Original Article

RISK FACTORS ASSOCIATED WITH THE OUTBREAK OF MEASLES IN LAHORE, PAKISTAN

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Abstract

In Pakistan, three consecutive epidemics of measles in 2012 – 13 affected many thousands of children.

Objectives: To determine the risk factors associated with the outbreak of measles in Lahore.

Methods: A population based case-control study with 1:1 case to control ratio was conducted in Lahore. Purposive Sampling was done.

Results: Out of 100 subjects 50 were cases and 50 were controls. Demographic characteristics were described. The risk estimation was done by Odds ratio and 95% confidence intervals. Logistic regression analysis was employed at significance of alpha 0.05. Among cases 89% children > 9 months of age, 57% males and 43% females came from highly populated areas with lack of vaccine availability (75%), mostly belonging to middle socioeconomic status (83%) and educated families (63%). Fifty five percent were vaccinated against measles from hospital or dispensary and few from mobile teams. 79% had history of travel to epidemic areas and history of breast feeding was present in 66%. Coexisting illness along with measles was present in 30% and 28% had Vitamin – A deficient diet. Twenty four percent parents showed lack of confidence in immunization program. Nineteen percent measles patient's mothers were sick and treated during pregnancy. The lack of cold chain, lack of awareness of expanded program of immunization, and malnutrition were found statistically significant.

Conclusion: The lack of Expanded Program of Immunization, transmission from surroundings and coexisting illness were found significant in measles epidemic.

Key words: Measles, risk factors, contagious, preventable disease, immunization, transmission.

Introduction

Mason WH (2001) described measles as an airborne contagious disease caused by Rubeola virus particularly dangerous in children. It was a major cause of death in children belonging to developing countries.[1] World Health Organization (2010) had reported the incubation period of measles was usually 8 – 12 days.[2] The prodromal symptoms included fever, cough, runny nose or conjunctivitis progressing to generalized rash with Koplik's spots inside the mouth. Serological tests could be done to confirm. The period of infectivity was considered to be four to five days following the onset of the rash. Vitamin A deficiency, pregnancy, immunodeficiency were described as risk factors for measles infection. Major complications were bronchitis, encephalitis, otitis media and pneumonia. In

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children analgesics, bed rest, humidified air and vitamin A supplements were known to lessen the severity. Routine immunization was found highly effective against measles.[3]

A number of research studies have been conducted on this disease and factors associated with its spread. In each case, the respondents represented all socio-demographic characteristics such as age, gender, education levels and occupation. According to Aldous et al (1961), Benson et al (1964), Schneider-Schaulies and Meulen (2002), and Takasu et al (2003), researches 90 per cent of those patients of measles infection who lost their lives, had not been vaccinated.[4-7] Disease Surveillance System of the Punjab Information Technology Board reported the number of measles cases in Punjab were 7,794 during 2013.[8] According to the survey of Pakistan Social and Living Standards Measurement routine immunization coverage in Pakistan did not meet favourable immunization rate of 80 percent. 4000 cases were reported in 2011 and documented deaths due to measles were 64. During 2012, number of deaths was 305 and 14000 cases of measles were reported. Death rate increased alarmingly from 1% in 2011to a very high to 45.7% in 2012.[9] The major potential barrier in vaccination was lack of awareness about seriousness and transmissibility of the disease. In France, Pulcini C et al (2013) described lack of awareness about vaccination to decrease measles infection.[10] According to Orenstein W.A et al (2000) research had shown that vaccine induced immunity started waning after 10 years.[11] Wasif S reported that 7000 laboratories confirmed cases of measles in Pakistan in 2012, more than 60% of children did not receive even a single dose of measles vaccine, whereas 20% received only one dose inspite of vaccination awareness campaigns. The 68% of the confirmed clinical cases of measles were below five years of age and 32 per cent of clinical cases were less than 10 years of age.[12] Moreover, Roberts RJ et al (1995) showed that the common reasons cited for non-immunization were previous measles infection (62.50%), previous incomplete immunizations against measles (33.62%), and concerns about side effects (23.70%).[13]

The whole world is threatened with measles. According to WHO, 139,300 people died of measles worldwide in 2010.[2] In Pakistan, the areas more affected were Hyderabad, Ghotki, Shikarpur, Kambar-Shadadkot, Jacobabad, Kashmore, Larkana, Sukkur and Khairpur districts of Sindh province.[14,15] More than 10,788 cases of measles had been reported in Punjab during 2013.[16] The Expanded Program on Immunization (EPI) was deficient and problems identified were non availability of the vaccines, doctors, nursing staff and ineffective immunization by failure to maintain the cold chain necessary for the efficacy.[17]

In order to find out the risk factors responsible for this epidemic in Lahore and to address the problems that hinder successful prevention of measles, this research study was planned. The struggle against measles may be succeeded in measles elimination[18-19] and eradicating this disaster in the long run by awareness campaigns and preventive strategies.

Materials and Methods

A case-control study was conducted in Lahore to identify various risk factors associated with outbreak of measles in children. Study population comprising of 100 individuals who were divided into two groups. One group included children less than 13 years of age who were affected with measles (case group). They were willing to participate and fulfill the criteria laid down for the determination of the factors associated with the disease. The inclusion and exclusion criteria was as follows.

The chronic ill children who were suffering from any disease more than 3 months duration were excluded. The children on medications for three months for any disease were also excluded. The parents or guardians who were co operative and showed willingness to participate in research study were included for interview regarding their child health. The control group comprised of children who were not affected with measles. The cases and controls were matched for socioeconomic status, father education and geographical distribution of residence.

Non probability purposive sampling approach was used to recruit study subjects. Prior consent was obtained from all selected study subjects. The variables were defined as below:

Lack of availability of vaccine implied that there was no Basic Health Unit, Rural Health Centre or any hospital in the vicinity of 2 – 6 km from patient's residence where Expanded Program on Immunization (EPI) was being carried out by the health workers and nursing staff. This program aimed at reducing the illness and mortality from preventable childhood diseases and included vaccination against Poliomyelitis, Tetanus, Diphtheria, Pertussis (Whooping Cough), Measles, Hepatitis – B, Hib Pneumonia and Meningitis

and Childhood Tuberculosis.[20] Lack of cold chain delineated the importance of low temperature 2 – 8°C maintained in cold rooms, hand carriers or refrigerators.[21] Travelling history to epidemic areas was reported to be present in all the subjects' residents of Lahore or those who had visited Lahore during past 5 months (during the time of epidemic of measles). Any natural disaster that might lead to hindrance in successful immunization of population (for example flood in our study) was also considered during the study. Any coexisting illness prior to developing measles was mentioned in the study.

Results

Among people under study (n = 100), majority of cases (n = 50) were males, age above 9 months and belonging to educated families. After describing the demographic characteristics, bivariate (table 1) and multivariate logistic regression (table 2) were used to calculate odds ratio and their 95% confidence intervals.

Table 1: Bivariate Analysis and Chi-square test to show association of risk factors with measles.

No.	Risk Factors	Measles Epidemic		Bivariate analysis			Chi-square Values
		Case N = 50	Control N = 50	Crude Odds Ratio	95% CI		
					Lower	Upper	
1.	Age of Patient • Less than 9 months • More than 9 months	 9 41	 2 48	.190	.039	.929	5.005
2.	Gender of patient • Male • Female	 30 20	 27 23	.783	.354	1.730	.367
3.	Education of patient's mother • Educated • Uneducated	 27 23	 36 14	2.190	.954	5.028	3.475
4.	Family income • More than Rs.5000 per month • Less than Rs.5000 per month	 42 8	 41 9	.868	.305	2.467	.071
5.	Religion of the patient • Non- Muslim • Muslim	 1 49	 2 48	2.042	.179	23.266	.344
6.	Lack of vaccination availability • Vaccine available • Vaccine not available	 38 12	 37 13	.899	.363	2.224	.053
8.	Lack of measles immunization • Vaccinated • Not vaccinated	 20 30	 33 17	2.912	1.290	6.571	6.784
9.	Lack of cold chain maintenance • Cold chain maintained • Not maintained	 26 24	 29 21	1.275	.579	2.807	.364
10.	History of breast feeding • Child was breastfed	 31	 35	1.430	.622	3.286	.713

	• Not breastfed	19	15				

No.	Risk Factors	Measles Epidemic		Bivariate analysis			Chi-square Values
		Case N = 50	Control N = 50	Crude Odds Ratio	95% CI		
					Lower	Upper	
11.	Lack of hygiene • Personal hygiene is maintained • Not maintained	 43 7	 44 6	1.194	.371	3.841	.088
12.	Travel history • No travel history • Travel history to epidemic area	 7 43	 14 36	2.389	.870	6.556	2.954
13.	School going child • No • Yes	 29 21	 18 32	.407	.182	.912	4.857
14.	Transmission from school, home or vicinity • No • Yes	 32 18	 38 12	1.781	.747	4.246	1.714
15.	Hindrance to immunization (natural disaster) • No • Yes	 49 1	 49 1	1.000	.061	16.444	.000
16.	Coexisting illness • No • Yes	 39 11	 33 17	.548	.225	1.332	1.786
17.	Lack of medication for coexisting ailment • Medicines taken • Medicines not taken	 48 2	 48 2	1.000	.135	7.392	.000
18.	Lack of vitamin A intake • No • Yes	 33 17	 39 11	1.826	.751	4.443	1.786
20.	Lack of awareness about measles in parents • Have awareness • No awareness	 31 19	 32 18	1.090	.484	2.455	.043
21.	Health status of mother during pregnancy • Healthy • Sick and treated	 38 12	 43 7	1.940	1.693	5.430	1.624

Discussion

Measles is an acute viral infection of respiratory tract which presents with fever, cough, runny nose and generalized rash. It has many complications like otitis media, pneumonia, bronchitis and encephalitis. The

alarming situation was created by three consecutive epidemics of this highly contagious disease in Pakistan and it has become a major cause of death among children. The determinants of sporadic epidemics were

Table 2: Multivariate analysis to show association of risk factors with measles.

No.	Risk Factors	Multivariate Analysis			p Values
		Adjusted Odds Ratio	95% CI		
			Lower	Upper	
1.	Age	.185	.039	.873	.033
2.	Religion	7.509	1.697	33.235	.008
3.	Lack of EPI vaccination	5.652	1.389	23.005	.016
4.	School going	.130	.036	.472	.002
5.	Measles transmission by contact	5.656	1.499	21.337	.011
6.	Coexisting illness	.214	.065	.699	.011
7.	Mother's sickness during pregnancy	3.663	.987	13.591	.052

complex and they could differ among different populations. Present research showed that following factors were associated with these measles epidemics.

In the study measles and its complications were found more in children above 9 months of age (89%). However in a study conducted at Johns Hopkins School of Public Health showed that in children < 5 years complication rates due to measles were the largest. The maternally derived antibodies during fetal life protected during the first few months of childhood to the most of the infants. However in cases of low immunity measles could be severe as described by John TJ et al (2000), Celers J (1965), Christensen PE et al (1951), Cliff AD et al (1993), and Peart AFW et al (1954).[23-26]

According to a study by Garenne M et al (1994), measles infection was declared as one of the main cause of increased female mortality,[27] however, in our study it was found more common in males (57%) as compared to females (43%). In our study 83% of the cases had been reported in children with middle socioeconomic status (income > 5000). A study by Perry RT et al (2004) had shown similar results.[28]

In Bangladesh, it was found by Koenig MA et al (2001) that children who lived in congested houses had risk of death due to measles 2.6 times more than other children who lived in well ventilated houses.[29] In our study all subjects belonged to highly congested areas.

WHO reported that in Europe almost 5 million individuals of age group 2 to 12 years had not vaccinated by MMRs. In recent study 75% of the subjects had vaccination centers near their houses, 81% were vaccinated per EPI and 53% of them received both doses of MMR.

Carrillo – Santistive P et al (2012), Senzoga et al (2011) reported determinants of measles included knowledge and practice gaps by health workers and inadequate supplies for vaccine cold chain maintenance.[30,31] According to the research 55% of subjects received vaccination from hospitals or dispensaries where refrigerators and cold rooms were present. WHO journal reported that breast milk contained antibodies, vitamins, and micronutrients which protected the young child against measles,[32] and in present study 66% of the subjects were breastfed.

A study conducted in U.S revealed that good personal hygiene is important to prevent the spread of disease; including washing hands regularly,[33] in recent study 87% of the subjects had good personal hygiene and regular hand washing was observed.

In the United States, In 2011, a total of 220 measles cases were reported's the highest number of reported cases were associated with importation Katz SL et al (2011)[34] and in our study also 79% of the subjects were either living in epidemic areas or had a travel history.

A research in Australia implies that parents should keep their diseased child away from other children and anyone who had not been immunized during the period of infectivity[35] and in our study 30% of children

were school – going from where they might get infection during epidemic.

In present research 30% of subjects had diagnosed cases of measles in contact while a research done in France by Pulcini C et al reported MMR vaccination should be given to the relatives who have not received vaccine previously and are in contact with a measles patient.[10] WHO and UNICEF used annual data from records and surveys reported by governments for the estimation of measles vaccination coverage among children aged 1 year Of the estimated 20.1 million infants who did not receive measles vaccine in 2011 through routine vaccination services, 55% (11.1 million) were in five countries including Pakistan (0.9 million). Simons E et al had documented that the percentage of children who could not get access to vaccination due to natural disasters like flood was 2%.[18]

According to WHO fact sheet no. 178, (revised September 1998) In childhood pneumonia, diarrhea, measles, malaria and malnutrition are five main causes that contribute to 7 out of 10 deaths in developing countries[36] and in our study 30% of subjects were also suffering either for cough, pneumonia, anemia or diarrhea as coexisting illness with measles.

Vitamin A deficient children in developing countries had increased case – fatality rates. Hussey GD reported that hospitalized measles patients frequently had deficiency in vitamin A and were more likely to have diarrhea, pneumonia or other complications due to measles.[18] In present study 28% children were lacking vitamin A in their diet.

A research in UK showed that vaccination levels for measles needed to be at around 95% to achieve "herd immunity" to prevent outbreaks of the disease but in recent study 67% of subjects had no trend of vaccination in their vicinity.

In France, over 17,000 cases of measles were reported during January 2008 and April 2011, including 6 deaths in 2011. From January to October 2011, number increased to 14,000, lead the country to launch an awareness campaign about vaccination and in our research 37% mothers of subjects were not aware of preventive measures. Also 12% of mothers were sick and treated during pregnancy for some disease other than measles. A study conducted in France concluded that potential barrier to the 2nd dose of MMR is fear of the vaccine's side effects (50%).[36] Similar findings were reported in present study and had shown that 24% of the parents had lack of confidence in immunization program.

Conclusion

The risk factors such as age, lack of Expanded Program of Immunization (EPI), transmission from surroundings like schools, and coexisting illness were found significant in measles epidemic in Lahore.

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