

## ORIGINAL ARTICLE

## MEASLES IN VACCINATED CHILDREN 1.5 TO 3 YEARS OF AGE IN RURAL COMMUNITY OF DISTRICT PESHAWAR, PAKISTAN

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**Background:** In many developing countries measles is a leading cause of childhood morbidity and mortality. Despite of vaccination thousands of children have been infected by measles virus during last couple of years in Pakistan. The objective of this study was to determine the measles vaccination coverage rate and frequency of measles among vaccinated children of age 1.5–3 years in rural community of district Peshawar. **Methods:** The cross-sectional study was carried out among 385 children aged 1.5–3 year of rural community of Peshawar. After taking informed consent from parents/guardians a predesigned questionnaire was filled. Evidence of vaccination and measles history was taken by vaccination card, doctor prescription and parent/guardian recall. Data was gathered and analysed by using SPSS-16. **Results:** Of the 385 children, 361 (93.7%) were vaccinated against measles at 9 month. It was found that 27 (7.48%) vaccinated children had measles history of which 23 (6.74%) were infected after 9 month vaccination. One hundred and ninety-two (49.8%) children were vaccinated both at 9 and 15 months, and 14 (7.29%) dual vaccinated children had a measles history, 9 among them (4.68%) were infected after taking both measles doses. **Conclusion:** The occurrence of measles among vaccinated children and low coverage rate of second dose of measles vaccine raises many questions about vaccination program and its efficacy. Further studies are needed to evaluate the influence of other predisposing factors like vaccine quality, manufacturer, supply, cold chain, handling, nutritional status of children and technical approach, on measles vaccine efficacy.

**Keywords:** Measles, vaccination, rural community, vaccination cards, Peshawar, Pakistan

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## INTRODUCTION

Measles a highly contagious and infectious disease is the main cause of child mortality and morbidity across the world especially in developing countries.<sup>1</sup> Measles infection has been controlled by vaccination in developed countries like United States and Europe.<sup>2</sup> However, measles is still affecting the developing countries due to insufficient coverage and improper handling of vaccines.<sup>3</sup>

Immunization in children against vaccine preventable diseases (VPDs) has been started by WHO in 1974, and in Pakistan it was initiated during 1978.<sup>4</sup> In general the vaccine coverage against vaccine preventable diseases in Pakistan ranged between 56–88% in 2011 and 2012, which greatly varied among various populations of different provinces.<sup>5</sup>

Number of measles outbreaks with high morbidity and mortality has been observed in various parts of Pakistan. These cases of measles appeared in different cities of Sindh Province by the end of 2012, which later spread in other cities of Punjab and Khyber Pakhtunkhwa.<sup>6,7</sup>

The main factors of these outbreaks were vaccination failure due to several reasons i.e. malnutrition and vitamin-A deficiencies, mis-handling of vaccines, low vaccination coverage, poor

vaccination facilities in remote and rural areas, and lack of immunization awareness among parents due to lower levels of education in various areas of the country.<sup>6-8</sup>

In developing countries the measles attack rates are high among children greater than twelve months of age with more severity in vitamin A deficient children. Pneumonia is the commonest complication of measles.<sup>9</sup>

In Pakistan measles vaccine was given in a single dose at nine months,<sup>10</sup> but later a booster dose at 15 months was introduced in Expanded Program on Immunization (EPI) in 2009<sup>11</sup>. Keeping in view the measles immunization strategy, measles outbreak in Pakistan, lack of immunization awareness and poor vaccination facilities in remote and rural areas, the present community based study was carried out in rural areas of Peshawar to determine the occurrence of measles in children inspite of vaccination.

## MATERIAL AND METHODS

This community based descriptive cross-sectional study was carried out in rural area of Peshawar during September 2013 to September 2014 among 385 children of age range 1.5–3 years. It was a community based household study in which atleast 90 children from each village Budhni, Dalazak, Jhagra and Timerpura were included. Samples were

collected through non probability purposive sampling technique. Pakistan Medical Research Councils trained staff and researchers carried out field work in rural community of Peshawar. After taking informed consent from parents/guardians, a predesigned questionnaire was filled by taking evidence of measles vaccination and measles disease from vaccination card and doctor's prescription and history of measles from parent/guardian recall. The data thus collected was analysed by using SPSS-16.

**RESULTS**

A total of 385 children of age range 1.5–3 years were included in the study. The male to female ratio was 1:1. Among 385 children 86 (22.3%) parents/guardians showed vaccination card as evidence of vaccination of their children while 299 (77.7%) provided verbal information. Study showed that 361 (93.7%) children were vaccinated against measles at 9 months and among them 192 (49.8%) children also received the second dose of measles vaccine at 15 months. (Table-1) It was found that 27 (7.48%) children had a history of

measles since birth, while 23 (6.74%) out of 27 measles cases were infected after 9 month vaccination. Among 192 dual dose vaccinated children 14 (7.29%) children had measles history since birth and 9 (4.68%) out of 14 were infected after taking both measles vaccine doses. Almost a similar pattern of infectivity was observed in both gender (Table-2 & 3) but in males measles infectivity slightly declined from 6.74–3.06% after taking both doses of measles vaccine.

Study showed that among dual measles vaccinated children 34 (8.8%), 32 (8.3%) and 125 (32.4%) children were vaccinated in Hospitals (BHU, THQs), dispensary and EPI centre respectively (Table-4).

Result showed that 3.1% vaccinated children from dispensary and 6.4% EPI centres vaccinated children got measles infection in spite of dual doses of vaccination. None of the children vaccinated from hospitals reported measles infection.

**Table-1: Measles vaccine coverage rate at 9 & 15 months**

Gender	Number of Children	Number of 1 <sup>st</sup> dose (9 months) vaccinated children	Number of children continued 2 <sup>nd</sup> dose of measles vaccine at 15 months
Male	192	178 (92.7%)	98 (51%)
Female	193	183 (94.8%)	94 (48.7%)
<b>Total</b>	<b>385</b>	<b>361 (93.7%)</b>	<b>192 (49.8%)</b>

**Table-2: Measles infection among measles first dose (9 months) vaccinated children**

Gender	Number of first dose vaccinated children	Total reported cases of measles infection	Number of measles cases before vaccination (Age <9 months)	Number of measles cases after vaccination (Age >9 month)
Male	178	15	3 (1.68%)	12 (6.74%)
Female	183	12	1 (0.55%)	11 (6.0%)
<b>Total</b>	<b>361</b>	<b>27</b>	<b>4 (1.1%)</b>	<b>23 (6.37%)</b>

**Table-3: Measles infection among measles dual dose (9 & 15 months) vaccinated children:**

Gender	Number of measles dual dose vaccinated children	Total reported cases of measles infection	Number of measles cases before vaccination (Age <15 months)	Number of measles cases after vaccination (Age >15 months)
Male	98	7	4 (4.08%)	3 (3.06%)
Female	94	7	1 (1.06%)	6 (6.38%)
<b>Total</b>	<b>192</b>	<b>14</b>	<b>5 (2.6%)</b>	<b>9 (4.68%)</b>

**Table-4: Frequency of Measles infection among dual dose vaccinated children distributed with respect to place of vaccination**

Place of Vaccination	Number of Vaccinated children	Number of measles cases after vaccination
Hospital	34	0 (0%)
Dispensary	32	01 (3.1%)
Vaccinator (Home)	01	00 (0%)
EPI Centre	125	8 (6.4%)
<b>Total</b>	<b>192</b>	<b>9 (4.7%)</b>

**DISCUSSION**

The study was carried out in rural community to find out measles morbidity cases among children inspite of vaccination and to determine measles vaccination coverage rate in rural area of city Peshawar. Measles coverage rate in Pakistan has been reported less than 80% in USAID research and development report 2012.<sup>6</sup> This study showed almost 94% coverage rate of measles vaccine at 9 month but its coverage

decreased almost 50% at 15 months, possibly because of long follow-up vaccination gap. In a similar kind of study in Karachi Pakistan, 9 month vaccination coverage was 78% while 15 month measles vaccination coverage was 12%.<sup>12</sup> After couple of years continuous intervention has raised the coverage rate but still long way to go in case of 15 month measles dose. Parents showed negligence due to long 6 months vaccination gap for second measles vaccine dose. Present study showed that 6.37%

children had measles inspite of single dose measles vaccination. However in female vaccinated children the infection rates were high (6.38%) inspite of 15 month booster dose but in male vaccinated children the infection rate was seen to decline to 3.06% (Table-3). The main difference is the possibility of nutritional fulfilment of male children which results in better immunity of male child as compared to female child. The effect of supplementary vaccination in children was determined by testing in two different cities of Punjab. A total of 871/1053 (82.71%) children from Faisalabad and 647/813 (79.58%) children from Jhang were found vaccinated either with single or dual dose of measles vaccination. Out of these 264 blood samples from vaccinated and 100 samples from non-vaccinated children were collected randomly and analysed for the presence of anti-measles IgG antibodies. Only 73.48% of vaccinated children developed humeral immune response as detected through ELISA. The prevalence of anti-measles IgG antibodies from samples collected from male children was higher as compared to female children.<sup>13</sup> This indicated that the protection against measles was not optimum according to WHO standards.<sup>14</sup> In another study it has been reported that risk of measles and level of anti-measles IgG antibodies was observed high in female children than male.<sup>15</sup>

Effectiveness of measles vaccine mainly depends on temperature, it is the most heat labile vaccine therefore measles vaccine must be stored within the temperature range recommended by manufacturers (2–8 °C) to ensure that it remains potent. The vaccination cold chain refers to all the materials, equipment and procedures involved in maintaining vaccine as according to manufacturer instruction.<sup>16,17</sup> In June 2009 vaccine storage related clinical audit in general practices and NHS trusts was carried out and final report was shared with National patient safety agency (NPSA) which showed that childhood vaccines had been stored incorrectly in a general practices which had resulted in an extensive vaccination recall.<sup>18</sup> This study explored the importance of place of vaccination in rural areas of Pakistan where power supply remained shed off for more than 12 hours daily. Maintaining the cold chain in these situations is very difficult. Study showed that 125 children took both measles vaccination doses from EPI centres, among them 8 children got infected from measles in spite of vaccination. EPI centres found in rural areas are badly facing the cold chain problem as compared to hospitals especially in summers because of long duration of load shedding. Another similar study showed that 39% patients admitted in a hospital of Peshawar were measles

vaccinated.<sup>19</sup> It raised question on the efficacy and quality of measles vaccines.

This study has some limitations like its non-exclusion of the undeveloped immune cases due to nutritional deficiencies in children and measles mortality cases to find the exact figure of measles occurrence in children of rural community inspite of vaccination.

It is therefore recommended that reduction in measles cases in vaccinated children can only be achieved by properly maintaining the cold chain according to manufacturer instruction. It is also necessary to supply certified vaccine with manufacturer name, lot number and quality control with vaccine potency certificate. The EPI centres must be instructed to follow the quality control while handling measles vaccine. A multicentre community based study will be more fruit-full and meaningful to address the exact mortality and morbidity cases of measles and sero-prevalence of measles antibody in nutritional deficient vaccinated children.

## CONCLUSION

Measles is common in vaccinated children, an optimum response to measles vaccination has not been observed. The occurrence of measles among vaccinated children and low coverage rate of second dose of measles vaccine raises many questions about vaccination program and vaccine efficacy. Further studies are needed to evaluate the influence of other predisposing factors like vaccine quality, its supply, cold chain, handling, nutritional status of children and technical approach on measles vaccine efficacy.

## AUTHOR'S CONTRIBUTION

AK: Conceptualization of study design, data collection, write up, corresponding author. OU: Proof reading, data interpretation. A: Data collection. IA: Data analysis

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