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Detection of Imported Measles Outbreak (Clusters) in Al-Buraimi Governorate during COVID-19 Pandemic: A Case Series Study

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Abstract

During the first wave of pandemic in 2020, the initial prodromal symptoms of COVID-19 were similar to vaccine preventable diseases like Measles apart from typical rash and probability of missing such cases during COVID-19 will lead to local spread of cases. The most significant risk lies in children below five years, especially unvaccinated expatriate children who contribute to imported cases of measles from highly endemic countries.

After initial confirmation of 3 cases in April 2020, this outbreak was epidemiologically investigated in Al Buraimi Governorate, Oman, which included data on clinical symptoms, exposure information, travel history, immunization, and history of contact with others. Among the positive cases, 75% were girls; 6 were Afghani nationals and 2 were Pakistani nationals. However, most cases were reported between Afghani nationals 6 (75%) due to their low vaccination status. Genotyping B3 was isolated, and the virus traced back to Pakistan as the country of origin.

In 2019, the Regional Verification Commission for Measles and Rubella (RVC), has declared Oman as a measles and rubella-free nation. The rationale of this study is to have a clear understanding of the events that led to the importation of genotype B3 measles outbreak in Al Buraimi Governorate, Oman, during initial phase of first wave of COVID-19 pandemic in April 2020 which highlighted the existence of vigilant surveillance system of the country.

The field investigation was done to confirm an outbreak and to prevent transmission by isolating the cases and vaccinating the unvaccinated children and lastly to make critical recommendations that should be applied to prevent similar outbreaks in the future.

Keywords: COVID-19, regional verification commission, measles and rubella

1. Introduction

Measles (also called rubeola) is a childhood disease caused by the Rubeola virus, which belongs to the genus Morbillivirus of the Paramyxovirus family (Maldonado, 2012; Moghadam et al., 2014; Weedon, 2010). The disease is highly contagious and spreads from person to person through airborne droplets from the nose, mouth, or throat of the patient (Fitzpatrick et al., 2018). Pathogenesis of measles begins with infection of respiratory epithelium. After lymph node infection, viremia occurs, followed by infection of other organs, including the skin, where Koplik spots appear before the more widespread rash (Perry & Halsey, 2004). Symptoms of the infection

may appear within 10–14 days after an individual is initially exposed.

The World Health Organization (WHO) has classified measles among the most lethal vaccine-preventable diseases in children (Moghadam et al., 2014). Studies have also revealed that measles accounts for 8% of all deaths from vaccine-preventable diseases worldwide. Based on WHO statistics, about 164,000 and 118,000 people died in 2008 and 2011, respectively, because of measles infection (Moghadam et al., 2014).

The basic reproductive rate (R_0) of measles is 12 to 18, meaning that each person with measles would, on average, infect 12–18 other people (Guerra et al., 2017; Moghadam et al., 2014). Measles has no specific treatment. Infected individuals usually recover from the illness within 14 to 21 days (Al-Qayoudhi et al., 2016). Children with malnutrition and immunocompromised conditions are most likely to suffer severe complications from measles. These complications may include blindness, encephalitis, croup, severe diarrhea, ear infection, and pneumonia (Al-Qayoudhi et al., 2016).

The World Health Organization (WHO) aims to eliminate the disease in recent years (Al-Owaidi, 2016). The virus can be eliminated due to the fact that humans are the only carriers of the virus, it can only be transmitted between humans, rarely mutates, and the existence of a highly effective vaccine that provides the most fundamental reason for eliminating the infection with Measles virus. Research has shown that the best time to administer a single dose of the Measles vaccine is between 9 and 12 months of age, when maternal immunity begins to wane (Moghadam et al., 2014). By introducing the vaccine currently, the success of immunity increases to 95 to 98%. However, experience has shown that, at the very least, high coverage of two doses of the vaccine is required to achieve the elimination. Therefore, a single vaccination technique may not be effective, and a second dose is recommended (Goodson et al. 2010). The introduction of double-dose vaccination has made vaccines more effective but has also increased their cost. However, to ensure that measles can be eradicated globally, the WHO urges nations to aggressively administer the vaccine.

In Oman, Measles cases have seen a drastic decrease in recent years. For example, during 1975-1982, more than 10,000 measles cases occurred annually, with a mortality rate of approximately 20–30% (Shyam et al., 2017). During the early nineteen eighties, Oman introduced the measles vaccine (MCV) into the Expanded Program on Immunization (EPI) at the age of nine months. This EPI program led to increase vaccination coverage of all the antigens in the immunization schedule to be more than 95% since 1995(Al Awaidy & Faraj, 2017; Shyam et al., 2017). Consequently, the ministry of health has, over the years, introduced various measures to eliminate measles, rubella, and Congenital Rubella Syndrome (CRS). For example, in 1994, a mass vaccination catch-up campaign targeted children between 9 months and 18 years with a coverage of 94% (Shyam et al., 2017). In the same year, the second dose of measles (MCV2) was introduced at the age of 15 months in the childhood immunization program. In 2006, the immunization schedule was changed from 9 and 15 months to 12 and 18 months (Al Awaidy, 2016). And in 2007, a campaign targeting the non-national students aged 15-18 years was conducted. It had a coverage rate of about 97%. This success could be attributed to Oman's defaulter retrieval system which shows the people who have missed their immunization, and the Effective vaccine management system. Figure 1 demonstrates a view of locally transmitted measles cases and vaccine coverage in Oman in the period from 1975 to 2017 (Shyam et al., 2017).

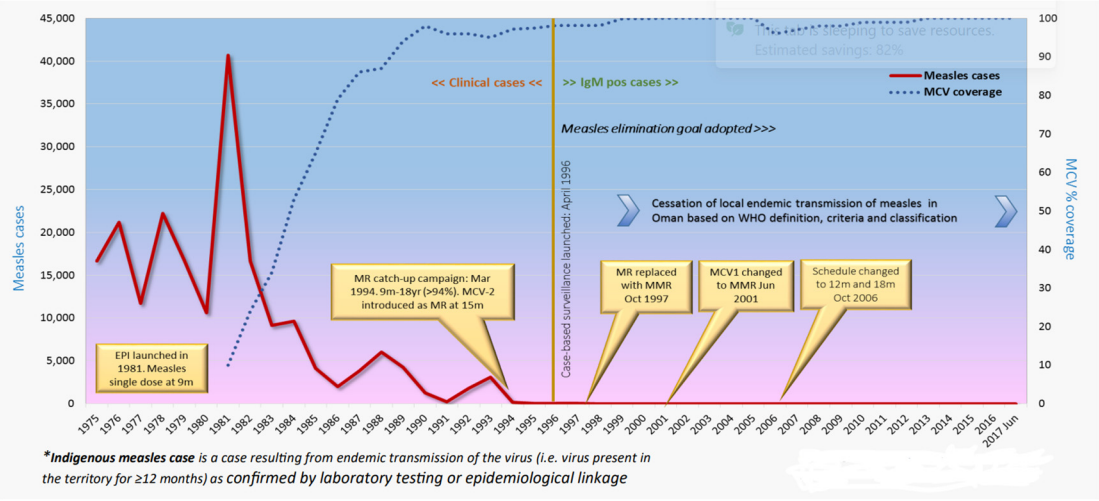

Figure 1. Indigenous* measles cases and vaccine coverage in Oman: 1975– 2017 (Jun) ((Shyam et al., 2017)

With these vaccination efforts, and a high-quality surveillance system, the incidences of measles had declined drastically, whereby in 2012, there was only one case per million persons, and zero cases for measles and rubella in 2013 (Al Awaidy, 2016).

The Regional Verification Commission for Measles and Rubella (RVC) has declared Oman as a measles and rubella-free nation in 2019. However, it is essential to note that despite the success in eliminating measles, the imported cases possess an epidemiological risk (Al Awaidy, 2016). This calls for increased sensitive case detection methods and immunization of unvaccinated non-Omani persons entering the country.

Recently, Al Buraimi Governorate has experienced imported measles outbreak. In April 2020, clusters of measles cases within 2 expatriate families, during first wave of COVID-19 pandemic, were attributed to importation related source of measles infection of B3 genotype.

2. Case Series Cluster Details:

2.1 Two Clusters in Afghani Family (Imported- Related)

Three children of Afghani nationality, with one being 15 years, and two children of 17 years old, were reported with confirmed measles serology between 16th to 19th of April. They had a typical history of fever and cough on the 10th and 12th of April, followed by a maculopapular rash without signs of dehydration or pneumonia. There was no history of recent travel (Figure 2).

It was discovered that these cases were linked to a similar kind of mild illness among three other siblings at home, one aged 11 years old and two aged 14 years old, within the last 2 weeks (clinically confirmed measles). All cases recovered with symptomatic treatment at home with no complications. Serological and PCR testing revealed that the children had Measles B3 genotype.

The family consists of the father who have 2 wives and a total of 12 children altogether. Among them only 2 children were completely immunized with 2 doses of MMR vaccine in Oman. All other children were born in Afghanistan except 2 children born in Oman and 1 child in UAE. Those who was born in Afghanistan, had no vaccination record and had not traveled recently.

A further investigation and interview revealed that the original source of the infection possibly from a family gathering that was held on March 20 by women and children primarily from Afghani and Pakistani families. According to their older children, two Pakistani children who attended the family gathering was having symptoms of fever and cough. These children had arrived from Pakistan on March 7, 2020.

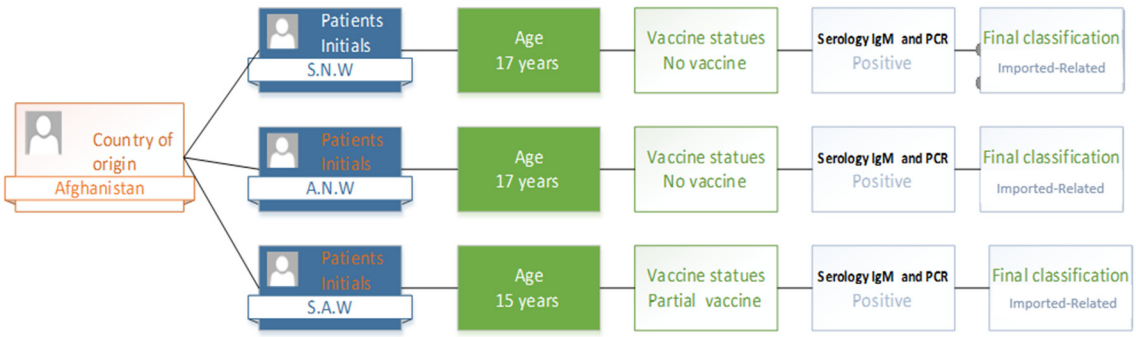

Figure 2. The contact tree shows the list of Lab confirmed cases: Afghani Children

2.2 Cluster in Pakistani Family: Imported

This cluster consists of 2 Pakistani children, aged 5 and 2 years old, who were detected during field epidemiological investigation after detection of Afghani clusters. They were the probable source for the Afghani cluster. The Family came from Pakistan on 7th March 2020 and then there was family/friends gathering at Afghani family home on 21st March 2020.

The Pakistani family was traced, and 2 children were serologically, and PCR confirmed as Measles B3 genotype linked to the same Afghani children (Figure 3).

This family comprised of 5 children among them only 1 child received 2 doses of MMR vaccine in Oman. Other 4 children had incomplete vaccination records with no MMR vaccine details as the family left Oman after initial vaccination at Birth. Family returned on 7th March with 2 children having symptoms and were tested positive as

they were probable sources for the Afghani family cluster.

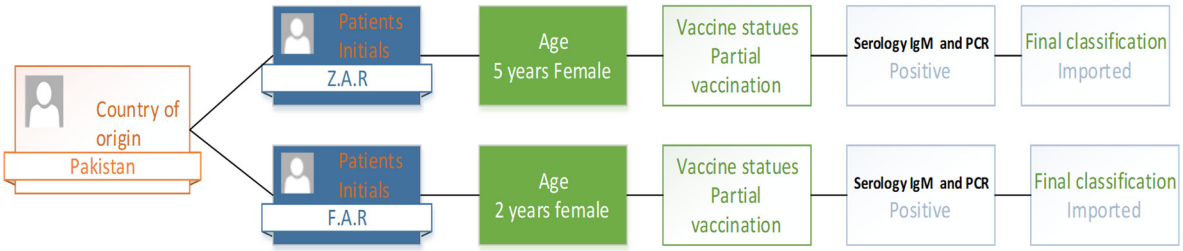

Figure 3. The contact tree shows the list of Lab confirmed cases: Pakistani Children

The demographic and clinical characteristics showed that the highest-risk age group was among 10–19-year-olds, as they make up to 75% of the total cases (6 of the 8 reported cases). Females were most affected (75%), 75% of the cases were from Afghanistan, while 25% were from Pakistan. All reported cases had fever, while 75% had rash. All patients recovered with no reported complications. However, about 62.5% had unknown vaccination status (5 cases) and 37.5% had incomplete vaccinations (3 cases). No reported cases among those with complete vaccination status. 62.5% of cases were confirmed by laboratory testing and 37.5% by clinical evaluation as shown in Table 1.

No one who had been fully vaccinated got measles. 62.5% was confirmed by laboratory and 37.5% by clinical evaluation as shown in Table 1.

Table 1. Demographic and Clinical Characteristics of Measles Cases (N=8), in Al-Buraimi, Oman, April 2020

Variables		Frequency	Percentage (%)
Age Group (Years)	0-4	1	(12.5)
	5-9	1	(12.5)
	10-14	3	(37.5)
	15-19	3	(37.5)
Gender	Female	6	(75.0)
	Male	2	(25.0)
Nationality	Afghani	6	(75.0)
	Pakistani	2	(25.0)
Symptoms (fever)	Yes	8	(100.0)
	No	0	(0.0)
Symptoms (maculopapular rash)	Yes	6	(75.0)
	No	2	(25.0)
Clinical Status (Outcome) (N=8)	Recovered	8	(100.0)
	Complication	0	(0.0)
Vaccination Status (N=8)	Unknown	5	(62.0)
	Partial	3	(37.5)
	Fully Vaccinated	0	(0.0)
Tested (N=8)	Yes	5	(62.5)
	No	3	(37.5)
Serologically confirmed (IgM) and PCR tested (N=5)	Positive	5	(100.0)
Diagnosis (N=8)	Clinically Confirmed	3	(37.5)
	Laboratory Confirmed	5	(62.5)

4. Discussion

Al Buraimi Governorate is a region in Oman that was separated from Ad Dhahirah Region in 2006. The governorate consists of three wilayats: Al Buraymi, Mahdah, and Al-Sunayna. Its headquarters is the Al-Buraimi town, which borders the United Arab Emirates, and for a long time, the city has served as an open border between these two countries. Based on 2019 data, the region has a total population of about 115,658 persons. This is a significant increase from 72,917 persons in 2003 and marks an average annual growth of 5.34% (Knoema, 2020). This population accounts for all alive Omani and expatriate populations.

The most significant risk lies in children below five years, especially unvaccinated expatriate children who contribute to imported cases of measles (Patel et al., 2008). However, Oman remains committed and on the right path to eliminating measles, rubella, and CRS. The key strategies implemented by Oman government to ensure that measles is eliminated include; ensuring high rates of vaccination coverage, establishing an active syndromic surveillance program which monitors case-based surveillance to measles (Al Awaidy, 2016), and high quality-surveillance system that is sensitive for CRS (Patel et al., 2008).

In 2016, there was an alarm from the national communicable diseases' surveillance, that noted a significant increase in measles cases (Health Launches National Strategic Directions and Introduction of New Vaccines - Media Center Display Page - Ministry of Health, 2022). Oman witnessed large clusters of measles lasting for several weeks during 2016 until June 2017. As a result of this outbreak, there was concerns as to whether or not the past gains in the elimination efforts will be compromised. Total 178 laboratory confirmed cases of measles were reported in 2016 and 2017 (June) in nine clusters (Shyam et al., 2017). The second phase National Immunization Campaign (NMIC) was launched in 2017 as part of containment measures, which targets people in the age group of 20-35 years (National Measles Immunization Campaign Phase 2 Launched Today - Media Center Display Page - Ministry of Health, 2022). This step was taken after measles serosurvey in 2016 which includes anonymous residual sera from Omani population by quantitative assay for measles antibody titer (IgG) identifying the target groups to be vaccinated (Shyam et al., 2017).

The campaign aimed to eliminate measles by mass vaccination, the most effective way to protect vulnerable people and interrupt Measles chain.

Newer developments include the introduction of new vaccines in the immunization program in august 2020. Thus, bringing the number of effective vaccines in the immunization program to 13, and achieving more than 99% coverage of all the vaccine doses (Health Launches National Strategic Directions and Introduction of New Vaccines - Media Center Display Page - Ministry of Health, 2022.).

The Regional Verification Commission for Measles and Rubella (RVC) has declared Oman as a measles and rubella-free nation. This was announced in May 2019 in Jordan during the launch of the National Measles and Rubella strategy to keep Oman free of these outbreaks. The summit also concluded that to ensure the country remains measles free; it is pivotal to maintain high vaccination coverage rates and to strengthen the national surveillance and immunization programs, as well as enhancing research and studies in this area (Health Launches National Strategic Directions and Introduction of New Vaccines - Media Center Display Page - Ministry of Health, 2022). In Oman, the non-Omani population comprises 45% of the population. Majority of the non-Omani population is from Asian countries where the measles elimination program has not been established or measles vaccine coverage is low (Shyam et al., 2017).

Through the National Fever and Rash surveillance system, the measles outbreak (clusters) in Al Buraimi were identified when three children presented to Al Buraimi Polyclinic with a history of fever, cough, and generalized maculopapular rash for six days.

This prompted an immediate field investigation, which revealed that these three children were exposed to other three siblings at home with similar symptoms within the last two weeks. Further investigations revealed that there was a recent family gathering in March 2020. Most of the family members who attended were Afghani and Pakistani. During the investigation, it was determined that two children came with flu-like symptoms, but no specific rash-like symptoms. These children came recently from Pakistan on 7th March 2020 and were considered as the probable sources of this outbreak that was confirmed by identical B3 strains isolated from the laboratory investigated cases. Both Afghani and Pakistani children (N = 5) were serological, and PCR confirmed between 16th and 19th April with genotype B3. Sequence of events that took place are shown in figure 4.

A single dose of MMR vaccine was given for all unvaccinated children and those without vaccination records. This action was taken to limit the spread of the infection in the community. Health care workers (9 staffs) who were exposed to the confirmed cases were at low risk as they received 2 doses of MMR vaccine during routine

HCWs vaccination, and they had taken all infection control and preventive measures effectively while dealing the cases.

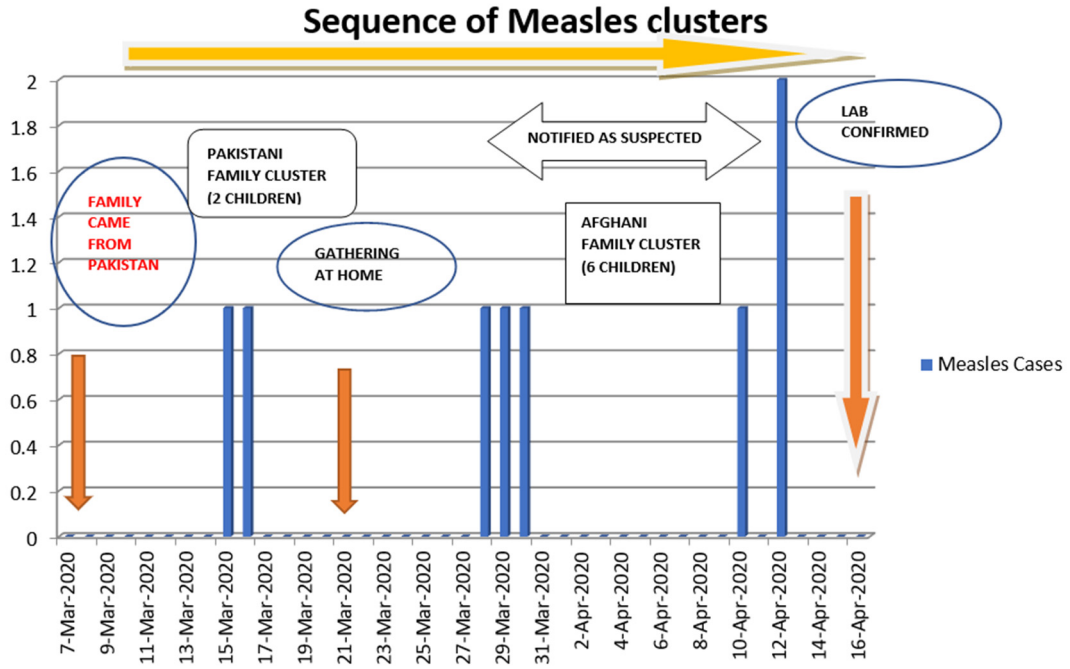

Figure 4. Graphic presentation of Sequence of Measles clusters among 2 expatriate families reported in April 2020

5. Conclusion

A vigilant surveillance system would help in preventing future outbreaks as well as to protecting the most vulnerable population in the community. This study also emphasizes the need for continued and maintained efforts of high vaccination coverage, timely investigation of reported positive cases, identification of clusters, linking them geographically or by time, and applying supplementary vaccination measures.

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Competing Interests Statement

The authors declare no competing or potential conflicts of interest.

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