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A report of outbreaks of measles on the southern coast of Iran from 2009 to 2015

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Abstract

Introduction: Immunogenicity assessment figures of the measles vaccine is approximately 90%, and decreases over time. Therefore, the immunity level of measles vaccine is variable which can result in outbreaks of measles in a population. The aim of current study was to report the outbreaks of measles in Hormozgan province from 2009 to 2015.

Methods: This cross-sectional study was carried out in Hormozgan Province on the southern coast of Iran. The documented data of all cases suspected of measles are included in this study. We used a checklist including gender, age, area, place of residence, contact history, and vaccination status to extract required data. Data was analyzed using IBM SPSS statistics software version 21.0.

Results: Eight hundred fifty-one suspicious cases of measles were determined from 2006 to 2015. Of those, 135 infected cases were reported. Among patients, 49% were male, 79% were Iranian, 18% were Afghans, and 3 % were Indians or Pakistanis. Also, 31% of cases were reported from Bandar Abbas, 25% were reported from Minab, 18% from Qeshm, 17 % from Jask and other cases were reported from other areas of the Hormozgan Province. Thirty percent of the cases were reported from urban areas.

Conclusion: A high percentage of cases with measles in rural areas were reported in the areas which were covered by complete vaccination. This shows interruption of cold continuum. Also, increasing the number of under one-years-old cases reported, could be due to poor nutritional status of the children and insufficient immunization of mothers. Further studies are required for identifying the causes of cold continuum interruption. Further studies are required for the assessment of immunization in children and mothers and various vaccination protocols.

Keywords: Measles, Cold continuum, Outbreak

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1. Introduction

Measles is a common disease in children, and is responsible for a large number of deaths among children worldwide (1, 2). Vaccination against measles can significantly reduce the rate of infection among children (3). Loss of high levels of immunity against measles among children causes outbreaks (4). In the global meeting for children in 1990, some main objectives were determined to be followed by different regions of the world which included; 90% decrease in complication of measles, 95% decrease in mortality from measles, and eradication of measles (5). The deadline for reaching the objectives was the year 2000 for the USA, 2007 for Europe, and 2010 for EMRO countries (5). Vaccination is the main part of the measles eradication program (6, 7). In 2000, the WHO, UNICEF, the US Department of Health and Human Services and Centers for Diseases Control and Prevention (CDC) recommended improving the measles vaccination program and surveillance of the measles eradication program. One main strategy specified was the two times vaccination of children. According to the protocols, the first dose was injected in 12-15 months' children and the second dose was injected in 18-24 months' children and has continued since 2001 in Europe (8). In Iran, a global vaccination program was established using a Measles, Rubella (MR) vaccine for around 30 million of the 5-25 years-old population with the objective of measles eradication in 2003 (9). Afterwards, the vaccination program was changed to a Mumps, Measles, and Rubella (MMR) vaccine and was injected two times; once in 12 months after birth and then at 4-6 years of age. Later, according to the 7th edition of "Iran National Immunization Program", the time of the vaccination program changed to 12 months and 18 months after birth in 2009-2010. After a mass immunization campaign in 2003, the number of measles cases reduced significantly from 21 cases per 1,000,000 in 2003 to <1 case per 1,000,000 in 2006, 2007 and 2008, respectively in Iran (9, 10). However, several outbreaks in measles occurred in Hormozgan in 2009, 2010, 2012 and 2015. The general objective of the current study was to report the outbreaks of measles from 2009 to 2015. The specific objectives of the study were to report the outbreak(s) of measles in Hormozgan according to gender, age groups, nationality, living area, place of residence, contact history and vaccination status.

2. Material and Methods

This was a cross-sectional study conducted in 2015 in Hormozgan province on the southern coast of Iran. Hormozgan is known to have a hot and humid climate. The study sample included all definite cases of measles from 2006 to 2015. According to the 2009 National Guideline for Measles Surveillance in Elimination Phase, suspected cases are all individuals with fever, rash, cough, and conjunctivitis who should be reported to the Health Center of Hormozgan province. According to this guideline, for suspected cases, IgM serology for measles should be measured. Thus, in this study, we included those cases with positive serology for measles. The study tool was a checklist for each patient. The checklist included demographic information, vaccination status, history of contact with a suspected person, and area of report. To complete the checklists, the available data in the Communicable Disease Surveillance Unit of the Health Center of Hormozgan province were investigated. The study was approved by the ethics committee of Hormozgan University of Medical Sciences (Hormozgan, Iran). The information regarding patients was kept confidential. Also, the information was extracted without patients' names by using codes. Data was analyzed using IBM© SPSS© Statistics version 21 (IBM© Corp., Armonk, NY, USA). Descriptive statistics including mean, standard deviation, frequency and percentage were used for data analysis.

3. Results

Table 1 shows the frequency of suspected and confirmed cases of measles from 2009 to 2015 according to the information reported by the health system. As this table shows, from 2009 to 2015 there were 851 suspected cases of measles, while only 135 people were confirmed cases. We investigated the records of 851 suspected cases of measles, among which 135 definite cases were recognized. As table one shows, 49% of patients were males, 51% were females, 79% were Iranian, 18% were Afghans, and 3% were Indians or Pakistanis. Also, 31% of cases were reported from Bandar Abbas (the capital of Hormozgan Province), 18% were reported from Minab, 18% from Qeshm, 17% from Jask and other cases were reported from other areas of the Hormozgan. 30% of the cases were reported from urban areas, while others were from rural areas (70%). The information regarding the distribution of the patients based on their gender, nationality, place of residence, age, and history of contact with suspected patients is reported in Table 2. According to Table 3, from 2009 to 2015, there were 44 cases with adequate vaccination and 91 cases with inadequate or no vaccination. The most cases with inadequate or no vaccination were reported in 2015, 2010 and 2012, respectively. The most cases with adequate vaccination were reported in 2012, 2010 and 2015, respectively.

Table 1. Frequency of suspected and confirmed cases of measles in 2009-2015

Variable	2009	2010	2011	2012	2013	2014	2015	2009-2015
Vaccination	No	No	Yes	No	Yes	Yes	No	-
Suspicious	23	154	76	187	151	118	142	851
Positive	19	29	2	28	7	11	39	135

Table 2. Demographic information of the patients in 2009-2015 outbreaks

Demographic information		Year; n (%)							
		2009	2010	2011	2012	2013	2014	2015	2009-2015
Gender	Male	9 (47.4)	9 (31)	1 (50)	20 (71)	2 (29)	7 (64)	18 (46)	66 (49)
	Female	10 (53)	20 (69)	1 (50)	8 (29)	5 (71)	4 (36)	21 (54)	69 (51)
Race	Iranian	14 (74)	24 (83)	2 (100)	24 (86)	7 (100)	6 (55)	36 (92)	113 (84)
	Afghan	2 (10)	5 (17)	0 (0)	4 (14)	0 (0)	5 (45)	2 (5)	18 (13)
	Other Races	3 (16)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3)	4 (3)
Area	Urban areas	15 (78.9)	9 (31)	0 (0)	2 (7)	3 (43)	5 (45)	7 (18)	41 (30)
	Rural areas	4 (21.1)	20 (69)	2 (100)	26 (93)	4 (57)	6 (55)	32 (82)	94 (70)
Place of residence	Bandar Abbas	16 (84)	7 (25)	0 (0)	12 (43)	1 (14)	1 (9)	5 (13)	42 (31)
	Jask	0 (0)	16 (55)	0 (0)	0 (0)	0 (0)	1 (9)	6 (15)	23 (17)
	Minab	0 (0)	0 (0)	1 (50)	8 (29)	2 (29)	0 (0)	23 (59)	34 (25)
	Qeshm	0 (0)	3 (10)	1 (50)	6 (21)	3 (43)	8 (73)	3 (8)	24 (18)
	Other areas	3 (16)	3 (10)	0 (0)	2 (7)	1 (14)	1 (9)	2 (5)	12 (9)
Age group (year)	< 1	5 (26)	9 (31)	0 (0)	4 (14)	2 (29)	2 (18)	18 (46)	40 (30)
	1-5	9 (48)	5 (17.3)	1 (50)	6 (22)	1 (14)	0 (0)	4 (10)	26 (19)
	5-12	1 (5)	8 (27.6)	0 (0)	12 (42)	1 (14)	1 (9)	5 (13)	28 (21)
	> 12	4 (21%)	7 (24.1)	1 (50)	6 (22)	3 (43)	8 (73)	12 (31)	41 (30)
Contact history	Positive	9 (48)	18 (62)	0 (0)	14 (50)	5 (71)	4 (36)	28 (72)	78 (58)
	Negative	10 (52)	11 (38)	2 (100)	14 (50)	2 (29)	7 (64)	11 (28)	57 (42)
Total		19	29	2	28	7	11	39	135 (100)

Table 3. Vaccination status in patients with confirmed measles in 2009-2015

Vaccination status during the period (year)			Bandar Abbas	Jask	Minab	Qeshem	Other areas	Total
2009	Adequate		6	0	0	0	0	6
	Inadequate or no vaccination	<	5	0	0	0	0	13
		>1	6	0	0	0	2	
2010	Adequate		1	10	0	0	1	12
	Inadequate or no vaccination	<1	3	2	0	3	1	17
		>1	4	4	0	0	0	
2011	Adequate		0	0	1	0	0	1
	Inadequate or no vaccination	<1	0	0	0	1	0	1
		>1	0	0	0	0	0	
2012	Adequate		10	0	2	2	0	14
	Inadequate or no vaccination	<1	1	0	1	2	1	14
		>1	1	0	5	2	1	
2013	Adequate		1	0	0	0	0	1
	Inadequate or no vaccination	<1	0	0	0	2	0	6
		>1	0	0	2	1	1	
2014	Adequate		0	1	0	2	0	3
	Inadequate or no vaccination	<1	0	0	0	2	0	8
		>1	1	0	0	4	1	
2015	Adequate		0	2	5	0	0	7
	Inadequate or no vaccination	<1	2	2	12	1	2	32
		>1	3	2	6	2	0	

4. Discussion

During 2006-2015 four outbreaks of measles occurred in Hormozgan province. Since the immunization program in 2005, we have experienced four outbreaks - in years 2009, 2010, 2012, and 2015. As table 2 indicates, fewer cases were reported in 2011 and 2013 due to vaccination of the relatives of definite cases who were discovered by the health surveillance system. One of the priorities of the health system in Iran is to control the diseases that are preventable through vaccination. For reaching the objective of measles eradication, the vaccination coverage of > 95% is required (5). However, as mentioned, incomplete vaccination in some years, has been a major obstacle in reaching this goal, which leads to outbreaks of the disease in susceptible areas. Also, another issue is the arrival of refugees especially from Afghanistan and Pakistan where a low coverage of vaccination is considered (11). The arrival of refugees can increase the likelihood of an outbreak. In Bandar Abbas 78% of measles cases occurred in individuals without vaccination or with incomplete vaccination in 2009 and 2010 outbreaks, which were similar to European countries. Vaccination coverage of less than 95% of the population was the main cause of measles outbreaks in 2009, 2010, 2012 and 2015. Low vaccination coverage was also the main reason for observing an outbreak of measles in European countries in 2010. Furthermore, similar studies in American and Asian countries confirm the role of vaccination coverage (12, 13). However, the reported outbreak in European measles cases was fewer in areas with 99% vaccination coverage. Vaccination coverage was 89% and 84% in the first and second vaccination projects respectively in Europe. In this epidemic, between 7,000 and 10,000 cases were reported from France, Italy, and Switzerland. It is important to identify the spatial clusters of measles in order to eliminate measles (14). A similar epidemic occurred in 2006 in Germany and 1,749 cases were reported among which 14% had incomplete vaccination and 80% had no vaccination (4). The information about the vaccination coverage of the areas with high frequency of reported cases is helpful. Cases of measles are still being reported from European countries in spite of routine vaccination in childhood. One study in 2009, reported 12,132 measles cases from 5 countries (Romania, Germany, England, Switzerland, and Italy), among them, 210 were refugees. One fifth of the patients were more than 20 years old. Patients often had incomplete vaccination or reported no vaccination at all. Also, mortality in 5 cases was reported in this study (15). One cause of incomplete vaccination in Germany is that the vaccination is not mandatory in this country. This may also be the reason for the lower number of affected cases in Iran in comparison to Germany. In our study a large percentage of measles cases were reported from Jask. In the 2010 outbreak in Jask, 63% of measles cases and in the 2012 outbreak in Bandar Abbas, 83% of measles cases were reported in patients with complete vaccination, which shows the importance of maintenance of cold continuum for prevention of measles outbreak. Also, most cases were reported from one area with complete vaccination coverage. Unavailability of electrical power, isolation from populated areas, and inappropriate transportation may have interrupted cold continuum. However, another important cause is genetic mutations in the virus which causes outbreaks in a population with high vaccination coverage (16, 17). According to national protocol in 2008, the second vaccination dose changed from 4-6 years to 18 months, and children between 18 months to 6 years old were exited from active mandatory vaccination in the second phase (6). This may have been a cause of outbreak in 2009 and 2010 in Bandar Abbas. It is shown that two doses of measles vaccination are more effective than a single dose vaccination (18) and timely routine vaccination plays an important role in measles eradication (19). However, the fewer cases of measles in 2011 and 2013, is due to vaccination of the relatives and close contacts of definite cases discovered by health surveillance system. After the outbreak in 2009 and 2010, vaccination in close contact people and universal vaccination was done for all people in the areas with measles outbreak, and no cases were reported after the universal vaccination. One study in Peru confirmed that the efficacy of universal vaccination and the last case of measles occurred 3 weeks after outbreak response immunization (20). Other studies have confirmed the efficacy of outbreak response immunization (21). A large number of cases in recent outbreaks are children less than 1year old. This could be due to lack of protocol for their vaccination; assuming that they are not at risk of the disease because of maternal immunization. Prevalence of measles increased among children less than 1 year old after 2009, and includes 46% of measles cases in 2015 which is incompatible with hypothesis of immunity of the children less than 1 year against measles by mothers' antibodies. One study in the Netherlands in 2007 confirms our hypothesis and indicates that the duration of the immunity is until 3.5 to 5.5 months after birth (22). After each outbreak, a duration of 1 to 3 years with fewer cases of measles are reported, which is due to immunization of close contact persons in areas with definite measles cases, but this doesn't prevent outbreaks during the following years. Therefore, the coverage and immunogenicity of current vaccination protocol is in doubt.

5. Conclusions

A high percentage of measles cases in rural areas was reported in areas with complete vaccination coverage. This shows interruption of cold continuum. Also, increasing the number of less than 1 year old cases reported could be due to poor nutritional status of the children and insufficient immunization of the mothers. More studies are recommended for finding the causes of interruption of cold continuum. Also, further studies are required for the assessment of immunization in children and mothers. Moreover, it is suggested that vaccination protocols of measles should be considered and modified according to these findings.

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Conflict of Interest:
There is no conflict of interest to be declared.

Authors' contributions:
All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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