Progress Toward Measles and Rubella Elimination in Egypt

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Measles and rubella were common infectious diseases in Egypt during the prevaccine era. Monovalent measles vaccine was introduced in 1977, and measles vaccination coverage increased from <50% to >90% from 1980 to 1999; however, measles outbreaks continued to occur at 2- to 4-year intervals during this period. After the introduction of a second routine dose of measles vaccine as a combined measles-mumps-rubella (MMR) vaccine in 1999 and the implementation of measles immunization campaigns targeting 6- to 16-year-old children during 2000–2003, reported measles cases dramatically decreased by 2003. In 2002, Egypt established a goal to eliminate measles and rubella and to prevent congenital rubella syndrome (CRS) by 2010. Large-scale rubella and measles outbreaks in 2005–2007, however, led to a revision of the plan of action to achieve the 2010 goals. A nation-wide measles–rubella immunization campaign, targeting children, adolescents, and young adults 2–20 years old, was conducted in 2 phases during 2008–2009 and achieved coverage >95%. With the decrease to record low levels of cases of measles and rubella in 2009 and 2010, Egypt should achieve measles and rubella elimination in the near future, but high coverage (>95%) with 2 doses of measles–rubella vaccine needs to be maintained, measles–rubella surveillance strengthened, and CRS surveillance developed.

The Arab Republic of Egypt is one of the most populous member countries of the Eastern Mediterranean Region, World Health Organization (WHO). Egypt is 1,009,550 km² in area [1] and is divided into 29 governorates [2]. The population of Egypt has increased dramatically over the past several decades and is currently estimated at 84,474,000, of whom 32.1% are <15 years of age [3]. The crude birth rate is estimated at 23.2 and approximately 7%–9% of births are among females 15–19 years old. The infant mortality rate has declined to 30.2 deaths per 1000 live births, and life expectancy at birth has increased to 71.1 years [3].

The national immunization program (NIP) in Egypt was established in the 1950s. Bacillus Calmette-Guerrin and diphtheria were the first 2 vaccines introduced, followed by poliomyelitis and combined diphtheria, pertussis, and tetanus vaccines in 1960, monovalent measles vaccine in 1977, Hepatitis B vaccine in 1992, and combined measles-mumps-rubella (MMR) vaccine in 1999 [2]. Since 2000, the Egyptian Ministry of Health and Population has reported coverage for all childhood immunizations to be >95% (except for 92% coverage with MCV1 in 2008) [4]. Due to the success of the immunization program, Egypt has successfully eliminated 2 vaccine-preventable diseases: poliomyelitis since 2005 and neonatal tetanus since 2007 [5, 6]. Measles has long been a recognized public health problem in Egypt, but the burden of rubella and congenital rubella syndrome (CRS) has been underappreciated until recently. In 2002, Egypt established a goal of measles and rubella elimination and congenital rubella syndrome (CRS) prevention by 2010. This report summarizes the progress to date made toward measles and rubella elimination and CRS prevention in
Egypt and the implementation and results of measles–rubella (MR) vaccination campaigns conducted in 2008 and 2009.

MEASLES VACCINATION AND EPIDEMIOLOGY

Monovalent measles-containing vaccine (MCV) was introduced in 1977 at 9 months of age. Before 1985, coverage with the first dose of MCV (MCV1) was <50% (Figure 1). Based on administrative data, MCV1 coverage increased from 74% to 89% during 1985–1995, has been >90% since 1996, and >95% since 1998. In 1999, a second dose of MCV (MCV2) was added to the schedule as a combined MMR vaccine and administered at 18 months of age. Since its introduction in 1999, MCV2 (MMR) vaccine coverage has been ≥95% (Figure 1) [4]. In addition to routine immunization for measles and rubella, catch-up measles campaigns were conducted in 2 phases during 2000–2003, targeting children aged 6–11 years and 11–16 years, respectively [Figure 1 and Table 1]. These catch-up and school-age campaigns achieved >95% coverage for all targeted populations [Table 1].

In 2002, Egypt established a goal of measles elimination by 2010 using the WHO/UNICEF Comprehensive Strategy for Sustainable Measles Mortality Reduction [7], and also set a goal of rubella elimination and CRS prevention (<1 CRS/100,000 live births) by 2010. The strategy for rubella elimination included the introduction of MMR as the second dose of measles containing vaccine in 1999. In 2008, the immunization schedule was updated to use MMR for both doses of MCV and to administer the first dose at 12 months of age and the second dose at 18 months of age [2].

Measles was endemic in Egypt until 2008. During the 1980s, large measles epidemics occurred every 2–4 years (Figure 1). Similarly, outbreaks in the 1990s continued to occur every 2–4 years, although not quite as large in magnitude as during the 1980s. Between 1996 and 2000, the majority (>80%) of measles cases were reported in persons aged <10 years; however, in 2001, >50% of reported measles cases were among persons aged >10 years and >20% in persons aged >15 years [8].

Since 2000, there has been a remarkable decrease in the number of reported cases of measles (Figure 1). This decrease has occurred among age-groups targeted by the mass vaccination campaigns conducted during 2000–2004 as a part of the measles elimination strategy (Table 1). The decrease has also occurred as a result of improved classification of measles cases. In 2002, laboratory diagnosis of measles and rubella virus infections by serological testing for immunoglobulin M (IgM) antibodies to each virus became available. Many suspected measles cases (>98%) were determined to be rubella virus infections or discarded based on a negative test for measles IgM antibody. During 2003–2005, only 164, 80, and 77 confirmed measles cases, respectively, were reported, which represents the lowest number of cases ever.

In 2006, however, the number of confirmed measles cases increased dramatically to 953, with measles outbreaks reported from Cairo, Giza, Bani Suef, Menia, Matrouh, and Dakahlia Governorates [2]. In 2006, the age distribution of cases was as follows: 22% aged 1–5 years, 56% aged 6–15 years, and 10% aged 16–20 years. In 2007, the epidemic continued; the number of cases increased to 1687, with an increase in the percentage of cases among >15 years (35.5%) and decrease among children aged 1–5 years (11.5%) compared with the preceding year. In 2005, only 2 governorates reported more than 5 measles cases per million persons; whereas in 2006 and 2007, 8 and 15 governorates reported more than 5 cases per million population, respectively [9].

Figure 1. Reported MCV1 and MCV2 coverage and measles and rubella cases in Egypt, 1980–2009.
In 2008, reported measles cases decreased to 771 with an age distribution similar to that found in 2007. As described below, a 2-phase MR campaign was conducted in 2008 and 2009 and had a significant impact on measles cases. In 2009, only 254 confirmed measles cases were reported, and as of December 2010, only 14 confirmed cases of measles were reported.

In 2006, Egypt initiated reporting of surveillance performance indicators. During 2006–2009, the reporting rate for suspected measles cases was estimated to be 5/100,000 in 2006, decreased to .9/100,000 in 2007, 1.1/100,000 in 2008, and .58/100,000 in 2009. During this time period, laboratory confirmation of suspected measles cases was ≥92% [10].

**RUBELLA EPIDEMIOLOGY**

The burden of rubella was underappreciated until 2002 when laboratory testing for rubella was implemented [5]. Even though rubella surveillance was part of communicable diseases surveillance in Egypt and had been in place for many years, a median of only 24 (range: 9–43) rubella cases were reported each year during 1996–2001 (Figure 1) [9].

In 2002 and 2003, 274 and 261 confirmed rubella cases were reported, respectively, of which many (>45%) occurred among children 5–9 years of age. In 2004, only 21 cases of rubella were reported. In 2005, however, a nationwide epidemic began; 520 rubella cases were reported, with >80% among persons 11–20 years old. In 2006, 2587 cases were reported, almost 60% of which occurred among 11- to 20-year-olds; cases were reported mainly from 7 governorates (Alexandria, Dakahlia, Damietta, Ismailia, Kafr El Sheikh, New Valley, and Port Said). In 2007, the epidemic peaked with 11,345 cases reported, 74% of which were among 11- to 20-year-olds from 22 governorates and 140 districts. In 2008, the epidemic waned; 1,684 cases were reported from 26 governorates and 62 districts. Following the 2008–2009 MR vaccination campaign described below, only 14 cases of rubella were reported in 2009, and by December 2010, only 15 confirmed cases of rubella have been reported [10].

**ASSESSMENT OF POPULATION IMMUNITY**

To assess preexisting immunoglobulin G (IgG) antibody titers to measles and rubella in the age cohorts targeted by the catch-up and school-age campaigns conducted in 2000–2003, the Ministry of Health and Population (MOHP) tested serum specimens in 2002 to assess IgG antibody titers against measles and rubella among children, adolescents, and young adults aged...
Given the rubella and measles outbreaks that occurred during 2005–2007, it became apparent that it would be difficult for Egypt to achieve its goal of measles and rubella elimination and CRS prevention by 2010. In 2007, therefore, a revised plan of action for the elimination of measles and rubella by 2010 was developed. The main components of the strategy included (1) conducting a national mass campaign targeting 36 million children, adolescents and young adults from 2 to 19 years, (2) achieving and maintaining high coverage with 2 doses of MMR, (3) strengthening school-based routine immunization programs, (4) strengthening measles and rubella surveillance, (5) establishing CRS surveillance, (6) improving social mobilization to increase coverage, and (7) establishing a measles, rubella, CRS interagency coordinating committee (ICC) [2, 11].

NATIONAL MEASLES–RUBELLA IMMUNIZATION CAMPAIGN

As part of the revised plan of action for measles and rubella elimination and to rapidly interrupt measles and rubella transmission in Egypt, a measles–rubella vaccination campaign targeting persons 2–19 years old was conducted in 2008–2009. Due to the size of the target population, the campaign was conducted in 2 phases. Phase I was conducted in November–December 2008 and targeted 18,397,660 persons aged 10–19 years old, because they represented >80% of the measles and rubella cases that had occurred during the previous 2 years [2]. Phase II was conducted in November 2009 and targeted 17,039,939 persons 2–10 years old.

PRECAMPAIGN PLANNING ACTIVITIES

As part of planning for both phases of the campaign, a measles–rubella elimination taskforce was established. The core group included Ministry of Health and Population (MOHP), United Nations Children’s Fund (UNICEF), and World Health Organization (WHO), and it oversaw the coordination of the activities of both phases of the campaign. Key activities of the task force included (1) development of measles/rubella elimination guidelines and training materials, (2) training of vaccinators and supervisors, (3) eliciting the participation of governors, other political leaders, and partners from the Ministries of Education, Internal Affairs, and Defense, among others, in planning meetings, and (4) developing a comprehensive national social and community mobilization plan of action [2, 11].

The focus of the national mobilization plan was to use mass media campaigns to inform the community about the campaign and encourage caretakers to bring their children to be vaccinated. Key messages for both phases of the campaign were the following: (1) rubella and measles are serious infectious diseases, (2) measles and rubella infect children, youth, and women, (3) the measles–rubella vaccine to be given in the campaign is safe, administered subcutaneously using a sterile auto-disposable syringe by a trained qualified health worker (nurse) and performed in the presence of a trained physician, and (4) vaccination is free of charge and will be given by mobile teams, at fixed sites and at health units [2, 11]. For Phase I, an additional key message informed the public that the campaign targeted females and males 10–19 years of age. For Phase II, messages were directed toward caretakers to encourage the vaccination of children 2–10 years old. Pre- and postcampaign surveys of the 2008 communication campaign were conducted to assess the outcome and to incorporate the lessons learned into the 2009 communication campaign.

For both phases, the communication campaign created a special logo to create visibility, broadcast TV spots on national TV and satellite channels, mainly during prime time, and broadcast radio announcements that were aired at favorite times on all radio stations [11]. In addition to the TV and radio announcements, special audio-visual advertisements were run on closed circuit TV screens at Cairo Metro stations where an average of 3 million commuters traveled daily. An SMS campaign was also undertaken, targeting media personnel and pediatricians. Furthermore, 72,000 posters and handouts with information on vaccination schedule were distributed to the >40,000 schools and universities throughout Egypt. For the Phase II campaign in 2009, newspaper articles, billboard announcements, brochures, posters, and flyers were published in order to reinforce the TV and radio spots.
CAMPAIGN IMPLEMENTATION

To ensure success of both phases of the campaign, extensive planning and preparation were undertaken at all administrative levels—governorate, district, and health units. Daily work plans were prepared for vaccination teams throughout the campaign [2]. For Phase I, primary and secondary school children, university students, and military and police recruits were vaccinated at mobile fixed-posts at schools, colleges, universities, technical institutes, and military and police camps, and at fixed-post sites in governorate health units. Hard-to-reach populations such as factory workers and young women living at home were invited by community health workers to be vaccinated at the closest health facility. In the rural areas, health care workers and community leaders played a key role in mobilizing the target population for vaccination. Rapid convenience monitoring was conducted in both phases of the campaign, and unvaccinated individuals were offered vaccine. In the schools and universities, registries were checked and persons not vaccinated were identified and offered vaccine. Lessons learned from the Phase I campaign were incorporated into the Phase II campaign. These included (1) adapting the strategic plan for the 2- to 10-year-old target population, (2) developing specific plans and activities to reach (a) preschool and kindergarten children and (b) primary school children, (3) developing a microplan for each health unit to ensure both preschool and school age groups were covered, (4) enhancing the social mobilization plan to reach the parents of children in the different age groups, and (5) emphasizing the safety of the vaccine and the disposable syringes being used.

For Phase II, microplans were developed to conduct vaccination activities at schools and nurseries as well as fixed health posts and to reach the “inaccessible” populations (ie, children 2–5 years old not enrolled in preschools or kindergartens) [12]. Health facility microplans for vaccination teams included the 150–170 targeted children expected to be vaccinated daily, logistic supplies, physician and supervisor names, and communities or schools to be covered by each team. MOHP staff shared campaign microplans with Health Insurance staff to coordinate vaccination activities at schools. For hard-to-reach populations in rural areas, health care workers and community leaders played a role in eliciting their participation. For urban areas, fixed posts were open daily for vaccination and health staff used mobile microphones to alert families to take their children to health facilities to be vaccinated.

PHASE II CAMPAIGN AND THE H1N1 OUTBREAK

Before the start of the 2009 Phase II MR campaign, Egypt was affected by the novel H1N1 influenza outbreak, which directly affected campaign planning and implementation. MOHP human and financial resources were overstretched in the response to the H1N1 outbreak. To minimize the possibility that increasing school absenteeism would negatively affect the MR campaign, the campaign timetable was accelerated to be completed in 2 instead of 3 weeks. The third week of the campaign was then used to find and vaccinate children who were missed during the first 2 weeks.

ADVERSE EVENTS FOLLOWING IMMUNIZATION (AEFI)

The established AEFI surveillance system was enhanced for both phases of the campaign [12]. Physicians at each hospital were assigned responsibility to report any AEFI every night. As part of the nightly debriefings for the campaigns, AEFIs were reviewed and discussed. During Phase I, no serious AEFIs and 930 minor adverse events were reported. Five cases of brief fainting were reported. During Phase II 6 serious AEFIs (2 cases of Stevens-Johnson Syndrome, 2 cases of anaphylaxis, 1 seizure, and 1 encephalitis case) and 469 minor adverse events were reported.

VACCINATION COVERAGE

For both phases of the campaign, vaccination coverage was estimated using the reported number of doses administered divided by the target population. To validate the campaign coverage determined by the administrative method, a coverage evaluation survey was conducted within one month after each campaign. The objectives of each survey were to (1) determine MR vaccine coverage overall, (2) estimate coverage rates by subgroups, and (3) identify reasons for vaccine noncompliance or refusal. Each survey included 40 clusters in 21 governorates and surveyed twenty subjects in each cluster.

During the Phase I campaign, MR vaccination coverage in the target population increased rapidly over the 3-week period, from 50% by the end of the first week, to 88% by the end of the second week, and 97% by the third week [12]. Overall, 18,375,015 persons (99.8%) of the target population were vaccinated. However, administrative coverage varied widely, from 44% in Nakhil District in North Sinai Governorate to 143.9% in Wasat District, Alexandria Governorate. Similar proportions of males (48%) and females (52%) were vaccinated. A post-campaign coverage survey found vaccination coverage of 96.3% (95% confidence interval [CI], 94.5%–98.1%).

During the Phase II campaign, concerns about the H1N1 outbreak resulted in slower vaccine uptake initially; however, with increased efforts in the schools in many governorates, the community response to the campaign improved quickly. A total of 17,843,811 children (104% of the target population) were vaccinated. Administrative coverage ranged from 96% in Qena Governorate to 122% in Helwan Governorate and was >95% in all governorates. Approximately 95% of the districts achieved
coverage above 95%, and no district reported coverage below 85%. Similar proportions of males (50.9%) and females (49.1%) were vaccinated. The post-campaign found vaccination coverage of 97.1%, (95% CI, 95.5%–98.7%).

DISCUSSION

The current epidemiology of measles and rubella in Egypt reflects the progress and challenges of the immunization program over time. Although immunization against measles began >30 years ago, measles remained endemic until recently. The introduction of laboratory testing for both measles and rubella in 2002 led to a decrease in the number of measles cases and the increase in rubella cases. At this time the public health importance of rubella was recognized. Even with the high measles/MMR vaccine coverage since 1999, large-scale measles outbreak during 2006–2007, primarily affecting school-aged children and adolescents, reflected the build-up of susceptibles during the 1990s before the 2-dose policy was implemented and, perhaps, lower coverage than reported by the administrative method.

Rubella vaccine was introduced into the routine program in 1999. From its inception, coverage with a single dose of rubella vaccine was ≥95% for the vaccinated birth cohorts. The 2002 serosurvey, however, documented <60% rubella seropositivity among school-aged children born in the late 1990s before rubella vaccination was started. As rubella virus circulation decreased during the early 2000s because of vaccination of young children, school-aged and older cohorts remained susceptible, and the rubella epidemic during 2005–2008 primarily affected these age groups (11- to 20-year-olds). The increased risk of rubella in susceptible women of childbearing age created a potential increased risk of infants being born with CRS, although this could not be documented because there was no functioning CRS surveillance system during the outbreak and no special investigations were performed after the outbreak to identify CRS cases.

In 2002, Egypt established a goal for the elimination of measles and rubella by 2010. The occurrence of measles and rubella epidemics during 2005–2008, among adolescents and young adults, however, indicated that a new strategy was needed. To achieve elimination of both viruses, a high-quality campaign using MR vaccine targeting males and females aged 2–19 was critical. The Egyptian MOHP chose to not include 1-year-olds due to the introduction of MMR at 12 months in 2008. With careful planning and effective social mobilization activities, both phases of the campaign were successfully implemented with high coverage of the target populations. Subsequently, the number of confirmed cases of measles and rubella in 2009 and 2010 were the lowest ever reported.

Even with the successes of both phases of the MR campaign, there were several challenges. Concerns about adverse effects of the MR vaccine required training of physicians and nurses to manage AEFI and availability of emergency transport. To alleviate vaccine safety fears, messages about MR vaccine and disposable needle safety were developed and incorporated into social mobilization. Vaccine safety concerns, founded or unfounded, have resulted in significant impact on measles and measles–rubella campaigns. In 2008, unfounded vaccine safety concerns resulted in the suspension of the MR campaign in Ukraine and only 50% coverage achieved in MR campaign in Georgia [13, 14]. In Phase II of the MR campaign, the novel H1N1 outbreak stretched the capacity of MOHP staff, resulted in increased absenteeism among school-aged children, and led to media coverage of the H1N1 outbreak rather than the campaign.

With the success of the MR campaign, Egypt is close to achieving the elimination of measles and rubella. To achieve elimination, high coverage (95%) with 2 doses of measles- and rubella-containing vaccine will be needed to be maintained and periodic follow-up immunization campaigns might be needed. In addition, high-quality surveillance for integrated measles–rubella surveillance should be strengthened and CRS surveillance should be established.

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References


