjeri su podigle procenat primovakcinacije sa MMR-om. Ipak, u jednom broju opština ni nakon dopunskih imunizacionih aktivnosti nije dostignut zahtijevani primovakcinacijski obuhvat od 95%. U poređenju sa rutinskim administrativnim izvještavanjem o sprovedenim imunizacijama, istraživanja koja uključuju pregled vakcinalnih kartona nakon dopunskih imunizacionih aktivnosti daju realniju sliku o stvarnom primovakcinacijskom obuhvatu obveznika, kao i podatke o pravovremenosti sprovedenih primovakcinacija. *Acta Medica Medianae 2009; 48(3):9-14.*

***Ključne reči**: vakcinom preventibilne bolesti, morbili, rubela, MMR, pravovremenost vakcinacije, obuhvat primovakcinacijom, vakcinalni kartoni*