



E-ISSN: 2320-7078  
P-ISSN: 2349-6800  
JEZS 2017; 5(4): 1655-1661  
© 2017 JEZS  
Received: 02-05-2017  
Accepted: 03-06-2017

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## Measles virus outbreak in district Karak, KP, Pakistan

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### Abstract

The present study was conducted to know the commonest age group, vaccination status, nutritional status and main complications in children admitted with measles in 14 different union councils of district Karak from 25-Feb-17 to 22-May-17. In this descriptive study, 170 patients (6 months to 9 years of age), with clinical diagnosis of Measles i.e. high grade fever, maculopapular rash, coryza, cough and conjunctivitis with its complications were included. Immunization status of the patients was checked by examining the EPI card where available or parental inquiry if EPI card was not available. Out of these 170 patients only 74(43.6%) were positive with measles in which males were 41(55.4%) and 33(44.6%) were females. Maximum number of children who had measles was between 6 months to 3 years of age, followed by 3-4 years. 12 children were under one year of age, and 34 children were between 1-3 years of age. Only 25 children were between 4-6 years of age and 3 children's were between 7-9 years of age. Out of 74 outbreaks there are 13(17.5%) vaccinated male and 13(17.5%) vaccinated female, and the unvaccinated male are 27(36.5%) and unvaccinated female are 21(28.5%).

**Keywords:** Measles, vaccination status, nutritional status, complications, Karak

### Introduction

Measles is an infectious disease caused by Morbillivirus (RNA virus with only one antigenic type), with a secondary attack rate in excess of 80%, that usually affects children [1]. The incubation period of measles is 9-12 days. The period of infectivity is 3-4 days prior to appearance and 4-6 days after the disappearance of rash. It usually does not kill children directly however, as a result of its associated immune suppression, measles can lead to lethal complications, such as pneumonia, croup, and diarrhea. Measles can also lead to lifelong disabilities, including blindness, brain damage, and deafness [2-3]. In developing countries, measles is a major cause of childhood morbidity and mortality due to underlying malnutrition and overcrowding [4]. Despite being a preventable disease, measles still remains a killer disease and causes over 1 million deaths worldwide each year [5]. According to the World Health Organization (WHO), measles is a leading cause of childhood mortality with 139,000 measles deaths globally in 2010, and 95% of all measles related deaths occur in low income countries with poor health infrastructure [6]. The global estimates for the year 2013 suggest that close to 0.14 million deaths were attributed to measles, accounting for nearly 16 deaths each hour [7]. Study findings have indicated that more than 50% of the global measles associated deaths were reported in India alone [8-9]. The World Health Organization (WHO) estimated that in 2004 there were 424,000 deaths due to measles in children under-5 years of age, of which a third (142,000) were estimated to be in India [10-11]. In Nepal identified about 82 000 cases and 900 deaths for all outbreaks in 2004. Pakistan one of the developing countries, has lost hundreds of lives to measles as a result of last year's outbreaks in many different areas [12]. In Pakistan 2012, there were 15,000 cases and 305 deaths [6]. The outbreaks started in Sind province of the country in December 2012 which killed more than 70 children and affected more than 500 children and then spread into many other parts of the country claiming further lives [13-14]. However in Punjab 94 deaths in the first half of year 2013 as compared to only 16 deaths in 2012. It was also very shocking that a maximum number of these deaths occurred in the capital city of the province, Lahore instead of any of another under developed rural areas [15].

Studies in West Africa [16-17] and the USA [18-19] have shown that nosocomial infection of measles is common among children.

In 1980, before widespread vaccination programs, measles was a cause of an estimated 2.6 million deaths each year globally. Wide spread immunization activities promoting measles vaccination had a major impact on reducing measles deaths. Global measles deaths have decreased by 79% from an estimated 6.5 lakhs in year 2000 to 1.3 lakhs in the year 2015. During 2000-2015, measles vaccination prevented an estimated 20.3 million deaths [20]. Mortality has declined dramatically since the introduction of a live attenuated vaccine. Prevention of measles using vaccination is still the most important task in developing countries [21]. A substantial proportion of measles related morbidity and mortality occur at the age younger than 9 months however, vaccination against measles is recommended at the age of 9 months in the developing countries. Maternal antibodies confer protection to infants against measles during the first few months of life [22]. The first dose of vaccine is recommended at 9-12 months of age and second at 16-24 months along with pentavalent vaccine [23]. However, if any child missed any of these doses, it could be given up to five years of age with an interval of at least 4 weeks between the two doses [24]. The aim of the current study was to find out the measles virus outbreak in district Karak, KP, Pakistan.

## Materials and Methods

### Study area

Karak is the North-South district of KPK. It is situated at 70.40° to 71.30° at longitudes 32.48° to 33.23° north latitudes. The total area of district Karak is 3372 sq-km. the total population 4, 30,000. Between 1940 and 1982 it was part of District Kohat, but on July 1, 1982, it has been upgraded is an independent district. Topographically Karak consists of broken hills and some 600–1400 meter above the sea level. Karak is the most literate and richest city of plenty deposits of oil, gas, uranium and salt in Pakistan which have a vital role in the economy of the country. The climate of district Karak hot in summer and very cold in winter, it is a semi-arid region.

In the present investigations, the measles cases were defined according to the WHO criteria [25], or as the combination of fever and rash. This study was conducted at the general headquarter hospital and civil hospital of district Karak, from January, 2017 to May, 2017. Six months to 9 years old children with measles were hospitalized and enrolled in the study. Infants below 6 months were not included in the study because of protection from maternal antibodies. Measles in these children was diagnosed on the basis of fever, maculopapular eruptions lasting for 3-4 days along with cough, runny nose and conjunctivitis. Complications associated with measles in these children were documented like Pneumonia, diarrhea, stomatitis, conjunctivitis and encephalitis. Some rare complications like myocarditis, pulmonary TB and laryngitis were also documented. To obtain blood samples for laboratory testing, for measles immunoglobulin (IgM) antibodies were performed by the NIH in Islamabad [26-27]. A comprehensive house-to-house survey was also conducted for the “active case finding” by using a pre- tested questionnaire. Information was collected on demographics, disease notification, clinical presentation,

and vaccination status and disease outcome. Information collected was based on respondents’ recall, and vaccination card if present. Apart from active case finding, the deaths were also verified by visiting the addresses of deceased children. Cases were defined by the WHO-recommended standard case definition for suspected measles: fever, rash, and at least one of the following-cough, conjunctivitis, or coryza [26]. WHO recommends that 5-10 clinical specimens should be collected for serologic testing at the beginning of an outbreak to confirm the measles virus as the cause [27].



Fig 1: Map showing district Karak.

## Results and Discussion

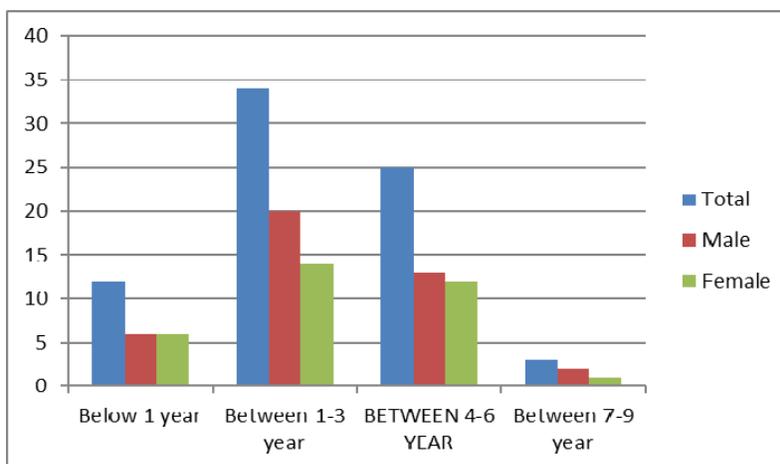
Measles is mainly the disease of the childhood and the current study further strengthens this fact with the observation that more than 90% of measles cases were less than 10 years of age. A total of 174 paediatric patients with diagnosis of measles were included in the study, out of these total 74(43.5%) cases positives and 96(56.5%) cases were negative, including 05 deaths. In the measles surveillance system, every patient with fever, maculopapular rash, and cough, coryza, or conjunctivitis, was considered to be a suspected measles case. The main symptoms of the measles cases were pneumonia among 94.5% cases (n=70), diarrhea among 87.7% cases (n=65), Encephalitis among 17.5% cases (n=13), Corneal ulcers among 12.1% cases (n=09), otitis media among 2.7% cases (n=02), Flaring of Tuberculosis among 13.5% cases (n=10), Thrombocytopenia among 1.3% cases (n=01), Myocarditis among 5.4% cases (n=04), fever among 100% cases(n=74), coryza among 100% cases (n=74), cough among 100% cases (n=74) and rash among 100% cases (n=74) followed by conjunctivitis among 95% (n=71). A recent study in Karachi of the WHO Integrated Management of Childhood Illness case definition for measles found that it predicted measles only 75% of the time, and that many suspected measles cases had Dengue fever [28].

**Table 1:** Regional based distribution of measles.

S. No.	AREA	No. of Measles cases	No of +VE (%)	No of -VE (%)	Death
1	Karak City	30	14(46.6%)	16 (53.4%)	02
2	Sabirabad	05	02(40%)	03(60%)	
3	Godi-Khel	16	09(56.3%)	07(43.7%)	01
4	Takht-e-Nasrati	20	09(45%)	11(55%)	
5	Ahmad abad	10	04(40%)	06(60%)	
6	Metakhel	17	06(35.2%)	11(64.8%)	
7	Latamber	03	01(33.4%)	02(66.6%)	
8	G.M khel	13	06(46.1%)	07(53.9%)	
9	Jandri	09	03(33.4%)	06(66.6%)	
10	Esakchantra	10	05(50%)	05(50%)	
11	PalosaSar	09	02(22.3%)	07(77.7%)	
12	SarajKhel	08	03(33.4%)	05(66.6%)	
13	Chokara	02	00(00%)	02(100%)	
14	Miaki	18	10(55%)	08(45%)	02
	Total	170	74(43.6%)	96(56.4%)	05

**Table 2:** Gender-based distribution of measles.

S. No	Age in years	Male	Female	Total
1	Below 1-year	06	06	12
2	1-3	20	14	34
3	4-6	13	12	25
4	7-9	02	01	03
Total		41	33	74

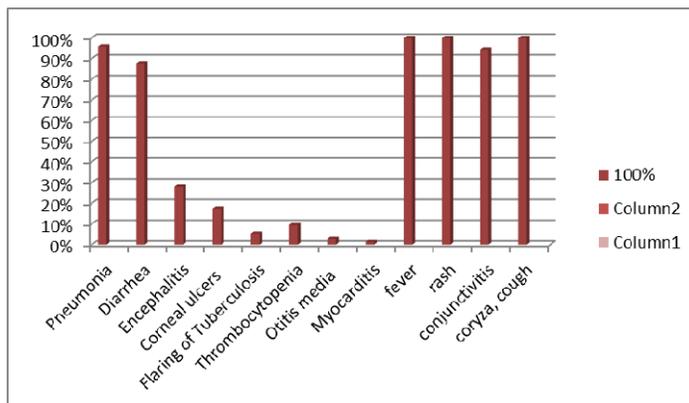


**Fig 2:** Age distribution among patients with an attacking rate (n = 74).

S. No.	Age in years	Total number in age group	Total No. of measles cases	Attack rate (%)
1	Below 1-year	41	12	41.3(%)
2	1-3	56	34	65.3(%)
3	4-6	52	25	51(%)
4	7-9	21	03	16.6(%)
Total		170	74	44%

**Table 3:** Complications Associated with Measles.

S. No	Complications	Total	No (%)
1	Pneumonia	71	95.9%
2	Diarrhea	65	87.8%
3	Encephalitis	20	28%
4	Corneal ulcers	13	17.5%
5	Flaring of Tuberculosis	04	5.4%
6	Thrombocytopenia	07	9.4%
7	Otitis media	02	2.7%
8	Myocarditis	01	1.3%
9	fever	74	100%
10	rash	74	100%
11	coryza, cough	74	100%
12	conjunctivitis	70	94.5%

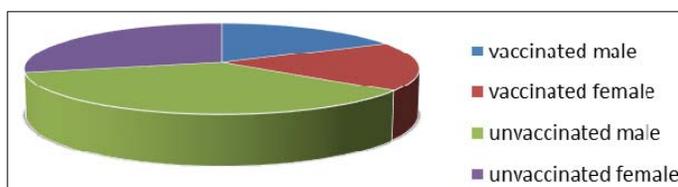


**Table 4:** Vaccination Status (%) n=74.

Vaccinated male	13(17.5%)
Vaccinated female	13(17.5%)
Unvaccinated male	27(36.5)
Unvaccinated female	21(28.5%)
Total	74(43.5%)

**Table 5:** Number of vaccine doses received by vaccinated (%) n=26.

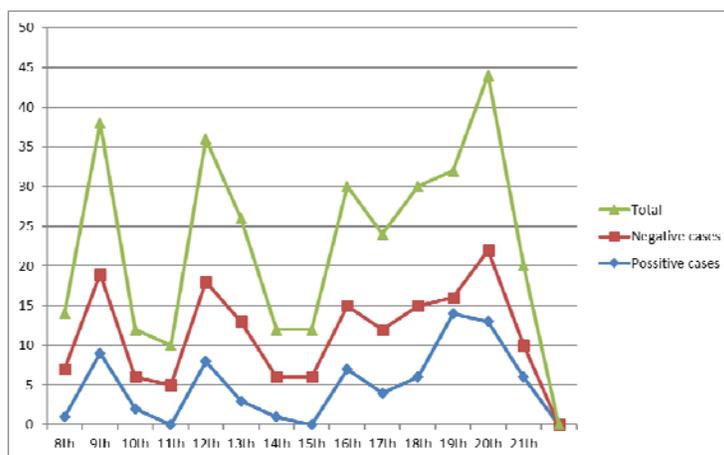
Single dose (M)	01(3.8%)
Double dose(M)	12(46.2%)
Single dose(F)	03(11.5%)
Double dose(F)	10(38.5%)



**Fig 3:** Number of male and female vaccinated and unvaccinated

**Table 6:** Week wise distribution from 25-Feb-17 to 22-May-17.

Weeks	Total cases	+ive No. of measles cases	-iveNo. of measles cases
08th	07	01	06
09 th	19	09	10
10 th	06	02	04
11 th	05	00	05
12 th	18	08	10
13 th	13	03	10
14 th	06	01	05
15 th	06	00	06
16 th	15	07	08
17 th	12	04	08
18th	15	06	09
19th	16	14	02
20th	22	13	09
21th	10	06	04
Total	170	74	96



**Fig4:** Weekwise distribution from 25-Feb-17 to 22-May-17.

In district Karak 14 different regions where the measles cases were found from [25-Feb-17] to [22-May-17]. Majority of the Measles cases was detected through the active search in the community during house to house survey. The highest measles (30) cases found in the Karak city out of these 14(46.6%) are positive and 16(53.4%) are negative, including 2 deaths. Similarly in Sabirabad, Godi-Khel, Takht-e-Nasrati, Ahmad abad, Metakhel, Latamber. G.M khel, Jandri, Esakchantra, Palosa Sar Miaki, Chokara, and in SarajKhel the total number of positive measles cases were respectively(02(40%), 09(56.3%), 09(45%), 04(40%), 01(33.4%), 06(35.2%),01(33.4%), 06(46.1%), 03(33.4%), 05(50%), 10(55%), 03(33.4%), 00(00%), 02(22.3%). Measles is much more common in children with malnutrition because of their reduced immune responses, making them vulnerable to viral infections like measles [29-30]. Table 1-6 shows the cases among children, total 74 measles outbreaks out of which 41 (55.4%) were boys and 33(44.6%) were girls. In our study 41 cases of children under 1-year, out of these 41 cases, 12 cases are positive including (6 boys and 6 girls), while 56 children's are between 1-3 years having 34 measles affected including (20 boys and 14 girls). Between 4-6 years there are 52 cases having 25 measles outbreaks, including 13 boys and 12 girls. Between 7-9 years old there are 3 positive cases out of 21 having 2 boys and 1 girl respectively. In this study the commonest age group affected by measles is between 6 months – 3 years, followed by 3-4 years of age compared to other studies performed in different countries including Pakistan [31-32]. The measles Attack rate is higher in between 1-3 years children's (65.3%) while in Below 1-year the attacking rate is (41.3%), and in between 4-6 years the rate is (51%), and 7-9 years children's the attacking rate is(16.6%). In the present study a significant proportion of measles cases developed complications and were admitted in hospital. Majority of patients were over 1-3 year of age. Mean age of the patients was between 20-25 months. Similar results have been reported by Imran Q *et al.* [33] where mean age was 23 months. Studies from West Bengal, India and Thailand have shown similar results [34-35]. In India, in 2010, among 8,984 measles patients from laboratory-confirmed outbreaks, 7% were aged <1 year, 41% were aged 1–4 years, 37% were aged 5–9 years [36]. Similar findings were observed from district Bajura of Nepal where 97% of them were under 15 years of age [37]. There is no specific antiviral treatment for measles and vaccination remains the most effective way to prevent

measles infection. Live attenuated measles virus vaccine should be given at 9 months and then at 12 months. The current ACIP recommendations for routine vaccination for children indicate a first dose of MMR at 12-15 months of age with a second dose at school entry (4-6 years) [38].

In our study in total of 170 cases only 74 patients are with measles outbreaks in which 26(35.1%) patients have been measles vaccinated and 48(64.9) % were unvaccinated. Among 26 vaccinated patients 13 were boys and 13 girls, and among 48 unvaccinated children's there were 27 boys and 21 girls. Among 26 vaccinated patients only 22(84.6%) patients had received two doses of measles vaccine and 04(15.4%) had only one dose of measles vaccine received. Lee MS *et al.* reported that two dose vaccination, comparing with one-dose, had a significantly higher seroprevalence and slightly longer half-life of measles IgG titers but the mean measles IgG in the two groups did not differ significantly [39]. In this study 35.1% of children with measles had measles vaccination while the percentage is high 97% in other studies conducted in Pakistan (Rawalpindi and Lahore) [40-41]. According to WHO Measles immunization coverage (MCV) among one year old children in Pakistan was 59% in 2002 and has reached to 80% in 2009 [42]. According to a report by Government of India in 2015, State with high percentage of immunization sessions where all vaccines were not available were Uttarakhand (45.5%), Rajasthan (42.9%) and Maharashtra (42.2%) [43]. Negligence among parents is also one of the main reasons of lower vaccination coverage among children vaccinated [44]. The RI status of entire country is very low according to Pakistan Health & Demographic Survey (PDHS) 2012-13 report; it is 47.45% for the country and is just 16.4% in Baluchistan [45]. In our study in total of 170 cases 74 were positive cases including 5 death cases. The epicure [Figure1-5] shows that the outbreak started from the 08 week of Feb-17 and continued until 3rd week of the May-17. Peak of the outbreak was in 19<sup>th</sup> and 20<sup>th</sup> week. Maximum number of cases occurred in between 9<sup>th</sup> 12<sup>th</sup> 18<sup>th</sup> 19<sup>th</sup> and 20<sup>th</sup> week of the episode, which are respectively (19, 18, 15, 16, and 22 cases), out of 19 only 09 cases are positive and out 18, 15, 16 the positive cases are respectively 08, 06, 14 cases. In 18<sup>th</sup> week only 22 cases are reported in which 13 cases are positive and 09 cases are negative. No further positive cases were reported in Karak regions in 11<sup>th</sup> and 15<sup>th</sup> weeks following the last case reported in 22-May-17 shown in Fig.1-5.



Fig 5: Measles virus shown in images.

## Conclusion

Most of the children with measles were documented in the lowest age group 1-5 years. The commonest complications in these children are pneumonia, diarrhea, encephalitis, corneal ulceration, which leads to significant morbidity and mortality especially in malnourished children. There is a need to

improve the nutritional status of the children and good coverage for the measles vaccine. The EPI needs to be strengthened. Surveillance system for vaccine preventable diseases (VPDs) should be strengthened to prevent such outbreaks.

**Acknowledgement**

I am immensely thankful to Hameed Ur Rehman (Department of Chemistry, KUST) for their help in practical work.

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