

Toward Rubella Elimination in Poland: Need for Supplemental Immunization Activities, Enhanced Surveillance, and Further Integration with Measles Elimination Efforts

Laura Zimmerman,¹ Justyna Rogalska,² Kathleen A. Wannemuehler,¹ Marzena Haponiuk,³ Adam Kosek,⁴ Ewa Pauch,⁵ Elzbieta Plonska,⁶ Daniel Veltze,⁷ Miroslaw P. Czarkowski,² Nilesh Buddh,⁸ Susan Reef,¹ and Pawel Stefanoff²

¹Global Immunization Division, National Center for Immunization and Respiratory Diseases, Center for Disease Control and Prevention, Atlanta, Georgia; ²Department of Epidemiology, National Institute of Public Health – National Institute of Hygiene, Warsaw; ³Section of Epidemiology and Surveillance, Voyvodship Sanitary-Epidemiological Station, Kielce; ⁴Section of Epidemiology and Surveillance, Voyvodship Sanitary-Epidemiological Station, Krakow; ⁵Section of Epidemiology and Surveillance, Voyvodship Sanitary-Epidemiological Station, Poznan; ⁶Section of Epidemiology and Surveillance, Voyvodship Sanitary-Epidemiological Station, Warsaw; ⁷Section of Epidemiology and Surveillance, Voyvodship Sanitary-Epidemiological Station, Gdansk, Poland; and ⁸WHO Regional Office for Europe Consultant, Copenhagen, Denmark

Background. All Member States of the World Health Organization (WHO) European Region have endorsed rubella elimination and congenital rubella syndrome (CRS) prevention. However, Poland has continued high levels of reported rubella.

Methods. We reviewed rubella incidence in Poland since 1966 and analyzed national aggregated surveillance data from the period 2003–2008 and case-based data from 4 provinces from the period 2006–2008. We described CRS cases since 1997 and assessed maternal receipt of vaccine. We reviewed national vaccination coverage from 1992 through 2008.

Results. Since 1966, rubella outbreaks have occurred every 4–6 years in Poland. Aggregate and case-based data from the period 2003–2008 indicate that rubella virus transmission has occurred across wide age ranges (from <1 year to 60 years), with disproportionately higher percentage of cases among adolescent boys. Of 18 children with reported CRS cases from 1997 through 2008, 15 (83%) of their mothers had not been vaccinated. Measles-mumps-rubella dose 1 vaccination coverage ranged from 97% to 99%.

Conclusions. Poland had the highest incidence of rubella in the WHO European Region in 2007 and 2008. Rubella occurs predominantly in age and sex cohorts historically not included in vaccination recommendations. The risk for CRS continues. To achieve rubella elimination, supplemental immunization activities among adolescent boys are needed, as is integration with measles elimination efforts.

Rubella is usually a mild, febrile rash illness in children and adults; however, intrauterine rubella virus infection during the first trimester of pregnancy can cause miscarriage, stillbirth, or a constellation of birth defects

known as congenital rubella syndrome (CRS). The most common congenital defects associated with CRS are cataract(s), heart defects, and hearing impairment [1–2]. The lifetime cost of treating a child born with CRS in an industrialized country is estimated to exceed \$200,000 [3].

Implementation of vaccination strategies for rubella control and congenital rubella prevention in the World Health Organization (WHO) European Region has resulted in record low levels of disease [4]. By 2009, all 53 Member States had incorporated a rubella-containing vaccine into their routine childhood immunization programs through the use of combined vaccines that contain either measles and rubella (MR) or measles, mumps, and rubella (MMR) components, and all Member States have supported the goals of measles and rubella elimination and CRS prevention. Integration of

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Correspondence: Laura Zimmerman, Global Immunization Division, National Center for Immunization and Respiratory Diseases, Center for Disease Control and Prevention, 1600 Clifton Rd, MS E-61, Atlanta, GA 30333 (laz5@cdc.gov).

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measles and rubella surveillance is recommended in WHO Regions with rubella goals because of the use of these combined vaccines and because of the similarities in clinical manifestations of the diseases and laboratory testing methodology using the enzyme-linked immunosorbant assay [5].

Poland has a population of ~38.5 million individuals, with an estimated birth cohort of 385,000 persons annually [6]. The country consists of 16 administrative units, with populations ranging of 1–5 million persons each and is divided into 379 districts. The history of measles- and rubella-containing vaccine recommendations has varied by age and sex in Poland during the past 30 years (Table 1).

During 2003–2005, Poland reported elimination-suggestive sustained annual measles incidence of <1 locally acquired case per 1,000,000 population [7, 8]. Annual measles incidence since 2005 has been <6 cases per 1,000,000 population primarily because of importations, with virus circulating primarily among unvaccinated specific populations, such as the Roma communities [7]. However, rubella incidence has not reached <100 cases per 1,000,000 population annually, and epidemics throughout the country are still reported.

Because of sustained high rates of rubella incidence in Poland, a WHO and Centers for Disease Control and Prevention mission was conducted in 2009 to review rubella and CRS surveillance data and to assist the national immunization program to develop evidence-based recommendations aimed at achieving WHO European Regional elimination goals. In this article, we used national surveillance data to describe rubella epidemiology in Poland and to discuss optimal approaches to reaching rubella elimination, including integrating measles and rubella program activities.

METHODS

Reported Rubella and CRS Cases

National rubella and CRS surveillance in Poland is based on a mandatory reporting system of cases from provinces since 1966 and 1997, respectively. Each district has a Territorial

Health Department that receives rubella case report forms from primary health care providers in hospitals, polyclinics, diagnostic centers, or other health care facilities. Information collected includes patient name, age, date of birth, sex, and vaccination status. These data are aggregated at the district level into specified age groups (individual years of age 0–9 years, 5-year age groups for 10–59 years, and a single group aged >60 years), stratified by sex, and reported bi-weekly to the Provincial Health Department. Aggregated data from the provincial level are then reported at the national level.

We assessed nationwide rubella incidence during 1966–2008, calculated per 1,000,000 population, with use of Census data from the Central Statistical Office in Warsaw. Annual aggregated data were analyzed by age, sex, and vaccination status since the first dose MMR vaccine recommendation was made in 2003. To assess overall differences in disease among male and female persons by age group, incidence among male and female persons in the 9 age strata was calculated per 10,000 population, and relative risks (RRs) with 95% confidence intervals (CIs) were estimated using a negative-binomial model. Population sizes for each region were used as offsets for the various age and sex strata.

For more detailed analysis of rubella epidemiology during 2006–2008, the years with the highest incidence since 2003, we obtained rubella case-based data from 4 geographically separated provinces (representing 31% of the total population). Case-based data were assessed by age, sex, vaccination status, and laboratory status. We also used the case-based data to conduct an individual birth cohort analysis for age groups with the highest proportion of cases and assessed the percentage of all cases by birth year among male and female individuals during 2006–2008.

We described the reported number of cases of CRS since 1997 and assessed maternal eligibility for receipt of vaccine. We obtained fertility rate data from the Central Statistical Office and births by maternal age from national statistics in Poland.

Vaccination Coverage

Vaccination coverage data in Poland is based on annual reports of immunization providers, who record the number of doses administered by birth cohort. Filling the immunization information on individual patient vaccination cards is compulsory for use of state-refunded vaccines. We reviewed data on Poland's vaccination coverage available at the National Institute of Public Health and National Institute of Hygiene (NIPH-NIH), Warsaw, for monovalent rubella vaccine among girls aged 15 years during 1992–2006 (the time frame and age of coverage availability) and on first dose MMR since the recommendations during 2005–2008.

RESULTS

Reported Rubella Cases

Nationwide Incidence of Rubella, 1966–2008. During 1966–2008, the reported incidence of rubella in Poland ranged from

Table 1. National Measles and Rubella Vaccination Schedules, Poland, 1975–2008

Year	Vaccine (recommended age)
1975–2003	Monovalent measles—dose 1 (13–15 months)
1991–2005	Monovalent measles—dose 2 (6 years)
1989–2005*	Monovalent rubella (13 years, girls only)
2003–2008	Measles-mumps-rubella (MMR) dose 1 (13–15 months)
2005–2008	MMR dose 2 (10 years)

NOTE. During 2005–2008, a supplementary dose of MMR was offered to 12 year old girls who were previously unvaccinated

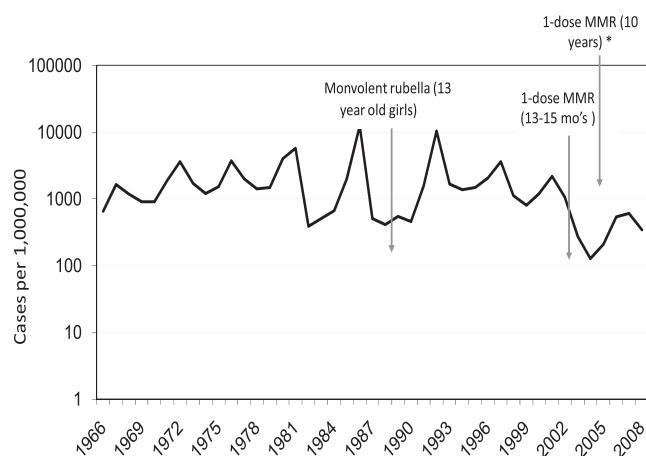


Figure 1. Reported rubella incidence, Poland, 1966–2009

127 to 12,350 cases per 1,000,000 population, with a consistent 4–6-year inter-epidemic cycle (Figure 1). The peak incidence years were 1986 (12,350 cases per 1,000,000 population) and 1992 (10,390 cases per 1,000,000 population).

National Aggregate Data, 2003–2008. During 2003–2008, 80,096 rubella cases were reported, with a low of 4857 cases reported in 2004 to a high of 22,891 cases reported in 2007. Cases occurred across a wide age range (<1 year to >60 years); >90% of cases each year occurred in persons <20 years of age. The percentage of cases among children <10 years was 61% in 2003 and, during 2004–2008, decreased from 74% to 44%. The percentage of cases among persons aged 10–19 years was 39% in 2003 and, during 2004–2008, increased from 26% to 56%.

Demographic characteristics of rubella cases are provided in Table 2. Overall, 64% of cases were in male individuals, increasing from 56% in 2003 to 73% in 2008. Figure 2 shows the overall incidence among male and female individuals and the corresponding RRs and 95% CIs for male versus female individuals for 5-year age cohorts from 0–39 years and for all persons aged ≥40 years. Incidence was highest among male and female individuals 5–9 years of age and remained high among male individuals through 19 years of age. The risk was higher among male individuals 10–24 years of age but was higher among all female individuals aged >30 years. RR trends by age groups and sex were similar before (during 2003–2005) and after (during 2005–2008) implementation of the 2-dose MMR vaccination schedule, with adolescent and young adult male individuals at higher risk than adolescent and young adult female individuals and female individuals aged ≥30 years at higher risk than male individuals (data not shown).

During 2003–2008, 61,661 case reports (77%) included information on receipt of a rubella-containing vaccine (RCV); of these, 7399 (12%) had received a single RCV dose, 617 (1%) had received 2 RCV doses, and 53,645 (87%) had never been vaccinated.

Regional Case-Based Data, 2006–2008. Case-based data were obtained from 4 provinces for 19,441 cases (34% of all cases reported nationwide) reported during 2006–2008. Case-based data reflected epidemiologic patterns similar to those of national aggregated data during the same time frame, with cases occurring across wide age ranges, mostly <20 years of age, with the majority of cases among male individuals, increasing in proportion over time. Vaccination status was available for

Table 2. Reported Rubella Cases by Sex and Age Group, Poland, 2003–2008

Characteristics	2003 (N = 10,588) n (%)	2004 (N = 4,857) n (%)	2005 (N = 7,946) n (%)	2006 (N = 20,668) n (%)	2007 (N = 22,891) n (%)	2008 (N = 13,146) n (%)	Total (N = 80,096) n (%)
Sex							
Male	5,969 (56)	2,574 (53)	4,221 (53)	12,635 (61)	16,337 (71)	9,554 (73)	51,290 (64)
Female	4,619 (44)	2,283 (47)	3,725 (47)	8,033 (39)	6,554 (29)	3,592 (27)	28,806 (36)
Age groups, years							
<1–4	2,202 (21)	1,801 (37)	2,106 (27)	2,602 (13)	2,257 (10)	1,579 (12)	12,547 (16)
5–9	4,246 (40)	1,778 (37)	3,481 (44)	8,161 (39)	8,016 (35)	4,197 (32)	29,879 (37)
10–14	2,835 (27)	837 (17)	1,702 (21)	6,389 (31)	6,205 (27)	3,205 (24)	21,173 (26)
15–19	892 (9)	212 (4)	338 (4)	2,445 (12)	4,682 (20)	3,024 (23)	11,593 (14)
20–24	138 (1)	71 (1)	80 (1)	442 (2)	924 (4)	600 (5)	2,255 (3)
25–29	103 (1)	52 (1)	69 (1)	194 (1)	235 (1)	201 (2)	854 (1)
30–34	85 (1)	39 (1)	73 (1)	207 (1)	236 (1)	143 (1)	783 (1)
35–39	36 (0)	28 (1)	44 (1)	125 (1)	171 (1)	104 (1)	508 (1)
40–44	32 (0)	17 (0)	23 (0)	60 (0)	77 (0)	40 (0)	249 (0)
45–49	11 (0)	9 (0)	17 (0)	24 (0)	48 (0)	22 (0)	131 (0)
50–54	3 (0)	6 (0)	4 (0)	10 (0)	20 (0)	17 (0)	60 (0)
55–59	1 (0)	4 (0)	2 (0)	3 (0)	7 (0)	6 (0)	23 (0)
> 60	4 (0)	3 (0)	7 (0)	6 (0)	13 (0)	8 (0)	41 (0)

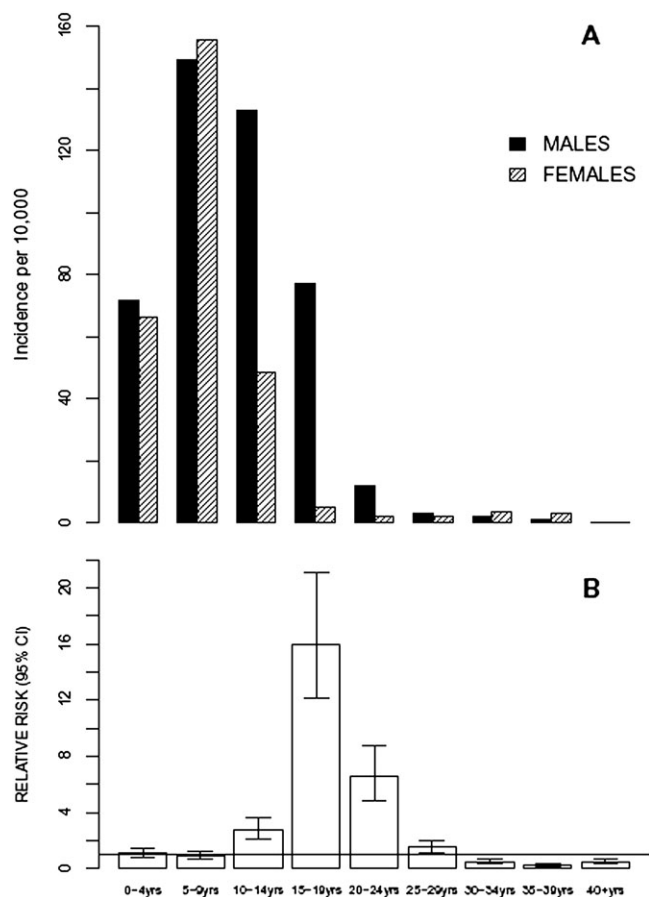


Figure 2. Incidence per 10,000 population and relative risk of rubella, males versus females, by age group, Poland 2003–2008.

16,106 case patients (83%); of these, 2255 (14%) reported having received a single dose of vaccine, 161 (1%) had received 2 doses, and 13,690 (85%) had never been vaccinated. Each year, <1% of reported cases were laboratory confirmed.

Figure 3 shows the case counts during 2006 (8986 cases), 2007 (5903 cases), and 2008 (4552 cases), stratified by sex, for birth cohorts 2008 through 1976. The last cohort shown (before or during 1975) are all cases born before 1976. During this period, there was a shift to a greater percentage of cases among male individuals: 62% in 2006, 71% in 2007, and 72% in 2008. All female cohorts, except those born before 1976, have been or will be targeted for vaccination by the current vaccination schedule. In 2008, 2073 (46%) cases were in male individuals born before 1997; 78% of these male individuals will not have an opportunity for vaccine under the current schedule because of birth before 1995.

Reported CRS Cases

During 1997–2008, 18 CRS cases were reported in Poland, ranging from 5 cases in 1997 to no cases during 2003–2006. The majority of cases were identified through detection of congenital malformations of live newborns or during infancy. According to the infant year of birth and maternal age, 6 (33%) of the mothers

of infants with CRS cases had been eligible to receive RCV as an adolescent but had not been vaccinated (Table 3).

The distribution by maternal age for 387,564 births in Poland during 2007 was <20 years, 19,866 (5%) births; 20–24 years, 92,745 (24%) births; 25–29 years, 142,112 (37%) births; 30–34 years, 95,307 (25%) births; 35–39 years, 31,290 (8%) births; and 40–44 years, 6,244 (1%) births.

Vaccination Coverage

National coverage for monovalent rubella vaccine among girls aged 15 years ranged from 94.5% to 99.2% from 1992 through 2006. National coverage with the first dose of MMR in children aged 3 years from 2005 through 2008 ranged from 91% to 98%.

DISCUSSION

Poland, along with all other Member States in the WHO European Region, has adopted the goal of rubella elimination and CRS prevention. Poland has had the highest incidence of rubella among the WHO European Region Member States¹ (This does not include San Marino, which had an incidence of 1680 cases per million population in 2007, because of its very small population [~28,000], which results in a highly unstable estimate.) since 2007 and among the 27 European Union countries since 2002 [4]. Rubella epidemiology in Poland in 2008 reflects the history of national vaccination recommendations, which included a dose of RCV for adolescent girls beginning in 1989 but did not include a routine childhood RCV dose for both sexes until 2003. Unless targeted vaccination efforts are implemented, male cohorts >13 years by 2008 (ie, born in 1994 and earlier) will not be included in any rubella vaccination program and remain potentially susceptible and at risk for disease.

Results of this assessment indicate that, among adolescents, the risk of rubella in Poland is higher among boys than among girls; however, among persons >30 years of age, women are at a higher risk than men. Seroepidemiologic data from Poland collected during 2000–2002 indicate that rubella susceptibility among women of childbearing age was 16%–21% [9]. Data from other countries indicate that CRS cases can occur even in small cohorts of rubella-susceptible women of childbearing age [10–12]. Of the 3 Latin American countries (Argentina, Brazil, and Chile) that conducted MMR campaigns targeting only adolescent and adult female cohorts, rubella remained endemic, with outbreaks among adolescent and adult male cohorts, and CRS cases continued to occur. To stop the outbreaks, Argentina and Chile conducted successful campaigns targeted to adolescent and adult male cohorts [13, 14]. In addition, Brazil conducted a MMR campaign targeting 70 million male and female adolescent and adult cohorts.

Despite long-standing efforts to vaccinate adolescent girls, high disease transmission across wide age ranges and,

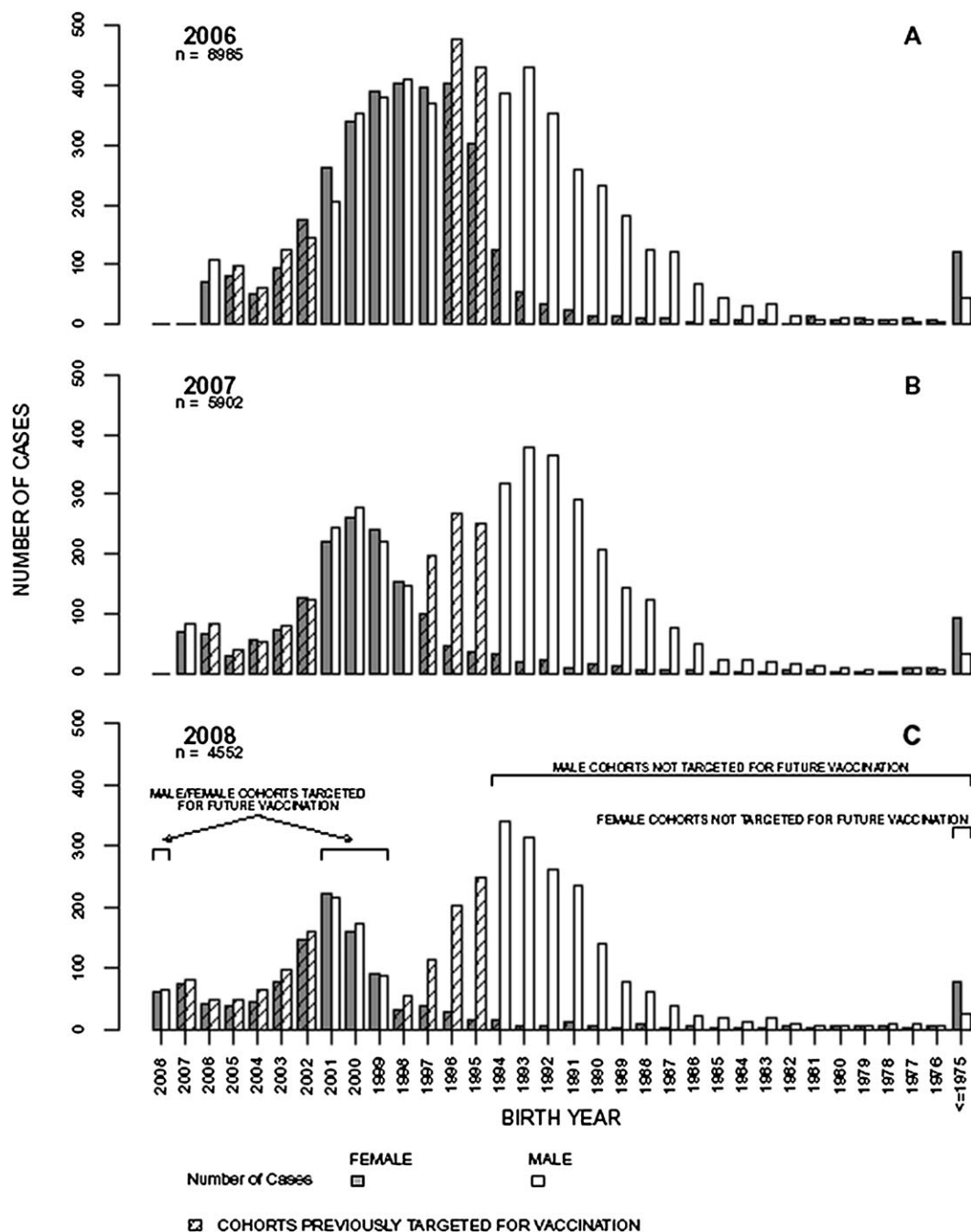


Figure 3. Reported rubella cases for males and females by year of birth, Poland, 2006–2008 (case-based data).

with ~one-third of births occurring in women >30 years, Poland is at risk for continued occurrence of CRS cases. To reduce this risk and allow for the opportunity to reach elimination, MMR supplemental immunization activities are needed among adolescent and teenage male individuals born from 1991 through 1996. This cohort includes those age cohorts with the highest disease transmission because of missed opportunities for receipt of vaccine (ie, birth during 1995 and 1996) and those who were never targeted by vaccination recommendations. Supplementary immunization activities (SIAs) should also include female

individuals born from 1991 through 1996 who do not have documented proof of receipt of a RCV to ensure immunity to rubella during the childbearing years. To ensure that unvaccinated cohorts of children reach the age of vaccination with a low likelihood of sustaining significant levels of transmission, Poland should consider lowering the currently recommended age for the second dose of MMR from 10 years to 6 years, while keeping a recommended dose at 10 years of age until 2013 or, alternatively, check official vaccination records until 2013 and offer vaccine to those who have not received at least 1 dose of a RCV.

Table 3. Maternal Age and Eligibility for Receipt of Rubella-containing Vaccine of Reported Congenital Rubella Syndrome (CRS) Cases, Poland, 1997–2008

Year of CRS report	Maternal age (years)	Mother vaccinated	Mother eligible to receive rubella-containing vaccine
1997	28	no	no
1997	28	no	no
1997	27	no	no
1997	30	no	no
1997	23	no	yes
1998	28	no	no
1998	24	no	yes
1998	36	no	no
1998	24	no	yes
1999	28	no	no
2000	23	yes	yes
2000	30	no	no
2001	24	unknown	yes
2001	26	no	yes
2001	28	unknown	no
2002	33	no	no
2002	27	no	yes
2008	34	no	yes

Rubella surveillance in Poland is currently based on aggregated data, which preclude the ability to assess individual case-based data at the national level. Results of case-based data from 4 of the 16 regions in Poland indicate that <1% of reported rubella cases are laboratory confirmed. Although laboratory confirmation is considered to be the most reliable evidence of acute disease, a high proportion of nationally reported rubella cases are likely to be true cases because (1) a noteworthy decrease in reported cases occurred since the 2003 advent of a childhood RCV recommendation, (2) the age and sex distribution of reported cases is consistent with age and sex cohorts historically not included in rubella vaccination recommendations, and (3) the likelihood that another disease would affect both male and female children and almost exclusively male adolescents and teenagers is extremely low. A serologic survey of Warsaw schoolchildren that revealed that <1% of girls and >36% boys did not have rubella antibodies also supports these findings [15]. After the number of cases of rubella decrease further as SIAs are conducted, implementation of rubella case-based surveillance should be feasible and established in Poland, including laboratory testing of >80% of suspected cases, as recommended by WHO [5].

In addition to rubella surveillance, establishing comprehensive CRS surveillance in Poland is critical to document the impact of the rubella vaccination program and, if necessary, make changes to the elimination strategies. Potential entry points into a CRS surveillance system include (1) identification and follow-up of pregnant women who are suspected to have or

receive a diagnosis of rubella (eg, establishing a pregnancy registry to monitor the follow-up of rubella-infected women) and (2) identification of infants born with congenital defects consistent with CRS (eg, performing retrospective studies to document the completeness of reporting and establishing prospective surveillance at maternity hospitals and tertiary referral centers) [16]. Conducting a serosurvey among women of childbearing age might provide additional information on rubella-susceptible cohorts in Poland and help determine the need for other targeted vaccination efforts among age groups at highest risk for resulting CRS.

The measles vaccination and surveillance program in Poland has reached a mature level, with sustained high vaccination coverage, case-based surveillance, and the ability to genetically characterize viruses from persons with reported measles cases [7,8]. Further integration of measles and rubella components of elimination activities will help address challenges of the rubella program and ensure progress toward the regional goals and will provide the steps toward Poland attaining the population immunity needed to reach and sustain indigenous rubella elimination and protection against CRS. Potential areas for strengthened integration include conducting case-based surveillance for both diseases, testing of measles- or rubella-negative serologic specimens for each other, and ensuring sustained high routine immunization coverage (>95% with both doses of MMR). The introduction school immunization requirements could help with achieving and sustaining high coverage with all routine vaccinations among school-aged children [17, 18]. In addition, engagement of policy decision-makers in Poland in supporting the WHO European Region's measles and rubella elimination and CRS prevention goals will be crucial [19].

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