

## Original Article

# A National Survey to Evaluate Measles-Rubella National Vaccination Campaign Coverage in Egypt

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## Abstract

**Background:** A national vaccination campaign for measles and rubella (MR) was conducted in Egypt in the period from October 31<sup>st</sup> to November 21<sup>st</sup>, 2015, across Egyptian governorates by the Ministry of Health and Population (MOHP), in collaboration with World Health Organization and UNICEF. It targeted 24 million children aged 9 months to 10 years.

**Objectives:** The present survey aimed at evaluating coverage of the MR national vaccination campaign, to identify the gaps and generate sound recommendations for the upcoming campaigns.

**Methods:** A cluster survey was conducted targeting children aged 9 months to less than 10 years. This household survey was carried out in 26 governorates of Egypt. In each governorate 240 interviews were completed.

**Results:** The survey revealed that the campaign achieved an overall coverage of 98.2% compared to 109.8% vaccination coverage as reported by the Ministry of Health (MOH). Some clusters showed below target coverage in a couple of governorates (Port Said 93.3% and Qena 93.8%). Non-vaccinated children constituted 1.8% of all surveyed children. When causes of non-vaccination were enquired about, the most frequently mentioned cause was ignorance of parents about the vaccination campaign (43 children, 38.1%).

**Conclusion:** The MOHP implementation of the national MR campaign was successful and achieved its objective for increased coverage with MR vaccine among the target age group.

**Keywords:** Measles-Rubella, vaccination coverage, Egypt

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## INTRODUCTION

Evident global progress has been made to reduce the impact of measles on childhood mortality, and measles cases have dramatically decreased. The Global Vaccine Action Plan, endorsed by the Sixty-fifth World Health Assembly, in May 2012, has targeted Measles and Rubella (MR) elimination in at least five of the six World Health Organization Regions by 2020.<sup>(1-3)</sup>

An Eastern Mediterranean vaccine action plan 2016–2020, was subsequently developed and was endorsed in October 2015 by the Regional Committee for the Eastern Mediterranean in resolution EM/RC62/R.1 as a framework for implementation of the Global Vaccine Action Plan (GVAP) in countries of the Region. The regional elimination and control targets of vaccine preventable diseases in the Eastern Mediterranean Region (EMR) include: measles elimination and interruption of endemic measles virus transmission as soon as possible, latest by 2020, as

well as enhancing the introduction of rubella vaccine in EMR countries (20 countries by 2020).<sup>(4)</sup> Countries of the EMR have been implementing the regional strategy for measles elimination with variable levels of success. Based on World Health Organization- United Nations International Children's Emergency Fund (WHO-UNICEF) estimate of national vaccination coverage for 2014, coverage with the first dose of measles-containing vaccine (MCV1) was ≥95% in 11 countries, 90%–94% in 2 and 95% in 7 countries only.<sup>(5)</sup>

The Region has witnessed significant progress. The number of reported measles cases decreased by around 80% between 1998 and 2014. As of 2014, eight countries reported incidence <5/million population. Measles elimination requires not only high coverage (>95%) with the vaccine but also a strong competent health system capable of reaching every child in the community.<sup>(6)</sup> Accurate and comparable data on vaccination coverage rates should be available to assess and monitor the performance of vaccination services at different national and subnational levels, to

support public health planning, allocate resources and measure the impact of interventions. Besides, it can raise attention to areas of program weaknesses for example by showing the proportion of children receiving no vaccines at all (indicator of access to health services), estimating the rate of dropout between starting and completing the vaccine series (health system barrier to re-attendance or weakness of tracking activity), and contributing data to models of the impact of vaccination or disease burden including risk assessment of outbreak potential.<sup>(1,2)</sup>

In 2002, Egypt has established a goal of measles elimination by 2010 using the WHO/UNICEF comprehensive strategy for sustainable measles mortality reduction and set a goal of rubella elimination and Congenital Rubella Syndrome (CRS) prevention by 2010.<sup>(3)</sup> Since 2000, there has been remarkable decrease in measles cases among age groups targeted by mass vaccination. However, in 2006, dramatic increase in measles cases was reported, with outbreaks in Cairo, Giza, Beni Suef, Menia and Matrouh.<sup>(7)</sup>

Global estimates of the burden of rubella suggest that the number of infants born with CRS in 2008 exceeded 110,000 which makes rubella a leading cause of preventable congenital defects. The 2008 estimates suggest that the highest CRS burden is in the South-East Asia (approximately 48%) and African (approximately 38%) Regions.<sup>(2)</sup> Currently, 15 of the 23 countries in EMR are using rubella vaccine in their Expanded Program on Immunization (EPI) with high coverage  $\geq 90\%$  coverage of RCV1 and 14 of them are using a 2-dose schedule. Thirteen countries have established a national target for rubella/CRS elimination. In addition, rubella case-based surveillance is integrated with measles surveillance in all countries in the Region. Ten countries now are implementing CRS surveillance as well. In addition, the new Global Alliance for Vaccine and Immunization (GAVI) window for supporting MR catch up campaign is an excellent opportunity to intensify measles/ rubella control and elimination activities.<sup>(8)</sup>

In Egypt, the burden of rubella was underestimated until 2002 when laboratory testing for rubella was implemented.<sup>(9)</sup> A median of only 24 rubella cases were reported each year during 1996–2001.<sup>(9,10)</sup> Between 2002–2004 few cases of rubella were reported. However, in 2005–2006 Egypt faced a nationwide epidemic which began in seven governorates including Alexandria, Ismailia, and Kafr Elsheikh. In which 2587 cases were reported, almost 60% of which occurred among 11- to 20-year-old children.<sup>(7,11,12)</sup> In 2012, Egypt faced an importation of measles virus from Sudan to the Red Sea and Aswan governorates, which spread then to other governorates. The root cause of the outbreak was accumulation of

susceptible and immunity gaps in some risky areas. There was a gradual increase in the reported cases of measles until it reached its peak in November, 2014.<sup>(12)</sup> A national vaccination campaign for measles and rubella was conducted in Egypt in the period from October 31st to November 21st 2015, by the Ministry of Health and Population (MOHP), in collaboration with World Health Organization (WHO) and UNICEF. The campaign targeted to vaccinate 24 million children between the age of 9 months and 10 years. It was implemented across Egyptian governorates in schools, nurseries and health care facilities affiliated to the Egyptian MOHP.<sup>(10)</sup> The vaccine used was a WHO pre-qualified combined measles and rubella vaccine, that was also approved from the National Regulatory Authority (NRA) in Egypt.<sup>(11)</sup>

The aim of present study was to evaluate the coverage of the MR national vaccination campaign, as one of the crucial steps to strengthen performance in the upcoming campaigns. The specific objectives are; to estimate the vaccination coverage among the targeted group (9 months to <10 years); to identify the reasons for non-vaccination during the campaign; to describe the most important sources of information used to inform people about the campaign; and to compare the assessed coverage with the administrative coverage of the MOHP.

## METHODS

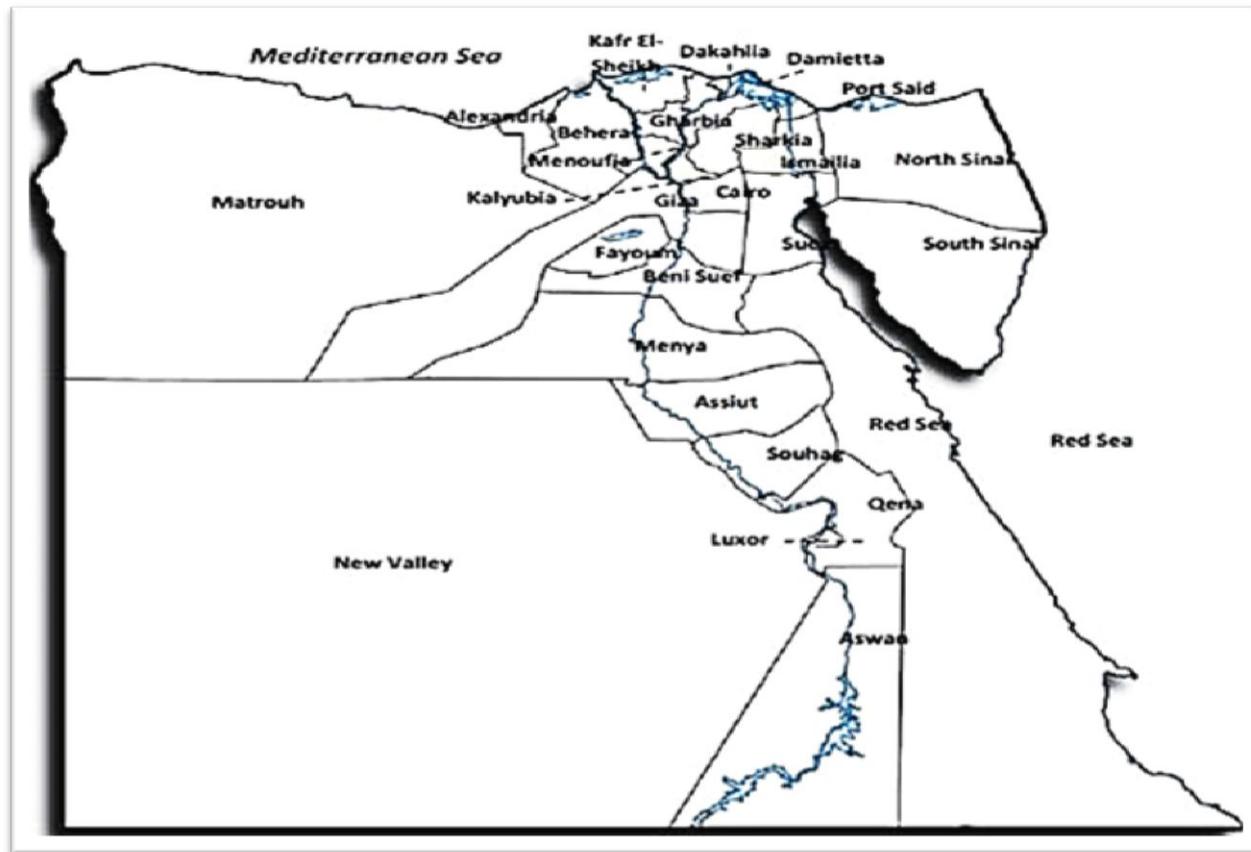
**Study setting and Design:** The survey was conducted during the period from February 15, 2016 till May, 15 2016 (3 months). It targeted children aged 9 months to less than 10 years in 26 governorates of Egypt. Figure 1 portrays the enrolled Egyptian governorates.

**Sampling technique and method of selection:** A cluster survey was conducted based on the World Health Organization Vaccination Coverage Cluster Surveys: Reference Manual version 3 working draft July 2015 with some modifications. In WHO Reference Manual of 2015, selection of survey clusters was based on household data but in the present survey, it was based on the catchment area of health offices which was agreed upon in the preparatory meetings of the survey due to unavailability of household data for all Egyptian governorates. The sample size was calculated according to the WHO reference manual 2015<sup>(13)</sup> equations; taking into consideration the following parameters: Each of the 26 governorates in the survey was considered as a separate stratum. Moreover, calculation of vaccination coverage in two age groups (9 months to less than 5 years and 5 years to less than 10 years) was done, where the number of strata in each governorate was two. The expected vaccination coverage in the campaign was 90%, the precision level 10%, the alpha 5%, the power 80% and the programmatic threshold 95% with delta 5% and upward direction, which

resulted in effective sample size of 70. Inflation factor for non-response was 1.05. It was decided to take 24 clusters representing the 26 governorates. Ten children in the target age group were required and were enrolled from each cluster (five children from nine months to less than five years and five children from five to less than ten years). In each governorate 240 interviews were completed. In each governorate, the affiliated health offices were arranged

according to the total population (the least administrative unit), and then the 24 clusters were selected by proportional allocation. Each selected cluster was divided into segments according to the population density, one segment was selected randomly to start from. The start point was also selected randomly by the principal investigator and the investigation team according to the available landmarks on the maps in the selected segment.

**Figure 1:** A map of Egypt showing the enrolled Egyptian governorates in the evaluation survey



A pilot study and training to data collectors, supervisors and field coordinators were conducted prior to data collection. An interview questionnaire with parents of the children was used to collect data about: age, date of birth and gender of the eligible children, place of vaccination, and causes of non-vaccination.

#### Statistical analysis

Data verification started in the field, with checking for completeness of the data and performing quality control checks. Data were analyzed using Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA). Version 22.0 for statistical analysis. Data were summarized and presented using appropriate descriptive statistics.

#### Ethical considerations

Verbal consents were obtained from interviewees (Caregivers of young children) and from school aged children themselves, prior to enrollment, after a full

explanation of the aim and purpose of the evaluation survey and that their participation is voluntary. Anonymity and confidentiality of the data was ensured throughout the survey.

## RESULTS

In the present study, 240 children were enrolled from each governorate. The participation rate was 99.6% (6240 children were included out of 6268 eligible children). Regarding the vaccination coverage, 98.2 % (95% C.I.= 97.87% - 98.53%) of the 6240 children enrolled in the survey were vaccinated during the MR campaign). The socio-demographic characteristics of the surveyed children were shown in Table 1. The 240 children included from each governorate, were equally distributed over the two age groups; 9 months to less

than 5 years and 5 years to less than 10 years. Males constituted 51.8% while females represented 48.2% of the sampled children.

More than two thirds of the fathers and mothers of the surveyed children had finished either secondary school or technical school education (45.5%, and 43.1% respectively). Illiterate parents represented 17.9% of fathers and 21.4% of mothers.

**Table 1: Distribution of the surveyed children by socio-demographic characteristics**

Socio-demographic characteristics	Surveyed children (n=6240) No. (%)
<b>Age</b>	
9ms - <5 years	3120 (50)
5 - ≤10 years	3120 (50)
<b>Gender</b>	
Male	3233 (51.8)
female	3007 (48.2)
<b>Educational level of child</b>	
At home	2361 (37.8)
At nursery	1450 (23.3)
At school	2429 (38.9)
<b>Education of fathers</b>	
literate	1114 (17.9)
Basic education	778 (12.5)
Secondary/technical	2838 (45.5)
University	1510 (24.1)
<b>Education of mothers</b>	
literate	1336(21.4)
Basic education	800(12.8)
Secondary/technical	2685 (43.1)
University	1419 (22.7)

The vaccination coverage by governorate is shown in Table 2 where the coverage rate in different governorates ranged between 93.3 % up to 100% with an estimated overall national coverage rate of 98.2% (95% C.I.= 97.87 - 98.53). Table (3) delineates the distribution of vaccination coverage rates by age group in different governorates. Vaccination coverage among children aged between 9 months and less than 5 years ranged between 89.2% in Qena and full coverage rate (100%) in Beni Suef, Fayoum and Souhag. All governorates revealed a coverage above 95% except Port Said (90.8%) Assuit (93.3%) and Ismailia (94.2%). The overall national vaccination coverage for children aged 9 months to < 5 years was 97.2% with 95% CI = 96.6 - 97.8.

Regarding surveyed children aged 5 years up to 10 years, the vaccination coverage was generally much higher than among the younger age group where the vaccination coverage ranged between 95.8% and 100% with an overall rate of 99.1%. (95% CI = 98.8 - 99.4). Twelve governorates reached 100% coverage namely Cairo, Alexandria, Giza, Beni Suef, Fayoum, Assiut, Souhag, Luxor, Damietta, Dakahlia, Kafr El-

Sheikh and the New Valley governorates. The least recorded coverage rate among this age group of children was found in Port Said (95.8%), Gharbia (97.5%) and Ismailia (97.5%). Otherwise, vaccination coverage in the remaining governorates exceeded 98%.

Regarding the distribution of vaccination coverage by sex, male children ranged from 91.8% to 100% with an overall coverage of 98.2% (95% CI = 97.7 - 98.7). Considering vaccination coverage among female children, it ranged between 92.9 % and 98.2% with an overall coverage of 98.2% (95% CI = 97.7 - 98.7). A coverage rate of 100% was recorded in Beni Suef, Fayoum and Souhag. The lowest coverage rates were observed in Port Said (93.3%) and Qena (93.8%).

Table 4 delineates distribution of the surveyed children at different governorates by place of vaccination. Generally, children were vaccinated at primary health care (PHC) facilities (45.6%, 95% CI= 44.4- 46.9), schools (36.3%, 95% CI= 35.1- 37.5), and less frequently at nurseries (14.4%, 95% CI= 13.5- 15.3) and at other settings including youth clubs, mosques and village Diwan (3.7%, 95% CI= 3.2-4.2). PHC facilities were the main setting for vaccination at the majority of governorates except Beni Suef, Fayoum, Aswan, Luxor, Damietta, Dakahlia and The New Valley where schools had the upper hand in vaccination.

Luxor was a special case regarding the high percentage of children vaccinated in other places as the village Diwan (20.7%). Moreover, mosques, youth clubs and village Diwan showed good contribution in vaccinating children at Aswan (13.4%), Behera (11.4%), and Fayoum (10.8%).

Table 5 portrays the different reasons for non-vaccination as mentioned by parents of non-vaccinated children (n=113). The most frequently mentioned cause was ignorance of parents about the vaccination campaign (43 children, 38.1%) which was evident in Qena, Port Said, Sharkia and Ismailia.

Ill children during the campaign contributed to 14.2% of the reasons for non-vaccination despite the long duration of the campaign. Rumors about the vaccine represented 12.4% of the causes. Such rumors were reported in Cairo, Assuit, Aswan, and Suez. In Cairo, several families mentioned their concerns about those rumors, yet at the end they vaccinated their children.

Other causes as fear of the child from injections, absence from school, having the compulsory vaccination concomitant to time of the campaign, being a busy mother, underestimating the importance of the vaccine, or inaccessibility to vaccination setting constituted 31.0% of the causes. Fear of adverse effects constituted 5.3% of the causes mainly in Damietta, Ismailia , Port Said, and Sharkia .Only three

children were not vaccinated due to incorrect age as calculated incorrectly by their parents. Only one child (0.9%) was not vaccinated due to lack of the vaccine at PHC facility in the New Valley governorate.

**Table 2: Distribution of vaccination coverage by governorate**

Governorate	Surveyed children (n=6240)		
	No.	%	95% C.I.
Urban	Cairo	238	99.2 98.1 - 100*
	Alexandria	238	99.2 98.1 - 100*
	Port Said	224	93.3 90.1 - 96.5
	Suez	236	98.3 96.7 - 99.9
Upper Egypt	Giza	239	99.6 98.7 - 100*
	Beni Suef	240	100 -
	Fayoum	240	100 -
	Menya	237	98.8 97.4 - 100 *
	Assuit	232	96.7 94.4 - 98.9
	Souhag	240	100 -
	Qena	225	93.8 90.8- 96.9
	Aswan	232	96.7 94.4 - 98.9
	Luxor	237	98.8 97.4 - 100*
Lower Egypt	Damietta	238	99.2 98.1 - 100*
	Dakahlia	239	99.6 98.7 - 100*
	Sharkia	234	97.5 95.5 - 99.5
	Kalyubia	236	98.3 96.7 - 99.9
	Kafr El-Sheikh	239	99.6 98.7 - 100*
	Gharbia	234	97.5 95.5 - 99.5
	Menoufia	235	97.9 96.1 - 99.7
	Behira	237	98.8 97.4 - 100*
	Ismailia	230	95.8 93.3 - 98.3
Frontier	Red Sea	237	98.8 97.4 - 100*
	New Valley	236	98.3 96.7 - 99.9
	Matrouh	235	97.9 96.1 - 99.7
	South Sinai	239	99.6 98.7 - 100*
Total vaccinated		6127	98.2
95% CI			97.9 - 98.5

**Table 3: Percent distribution of vaccination coverage according to age group and governorate**

Governorate		Age of surveyed children (n=6240)					
		9 months-< 5 years (n surveyed=3120)			5 -≤10 years (n surveyed =3120)		
		No.	(%)	95% CI	No.	(%)	95% CI
Urban	Cairo	118	98.3	96.0 - 100*	120	100.0	-
	Alexandria	118	98.3	96.0 - 100*	120	100.0	-
	Port Said	109	90.8	85.6 – 96.0	115	95.8	92.2 - 99.4
	Suez	118	98.3	96.0 - 100*	118	98.3	96.0 - 100*
Upper Egypt	Giza	119	99.2	97.6 - 100*	120	100.0	-
	Beni Suef	120	100	-	120	100.0	-
	Fayoum	120	100	-	120	100.0	-
	Menya	118	98.3	96.0 - 100*	119	99.2	97.6 - 100*
	Assuit	112	93.3	88.8 - 97.8	120	100.0	-
	Souhag	120	100	-	120	100.0	-
	Qena	107	89.2	83.7 - 94.8	118	98.3	96.0 - 100*
	Aswan	114	95	91.1 - 98.9	118	98.3	96.0 - 100*
	Luxor	117	97.5	94.7 - 100*	120	100.0	-
Lower Egypt	Damietta	118	98.3	96.0 - 100*	120	100.0	-
	Dakahlia	119	99.2	97.6 - 100*	120	100.0	-
	Sharkia	115	95.8	92.2 - 99.4	119	99.2	97.6 - 100*
	Kalyubia	118	98.3	96.0 - 100*	118	98.3	96.0 - 100*
	Kafr El-Sheikh	119	99.2	97.6- 100*	120	100.0	-
	Gharbia	117	97.5	94.7 - 100*	117	97.5	94.7 - 100*
	Menoufia	117	97.5	94.7 - 100*	118	98.3	96.0- 100*
	Behera	119	99.2	97.6 - 100*	118	98.3	96.0 - 100*
	Ismailia	113	94.2	90.0 - 98.4	117	97.5	94.7 - 100*
Frontier	Red Sea	118	98.3	96.0 - 100*	119	99.2	97.6 - 100*
	New Valley	116	96.7	93.5 - 99.9	120	100.0	-
	Matrouh	116	96.7	93.5 - 99.9	119	99.2	97.6 - 100*
	South Sinai	119	99.2	97.6 - 100*	120	100.0	-
Total vaccinated		3034	97.2		3093	99.1	
95% CI			96.6 - 97.8			98.8 - 99.4	

\*: Confidence interval is adjusted by using asymmetric technique as upper limit is above 100%

**Table 4: Distribution of surveyed children in different governorates by place of vaccination**

Governorate	Number of vaccinated	Place of vaccination (n=6127)								
		PHC		School		Nursery		Others		
		No.	(%)	No.	(%)	No.	(%)	No.	(%)	
Urban	Cairo	238	143	60.1	72	30.3	23	9.7	0	0.0
	95% CI		53.9 - 66.3		24.5 - 36.1		5.9 - 13.5		-	
	Alexandria	238	140	58.8	80	33.6	18	7.6	0	0.0
	95% CI		52.6 - 65.1		27.6 - 39.6		4.2 - 10.9		-	
	Port Said	224	123	54.9	77	34.4	21	9.4	3	1.3
	95% CI		48.4 - 61.4		28.2 - 40.6		5.6 - 13.2		0 - 2.78%*	
	Suez	236	132	55.9	87	36.9	15	6.4	2	0.8
	95% CI		49.6 - 62.2		30.7 - 43.1		3.3 - 9.5		0 - 1.94%*	
Upper Egypt	Giza	239	116	48.5	87	36.4	36	15.1	0	0.0
	95% CI		42.2 - 54.8		30.3 - 42.5		10.6 - 19.7		-	
	Beni Suef	240	89	37.1	96	40	53	22.1	2	0.8
	95% CI		31 - 43.2		33.8 - 46.2		16.9 - 27.4		0 - 1.93*	
	Fayoum	240	86	35.8	87	36.3	41	17.1	26	10.8
	95% CI		29.7 - 41.9		30.2 - 42.4		12.3 - 21.9		6.8 - 14.7	
	Menya	237	108	45.6	94	39.7	35	14.8	0	0.0
	95% CI		39.3 - 51.9		33.5 - 45.9		10.3 - 19.3		-	
	Assuit	232	106	45.7	98	42.2	23	9.9	5	2.2
	95% CI		39.3 - 52.1		35.8 - 48.6		6.1 - 13.7		0.3 - 4.1	
	Souhag	240	105	43.8	83	34.6	34	14.2	18	7.5
	95% CI		37.5 - 50.1		28.6 - 40.6		9.8 - 18.6		4.2 - 10.8	
	Qena	225	125	55.6	82	36.4	18	8	0	0.0
	95% CI		49.1 - 62.1		30.1 - 42.7		4.5 - 11.5		-	
	Aswan	232	77	33.2	86	37.1	38	16.4	31	13.4
	95% CI		27.1 - 39.3		30.9 - 43.3		11.6 - 21.2		9.4 - 17.8	
	Luxor	237	47	19.8	94	39.7	47	19.8	49	20.7
	95% CI		14.7 - 24.9		33.5 - 45.9		14.7 - 24.9		15.5 - 25.9	
Lower Egypt	Damietta	238	89	37.4	91	38.2	58	24.4	0	0.0
	95% CI		31.3 - 43.6		32 - 44.4		18.9 - 29.9		-	
	Dakahlia	239	93	38.9	96	40.2	47	19.7	3	1.3
	95% CI		32.7 - 45.1		33.9 - 46.4		14.7 - 24.7		0 - 2.74*	
	Sharkia	234	100	42.7	84	35.9	37	15.8	13	5.6
	95% CI		36.4 - 49		29.8 - 42.1		11.1 - 20.5		2.7 - 8.6	
	Kalyubia	236	115	48.7	79	33.5	36	15.3	6	2.5
	95% CI		42.3 - 55.1		27.5 - 39.5		10.7 - 19.9		0.5 - 4.5	
	Kafr El-Sheikh	239	97	40.6	92	38.5	34	14.2	16	6.7
	95% CI		34.4 - 46.8		32.3 - 44.7		9.8 - 18.6		3.5 - 9.9	
	Gharbia	234	106	45.3	92	39.3	36	15.4	0	0.0
	95% CI		38.9 - 51.7		33 - 45.6		10.8 - 20		-	
	Menoufia	235	98	41.7	95	40.4	36	15.3	6	2.6
	95% CI		35.4 - 48		34.1 - 46.7		10.7 - 19.9		0.6 - 4.6	
	Behera	237	90	38	80	33.8	40	16.9	27	11.4
	95% CI		31.8 - 44.2		27.8 - 39.8		12.1 - 21.7		7.0 - 15.4	
	Ismailia	230	128	55.7	82	35.7	16	7.0	4	1.7
	95% CI		49.3 - 62.1		29.5 - 41.9		3.7 - 10.3		0.1 - 3.4	
Frontier	Red Sea	237	127	53.6	65	27.4	42	17.7	3	1.3
	95% CI		47.3 - 59.9		21.7 - 33.1		12.8 - 22.6		0 - 2.7*	
	New Valley	236	91	38.6	99	41.9	34	14.4	12	5.1
	95% CI		32.4 - 44.8		35.6 - 48.2		9.9 - 18.9		2.3 - 7.9	
	Matrouh	235	156	66.4	58	24.7	18	7.7	3	1.3
	95% CI		60.4 - 72.4		19.2 - 30.2		4.3 - 11.1		0 - 2.8*	
	South Sinai	239	106	44.4	86	36	47	19.7	0	0.0
	95% CI		38.1 - 50.7		29.9 - 42.1		14.7 - 24.7		-	
Total		6127	2793	45.6	2222	36.3	883	14.4	229	3.7
95% CI			44.4 - 46.9		35.1 - 37.5		13.5 - 15.3		3.2 - 4.2	

# Others include youth clubs, mosques, village Diwan

\*: Confidence interval is adjusted by using asymmetric technique as lower limit is below zero

**Table (5): Causes of non-vaccination among non-vaccinated children by governorates**

Governorate	Number of non-vaccinated children	Causes of non-vaccination [n=113]						
		Did not know	Rumors	Incorrect age	No available vaccine	Ill child	Fear of adverse effects	Others
Urban	Cairo	2	1	-	-	-	1	-
	Alexandria	2	1	-	-	-	1	-
	Port Said	16	7	1	-	-	3	1
	Suez	4	1	2	-	-	-	1
Upper Egypt	Giza	1	-	-	-	-	1	-
	Beni Suef	0	-	-	-	-	-	-
	Fayoum	0	-	-	-	-	-	-
	Menya	3	2	-	1	-	-	3
	Assuit	8	-	3	2	-	1	-
	Souhag	0	-	-	-	-	-	-
	Qena	15	13	-	-	-	-	2
	Aswan	8	2	3	-	-	-	3
	Luxor	3	1	-	-	-	-	2
Lower Egypt	Damietta	2	-	-	-	-	2	-
	Dakahlia	1	-	-	-	-	-	1
	Sharkia	6	5	-	-	-	1	-
	Kalyubia	4	1	2	-	-	-	1
	Kafr El-Sheikh	1	-	-	-	-	-	1
	Gharbia	6	2	-	-	-	3	-
	Menoufia	5	1	1	-	-	2	-
	Behera	3	-	-	-	-	1	-
	Ismailia	10	4	2	-	-	1	2
Frontier	Red Sea	3	-	-	-	-	-	3
	New Valley	4	1	-	-	1	-	-
	Matrouh	5	-	-	-	2	-	3
	South Sinai	1	1	-	-	-	-	-
Total		113	43	14	3	1	16	6
Percent (%)		100.0	38.1	12.4	2.7	0.9	14.2	5.3
								31.0

Regarding the source of information about the campaign was television (47.6%) followed by PHC facilities (29.0%), mosques (24.1%), schools (23.7%), megaphones on mobile vehicles (16.5%) and posters (13.3%). Only a minority of parents reported other sources of information namely radio (1.1%), private physicians (0.5%) and newspapers (0.2%). Other sources including internet, relatives and neighbors constituted 5.2%. Table 6 compares the vaccination coverage of the present survey with the administrative vaccination coverage of the

MOHP.<sup>(12)</sup> In the national campaign out of 23 million children targeted, 12093387 children between 5 and 10 years, and 11225058 children from 9 months to less than 5 years were vaccinated. Out of those, the non-Egyptian vaccinated children were 16772 and 8305 children in the two former age groups respectively. 53,294 vaccination sites were included. The administrative coverage was higher in all governorates, as portrayed in the table and reached even more than 100 % in the vast majority of the governorates.

**Table 6: Vaccination coverage of the present survey versus administrative vaccination coverage of the MOHP measles rubella campaign**

Governorate	Vaccination coverage of the present survey)	95% CI	Administrative vaccination coverage <sup>(12)</sup>
Cairo	99.2	98.1 - 100*	<b>103.9</b>
Alexandria	99.2	98.1 - 100*	<b>122.6</b>
Port Said	93.3	90.1 - 96.5	<b>115.3</b>
Suez	98.3	96.7 - 99.9	<b>113.8</b>
Giza	99.6	98.7 - 100*	<b>129.3</b>
Beni Suef	100	-	<b>103.3</b>
Fayoum	100	-	<b>105.3</b>
Menya	98.8	97.4 - 100*	<b>104.9</b>
Assuit	96.7	94.4 - 98.9	<b>110.1</b>
Souhag	100	-	<b>110.6</b>
Qena	93.8	90.8 - 96.9	<b>106.5</b>
Aswan	96.7	94.4 - 98.9	<b>104.3</b>
Luxor	98.8	97.4 - 100*	<b>102.4</b>
Damietta	99.2	98.1 - 100*	<b>111.0</b>
Dakahlia	99.6	98.7 - 100*	<b>107.5</b>
Sharkia	97.5	95.5 - 99.5	<b>105.5</b>
Kalyubia	98.3	96.7 - 99.9	<b>123.2</b>
KafrEl-Sheikh	99.6	98.7 - 100*	<b>107.0</b>
Gharbia	97.5	95.5 - 99.5	<b>102.7</b>
Menoufia	97.9	96.1 - 99.7	<b>110.6</b>
Behera	98.8	97.4 - 100*	<b>108.7</b>
Ismailia	95.8	93.3 - 98.3	<b>103.9</b>
Red Sea	98.8	97.4 - 100*	<b>105.3</b>
New Valley	98.3	96.7 - 99.9	<b>99.8</b>
Matroh	97.9	96.1 - 99.7	<b>89.8</b>
South Sinai	99.6	98.7 - 100*	<b>108.2</b>
Total	98.2	98.1 - 100*	<b>109.8</b>

## DISCUSSION

Surveys that are commonly used to estimate vaccination coverage in developing countries include demographic and health surveys, multiple indicator cluster surveys, Expanded Programme on Immunization (EPI) cluster surveys and surveys based on lot quality assurance sampling.<sup>(14,15)</sup> The EPI cluster surveys have been used to assess coverage in supplementary measles or measles-rubella immunization activities. These surveys often include some evaluation of routine immunization, the

communication strategies that have been used and the reasons for non-vaccination.<sup>(16)</sup>

Egypt is moving in the direction to achieve the elimination of measles and rubella through high coverage (95% or more) with two doses of MR-containing vaccine to be maintained together with periodic follow-up vaccination campaigns. It requires a political will, stewardship by national authorities and the collaboration of different concerned agencies.<sup>(17)</sup> High quality cluster surveys are considered a routine component in monitoring the progress of immunization system within the context of the Global

Vaccine Action Plan. All supplementary campaigns should include a plan or budget for an independent coverage evaluation survey as a part of general monitoring and planning.<sup>(18)</sup> In the present survey, validation of the campaign coverage determined, by the recall of administration, was done by conducting a coverage evaluation survey over 26 Egyptian governorates.

The MR vaccine campaign achieved an overall coverage of 98.2% among children aged 9 months to less than 10 years.

Even with the high overall coverage rate, a proxy indicator of low immunization coverage or vaccine performance below target was observed in some districts in a couple of governorates as Port Said (93.3%) and Qena (93.8%), which might lead to "islands of low immunity" or pockets in the midst of high national vaccination coverage which pose high risk for MR transmission.

The primary cause of non-vaccination, in the present survey, was lack of awareness of the campaign. Most of the mothers reported interpersonal communication to know about the campaign including school staff.

A WHO review of the results of 13 coverage surveys conducted in 2012–2013, following 16 programmes of supplementary measles immunization was conducted in Africa. In 69% of the surveys reported, the supplementary immunization-coverage estimate based on the survey results was lower than that based on the corresponding, routinely collected administrative data. It showed that coverage surveys have become a regular component of supplementary measles immunization activities in the countries studied. Most of the reviewed surveys included some investigation of routine immunization services.<sup>(18)</sup>

In the current survey the administrative vaccination coverage provided by the MOH<sup>(12)</sup> was higher in all governorates than the reported coverage. This minor discrepancy could be explained by the fact that during the campaign, all school children in fifth primary were included despite many of them were above 10 years of age, even children 11 years of age were included., meanwhile, in the present survey only children below 10 years were included. Moreover, non-Egyptian children as Syrian and others present during the campaign were vaccinated as well.

The findings of the current survey were similar to the vaccination coverage survey in Moba, Katanga, Democratic Republic of Congo (DRC), 2013. The Democratic Republic of Congo has committed to eliminate measles by 2020. In 2013, after a large outbreak, Médecins Sans Frontières conducted a mass vaccination campaign (MVC), that revealed that the measles vaccination campaign in Moba in 2013 did not achieve the 95% coverage which was the target for vaccination campaigns to eliminate measles. Their

coverage estimates contrast with the estimated administrative coverage of the campaign (77%). This contrast highlights the importance of field-based coverage surveys for reliable estimates.<sup>(19)</sup>

This survey in Congo identified three main barriers to vaccination during the MVC: accessibility of the villages for vaccination teams, lack of EPI measles dose at nine months and the absence of families at the time of vaccination. Six percent of children were never vaccinated. The main reason for non-vaccination was family absence 68% (95% CI 58-78).<sup>(19)</sup>

## CONCLUSION & RECOMMENDATIONS

The current survey revealed that the MR vaccine campaign achieved an overall coverage of 98.2% among children aged 9 months to less than 10 years, compared to administrative vaccination coverage of 109.8%. Some clusters showed below target coverage in a couple of governorates as Port Said (93.3%) and Qena (93.8%). The most frequently mentioned cause was ignorance of parents about the vaccination campaign (43 children, 38.1%). Ill children during the campaign contributed to 14.2% of non-vaccinated children, despite the long duration of the campaign. Non-vaccination attributed to rumors about the vaccine represented 12.4% of the causes.

It is recommended therefore that the country program should be praised for its efforts in implementing the national campaign but should also consider strengthening and reinforcing of intra-campaign monitoring activities in order to take immediate corrective action during campaign days for areas that have not reached the target coverage.

Trainings for campaign monitors should emphasize the importance of identifying reasons for non-vaccination in order to appropriately respond to any concerns and strengthen future campaigns. The MOH and international partners should prioritize districts in which vaccination coverage was below the target especially Port Said and Qena. These districts need high quality targeted vaccination campaigns to close the potential immunity gaps.

A well-planned timely awareness strategy to promote the importance of immunization is required. Moreover, an emphasis on effectively disseminating campaign messages and reaching those unreacheds is fundamental.

Concerns of parents about adverse events of MR vaccine require training of physicians and vaccine providers to improve awareness and education of the target population. Moreover, messages about vaccine safety procedures should be developed and disseminated to alleviate vaccine safety fears.

Special strategies for overcoming challenges as lack of confidence in school health providers and

school vaccines, as reported, should be developed and deployed in future campaigns.

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