UNDERSTANDING THE IMPACT, PREVENTION, AND CO-MORBIDITIES OF MEASLES: A CROSS-SECTIONAL STUDY AT CITY HOSPITAL, JALALABAD, KYRGYZSTAN

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Abstract
Measles, a highly contagious viral infection, remains a significant public health challenge despite the availability of an effective vaccine. This cross-sectional study, conducted at City Hospital in Jalalabad, Kyrgyzstan, from December 10, 2023, to March 30, 2024, investigated a measles resurgence among 50 hospitalized children aged 1 month to 14 years. The study aimed to identify risk factors, evaluate vaccine effectiveness, assess complications, and propose control strategies. Findings revealed that 60% of cases were infants under 2 years, with 86% unvaccinated due to religious beliefs and misinformation. Malnutrition was prevalent, with 56% of children underweight and 60% stunted. Pneumonia (80%), anemia (34%), and parasitic infections (18%) emerged as significant co-morbidities. Transmission was associated with low herd immunity and direct contact (40%). These results underscore the urgent need for enhanced vaccination campaigns, nutritional interventions, and community education to reduce measles morbidity in Jalalabad.

Keywords: Measles, Infectious disease, Pediatrics, Kyrgyzstan

ПОНИМАНИЕ ВЛИЯНИЯ, ПРОФИЛАКТИКИ И СОПУТСТВУЮЩИХ ЗАБОЛЕВАНИЙ КОРИ: ПОПЕРЕЧНОЕ ИССЛЕДОВАНИЕ В ГОРОДСКОЙ БОЛЬНИЦЕ, ДЖАЛАЛ-АБАД, КЫРГЫЗСТАН

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Аннотация
Корь, высококонтагиозная вирусная инфекция, остается серьезной проблемой общественного здравоохранения, несмотря на наличие эффективной вакцины. Это поперечное исследование, проведенное в городской больнице в Джалал-Абаде, Кыргызстан, с 10 декабря 2023 года по 30 марта 2024 года, изучало повторную вспышку кори среди 50 госпитализированных детей в возрасте от 1 месяца до 14 лет. Целью исследования было выявление факторов риска, оценка эффективности вакцины, оценка осложнений и предложение стратегий контроля. Результаты показали, что 60% случаев были у младенцев в возрасте до 2 лет, 86% из которых не были вакцинированы из-за религиозных убеждений и дезинформации. Распространенным было недоедание, 56% детей имели недостаточный вес и 60% отставали в росте. Пневмония (80%), анемия (34%) и паразитарные инфекции (18%) стали значительными сопутствующими заболеваниями. Передача была связана с низким коллективным иммунитетом и прямым контактом (40%). Эти результаты подчеркивают острую необходимость в усиленных кампаниях вакцинации, вмешательствах в питание и просвещении населения для снижения заболеваемости корью в Джалал-Абаде.

Ключевые слова: Корь, Инфекционные заболевания, Педиатрия, Кыргызстан

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Introduction

Measles, caused by the measles virus (genus Morbillivirus, family Paramyxoviridae), is a highly contagious disease transmitted through respiratory droplets, infecting approximately 90% of non-immune individuals in close proximity [1]. The virus remains viable in air or on surfaces for up to two hours, facilitating its rapid spread [2]. Following a 10–14-day incubation period, measles manifests with a prodromal phase characterized by high fever, cough, conjunctivitis, coryza, and Koplik spots, progressing to a maculopapular rash with cephalocaudal spread [3]. Recovery typically occurs within 10–14 days; however, complications such as pneumonia, diarrhea, encephalitis, and immune suppression elevate morbidity, particularly among unvaccinated populations [4]. A rare but severe long-term sequela, subacute sclerosing panencephalitis (SSPE), may develop 7–10 years post-infection, especially in children under 2 years [5].

Globally, measles persists as a leading cause of childhood mortality in regions with suboptimal vaccination coverage [6]. In Jalalabad, Kyrgyzstan, a notable increase in measles cases despite vaccination efforts highlights critical gaps in prevention strategies, necessitating a comprehensive analysis of its epidemiology, risk factors, and co-morbidities.

Objectives

1. To investigate the resurgence of measles in Jalalabad.
2. To identify associated risk factors and complications.
3. To assess vaccine effectiveness and barriers to uptake.
4. To propose evidence-based strategies for measles control.

Rationale

Hospital records at City Hospital indicate a year-on-year rise in measles cases in Jalalabad, reflecting deficiencies in current prevention measures and the need for targeted interventions.

Methodology

Study Design

A cross-sectional study was conducted to evaluate the resurgence of measles and its health impacts.

Study Setting

The study was carried out at the Infectious Disease Department of City Hospital, Jalalabad, Kyrgyzstan.

Study Duration

Data were collected from December 10, 2023, to March 30, 2024.

Participants

Inclusion Criteria: Children aged 1 month to 14 years hospitalized with laboratory-confirmed measles.

Exclusion Criteria: Children without a confirmed measles diagnosis or aged over 14 years.

Sample Size: From 573 eligible cases, 50 participants were selected via random sampling.

Data Collection

A structured questionnaire captured demographic details, vaccination status, clinical symptoms, and complications. Anthropometric measurements (weight and height) assessed nutritional status. Data were analyzed using SPSS version 25.

Ethical Considerations

Ethical approval was obtained from the Department of Research Activities, Jalalabad State University, and the Infectious Disease Department of City Hospital. Informed consent was secured from guardians, ensuring confidentiality and adherence to ethical standards.

Results

The resurgence of measles has brought to light the complex interplay of factors influencing disease transmission, including vaccine access, misinformation, complacency towards preventable illnesses and demographic factors. According to data, Children less than 2 years old are more prone to measles and in this range of one month to two years old, children less than 9 months of age are more suffered from measles.

In total 50 respondents, 30 respondents have age between 1 month to 2 years (60%), 9 respondents have age between 2 years to 4 years (18%), 6 respondents have age between 4 years to 8 years (12%) and 5 respondents have age above from 8 years old (10%).

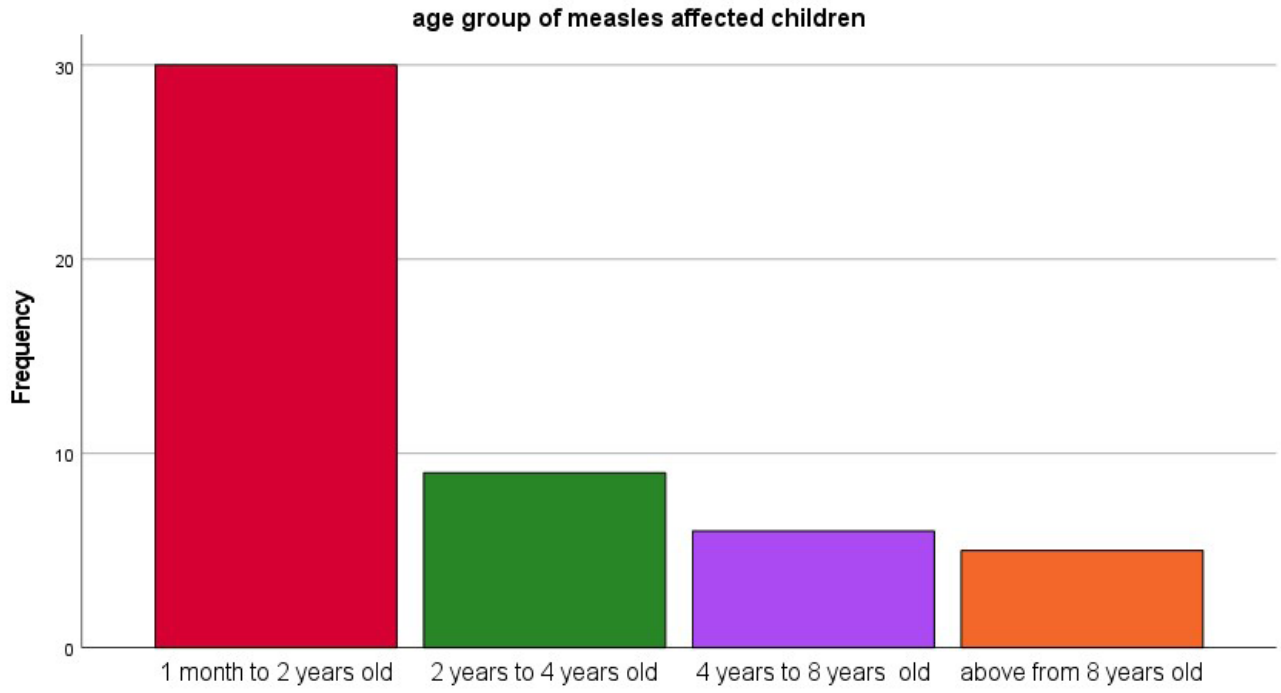

Figure 1: Distribution of Respondents according to Age

According to data, out of 50 respondents; there are 30 males and 20 female children suffered from measles.

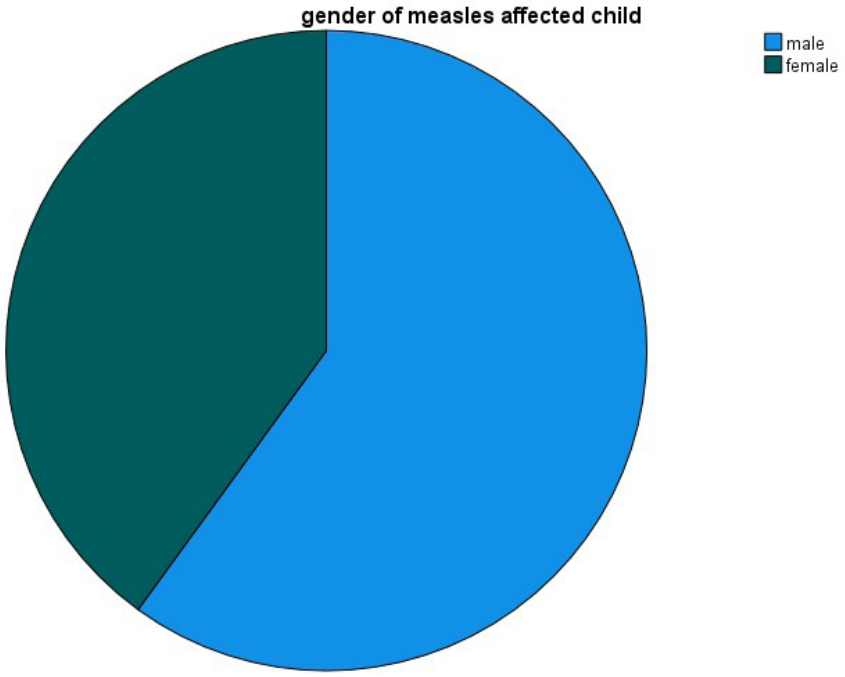

Figure 2: Distribution of Respondents according to Gender

The severity of disease, healthy response of immune system and recovery can be evaluated by the days of hospitalization of patient. According to evaluation of data, 58% respondents take rest for 5 to 7 days, 24% respondents take rest for 2 to 4 days, 12% take rest for 8 to 10 days and 6% take rest for 11 to 13 days in hospital to recover from measles.

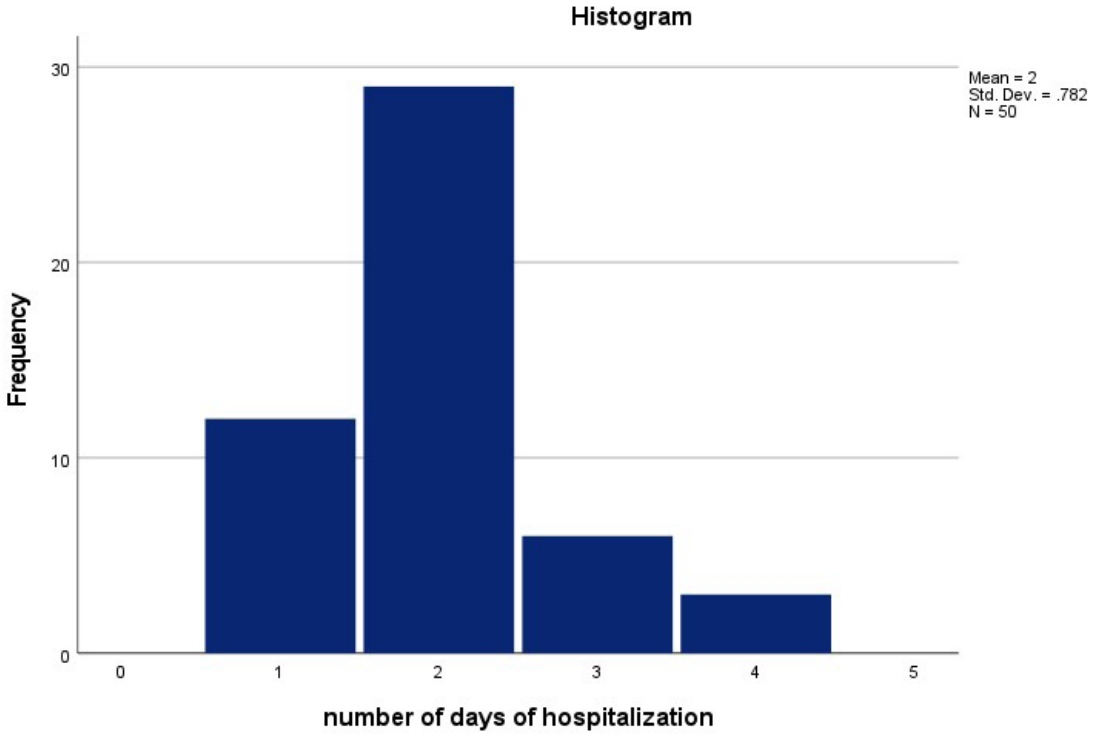

Figure 3: Distribution of Respondents according to days of Hospitalization

For nutrition assessment, we cross tabulate between weight and height with gender and age of respondents. Comparison of weight with age of children gives indication of malnutrition because out of 30 Respondents (age between 1 month to 2 years) having weight less than 10 kg; if we investigate individual about weight of this age group these 28 children have less weight according to standard and also 2 respondents have weight less than 10 kg having age between 2 to 4 years old. There are 7 respondents of age between 2 to 4 years old and 2 respondents of age between 4 to 8 years old have weight less than 14 kg. There is also 1 respondent age above from 8 years old having weight less than 20 kg; these all results clearly indicate the malnutrition

There is following table shows the cross tabulation between age and weight of children.

• *Table 1: age group of measles affected children weight of child Crosstabulation*

		weight of child				
		2 kg to 10 kg	10 kg to 14 kg	14 kg to 20 kg	more than 20 kg	Total
age group of measles affected children	1 month to 2 years old	28	1	1	0	30
	2 years to 4 years old	2	7	0	0	9
	4 years to 8 years old	0	2	4	0	6
	above from 8 years old	0	0	1	4	5
Total		30	10	6	4	50

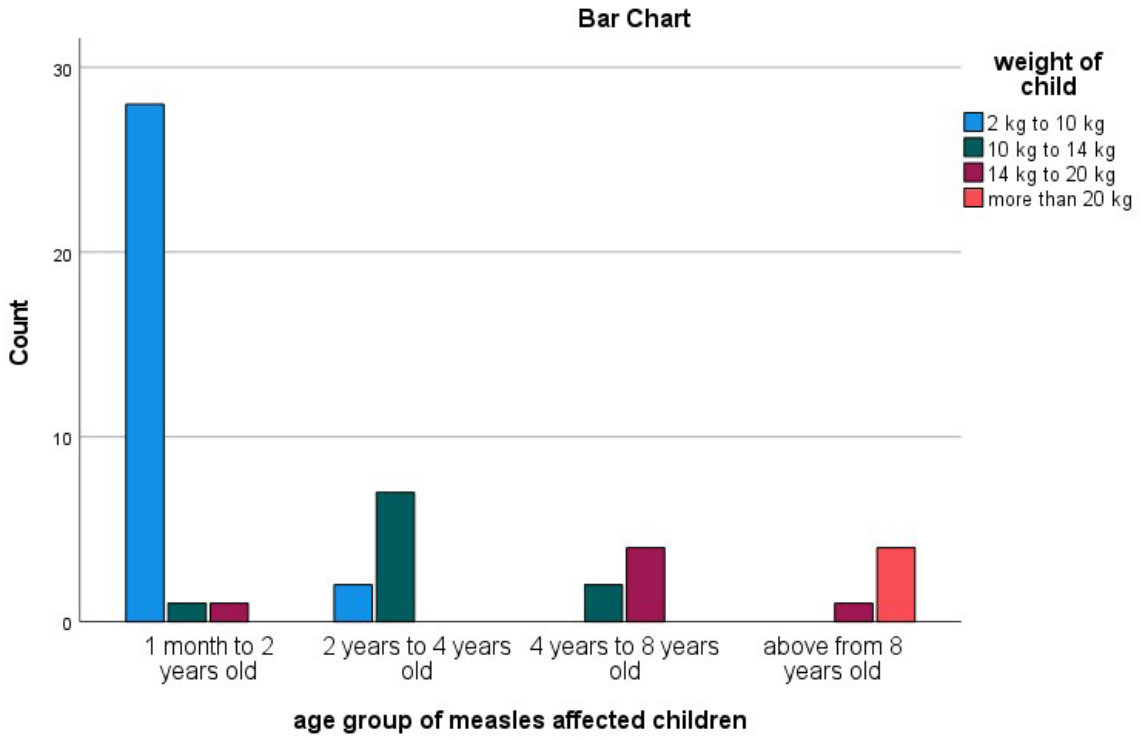

Figure 4: Cross tabulation between age and weight of respondents

If we compare gender with weight of respondents, it's revealed that 63% male and 55% females having low weight than normal.

• *Table 2 : gender of measles affected child weight of child Crosstabulation*

		weight of child				
		2 kg to 10 kg	10 kg to 14 kg	14 kg to 20 kg	more than 20 kg	Total
gender of measles affected child	male	19	5	3	3	30
	female	11	5	3	1	20
Total	30	10	6	4	50	

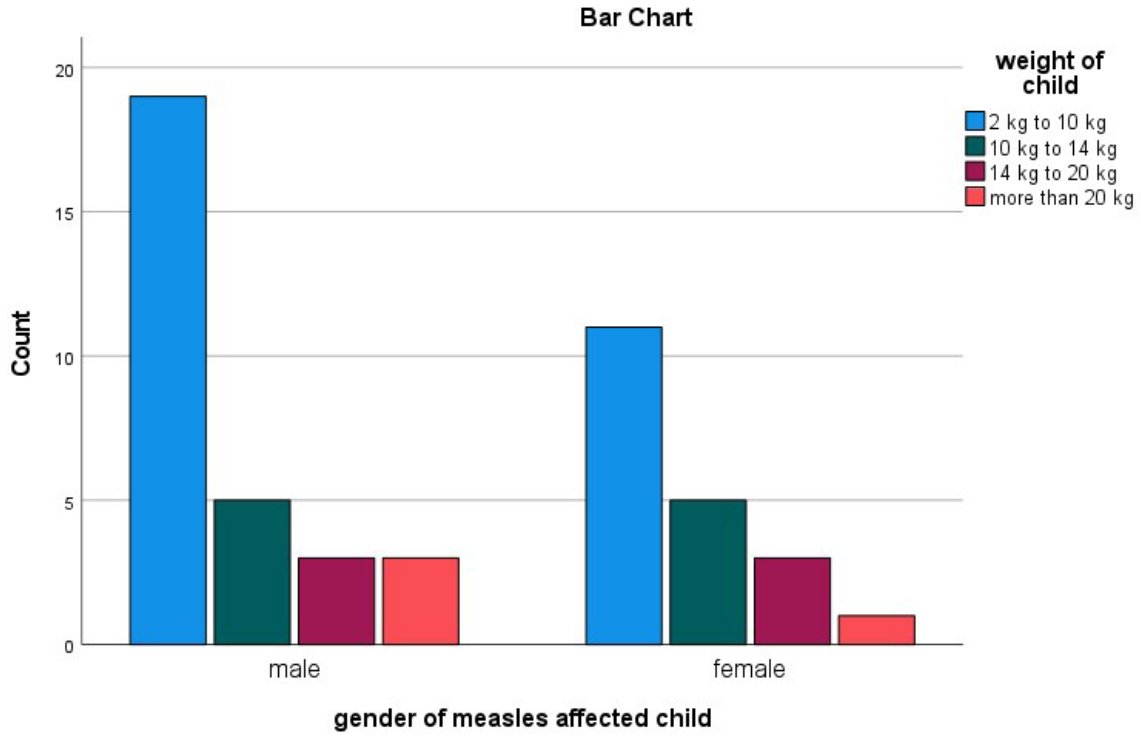

Figure 5; Cross tabulation of height and age is also a indicator to access nutrition status , according to analysis, 28 children having age between 1 month to ,2 years old have height less than 80cm and 7 children age of 2 years have height less than 96 cm ; 2 children age 4 to 8 years old also have height less than 96 cm .

There is following table distribute number of respondent respective to Height and weight of children.

• *Table 3 :age group of measles affected children height of child Crosstabulation*

		height of child				
		47 to 80 cm	80 to 96 cm	96 to 119 cm	more than 119 cm	Total
age group of measles affected children	1 month to 2 years old	28	1	1	0	30
	2 years to 4 years old	2	7	0	0	9
	4 years to 8 years old	0	2	4	0	6
	above from 8 years old	0	0	1	4	5
Total	30	10	6	4	50	

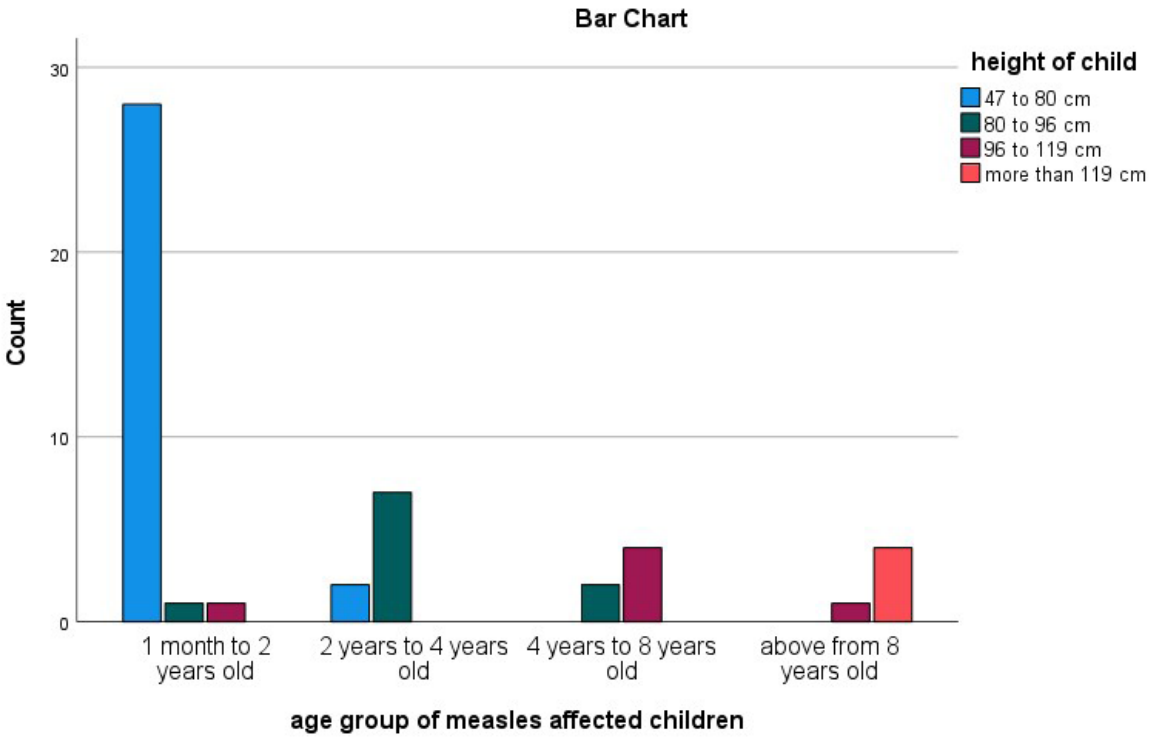

Figure 6: The correlation of height with gender explain that 63% males and 55% females are shorter from their height. Out of 30 male respondents, 19 children have height less than 80cm and in females out of 20 respondents, 11 are having height less than 80 cm.

• *Table 4: gender of measles affected child height of child Crosstabulation*

		height of child				
		47 to 80 cm	80 to 96 cm	96 to 119 cm	more than 119 cm	Total
gender of measles affected child	male	19	5	3	3	30
	female	11	5	3	1	20
Total		30	10	6	4	50

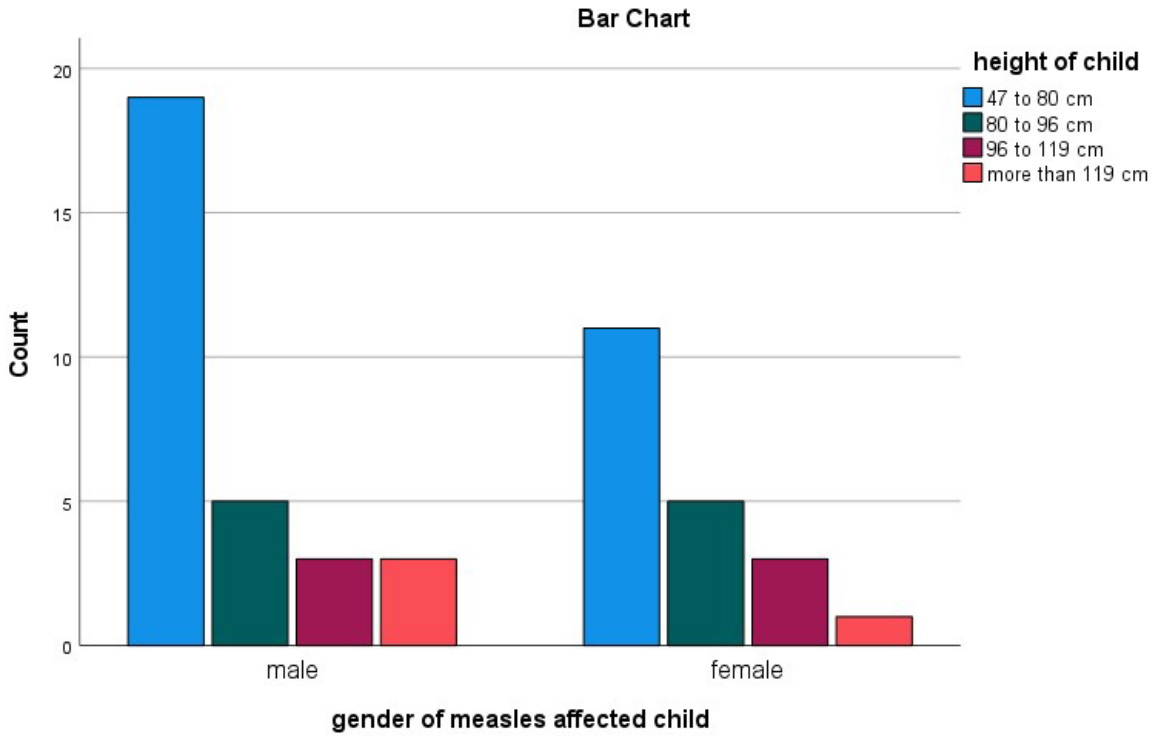

Figure 7: indicates correlation between height and gender

Out of 50 respondents, 4 mothers are working women and 46 of them are non-working according to Data, that indicates that mothers stay most of time with their children. There graph indicating the ratio of working and non-working mothers.

Figure 8: Distribution of Respondents Parents on the basis of work

Out of 50 responses, 43 of them are non-vaccinated (86%) due to mainly religious issues and illiteracy about vaccination. 7 of them due to older age didn't know they vaccinate their child with measles vaccine. This graph clearly show that non-vaccinated children are on high risk to catch measles and 86% of respondent are non-vaccinated, out of these most of children infected with measles before age of vaccination due to inadequate breast feeding and contact to measles patients.

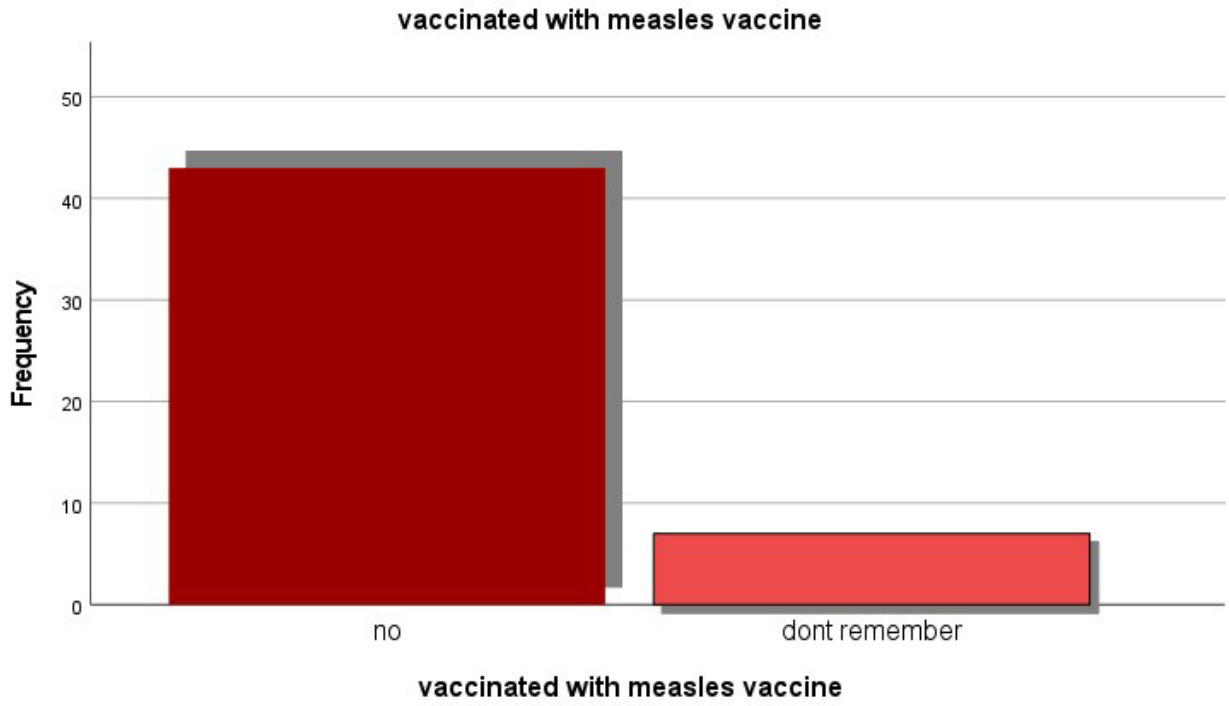

Figure 9: Distribution of Respondents on the status of Vaccination

According to data, there are some symptomatic information regarding measles, complications and factors that influence the resurgence of disease. Firstly, we collect data about dehydration and lost of water-soluble vitamins and minerals due to loose stool, diuresis and vomiting. According to our data collection 60% respondents having loose stool, diuresis and vomiting and 40% didn't have association with these symptoms.

The following histogram showing the ratio of fluid loose symptoms in measles patients according to Data collection with standard deviation of 0.495 . Due to this fluid lose , doctors prescribe IV fluid in severe condition and water intake in moderate condition of symptoms and also prescribe vitamin A doses on daily basis.

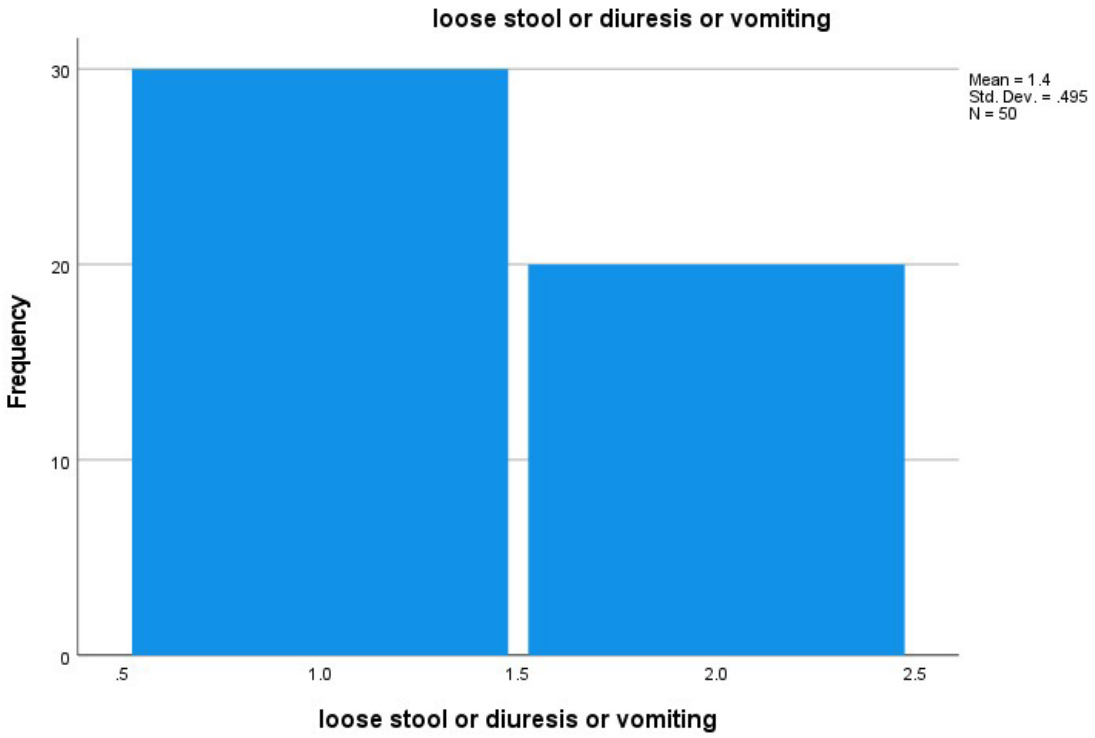

Figure 10: Distribution of Respondents on the status of symptoms (loose stool /Diuresis/ Vomiting)

Out of 50 respondents, 28% respondents measles is associated with moderate anemia , 6% have severe anemia and 66% measles patients have not any association with anemia. There is following table the demonstrate the numbers:

• *Table 5: showing 14 of them have moderate anemia , 3 have severe anemia and 33 have no association with anemia*

Response	Frequency
No	33
Yes , Moderate	14
Yes Severe	3

Transmission of vector is important point ; according to Data , 20 of respondents have direct contact with measles patient and 30 of them didn't sure about this information .Pie graph is showing that 40 percent of children contact with measles patients and 60% of children parents didn't know exactly.

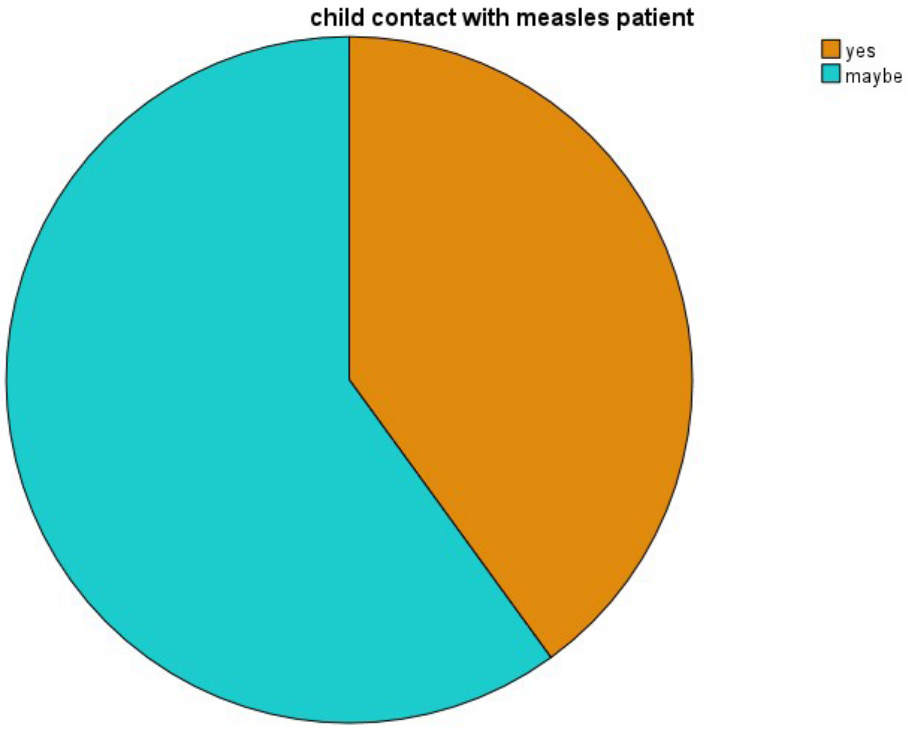

Figure 11: Distribution of Respondents according to Contact with measles patients

According to Data regarding complication of measles in children, there is 80% of children suffering from pneumonia, 10% of children have otitis media, 4% children tainted with intestinal infection , 4% children distressed with residual encephalopathy, meningitis, seizures and 2% of children don't have any associated complication.

• *Table 6: Distribution of Respondents according to associated complications*

	Frequency	Percent
Pneumonia	40	80.0
otitis Media	5	10.0
Intestinal infection (unspecified)	2	4.0
residual Encephalopathy	2	4.0
no associated disease	1	2.0
Total	50	100.0

This following graph below plotting complications in x-axis and frequency in y-axis . It describes that pneumonia is most common complication with measles among our respondents. These complications results in further symptoms in patients like cough , breathing disorder due to pneumonia , ear discharge due to otitis media, diarrhea due to intestinal infection, seizures due to encephalopathy etc .

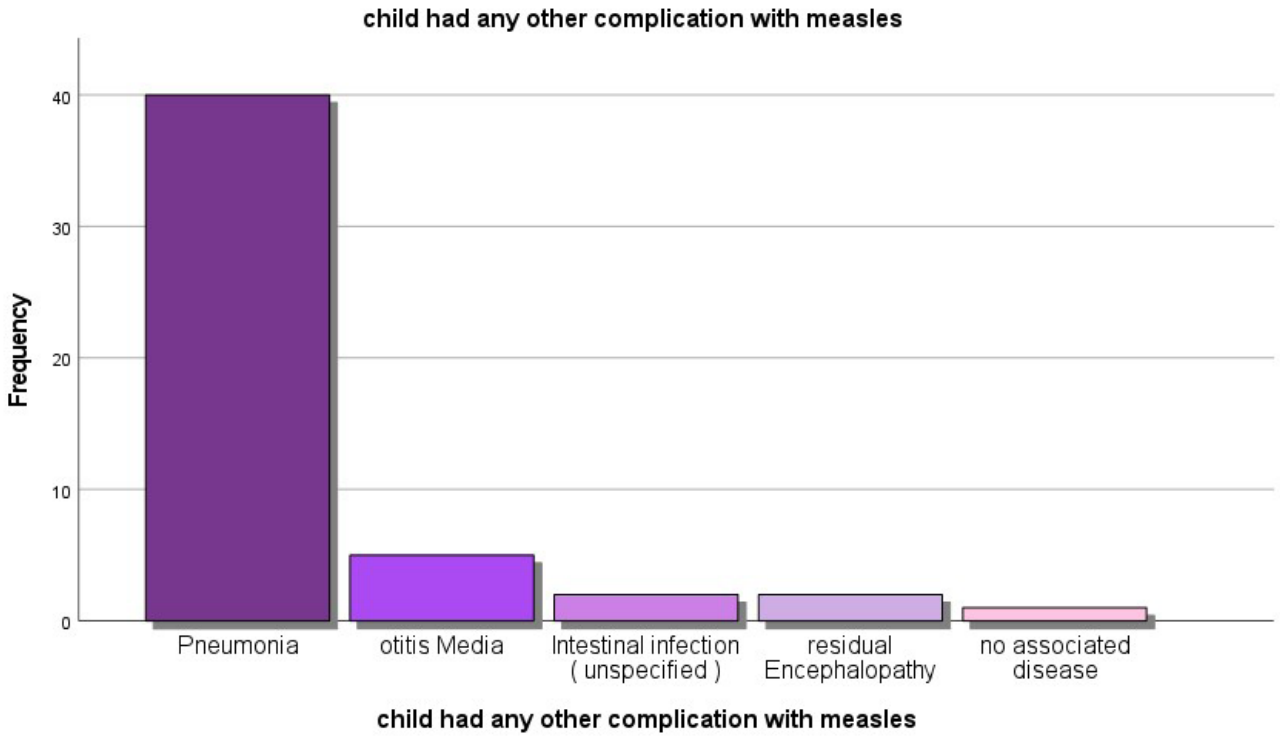

Figure 12: Distribution of Respondents according to associated complications

There is 94% of children agony with measles have maculopapular rashes behind ear and neck and 6% patients didn't observer prominent rashes behind neck and ear .

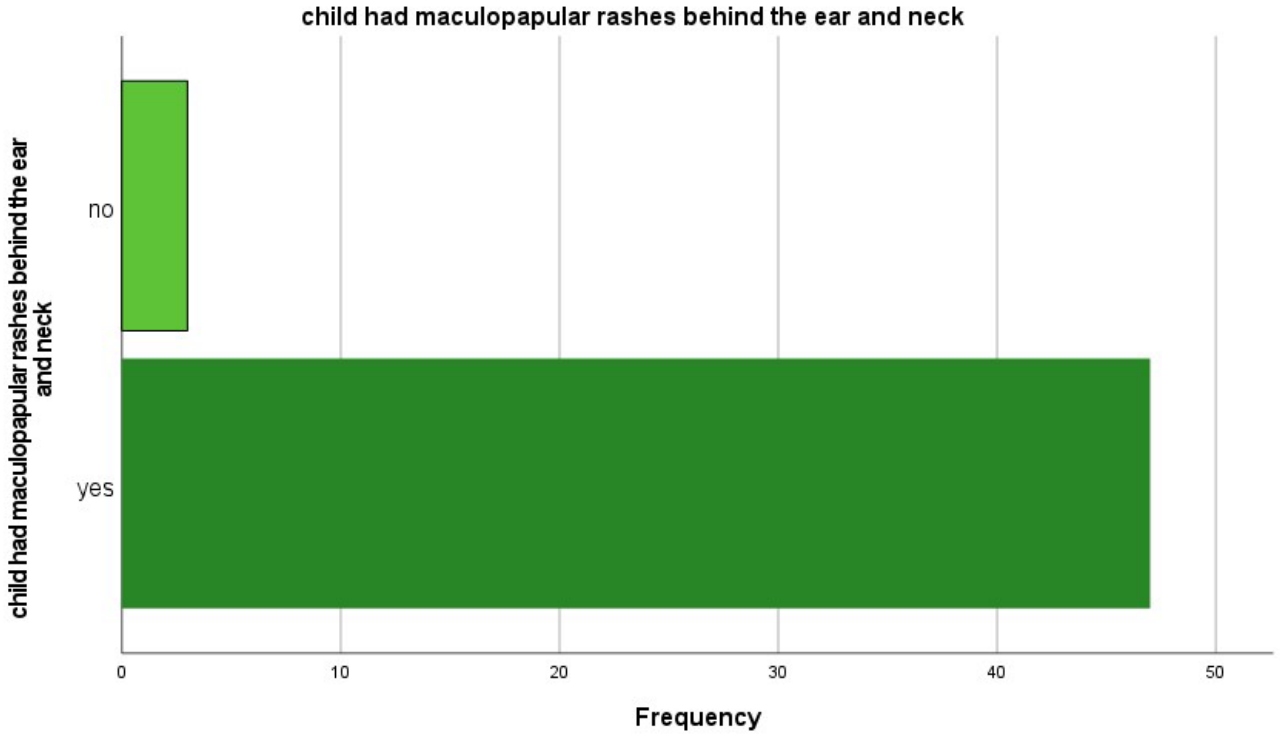

Figure 13: Distribution of Respondents on appearance of Maculopapular rashes

Loss of consciousness indicates the severity of measles , according to evaluation; 92% percent children are clearly unconscious and 8% didn't observe unconscious. According to observation The reason behind unconsciousness is hyperthermia , malnutrition, lost of fluid and carelessness of parents because they didn't approach the doctor on time prescribe the medicine to their children at home that lead to severity of disease.

• *Table 7 : Distribution of Respondents on Consciousness*

Response	Frequency
Yes	46
No	04
Total	50

In 38% children , we observed pus discharge from ear or eye and 62% children didn't report any discharge of pus from ear and eyes . It most commonly observer when mealses is complicated with otitis media.There is graphically representation regarding discharge of pus from ear or eye in measles patients.

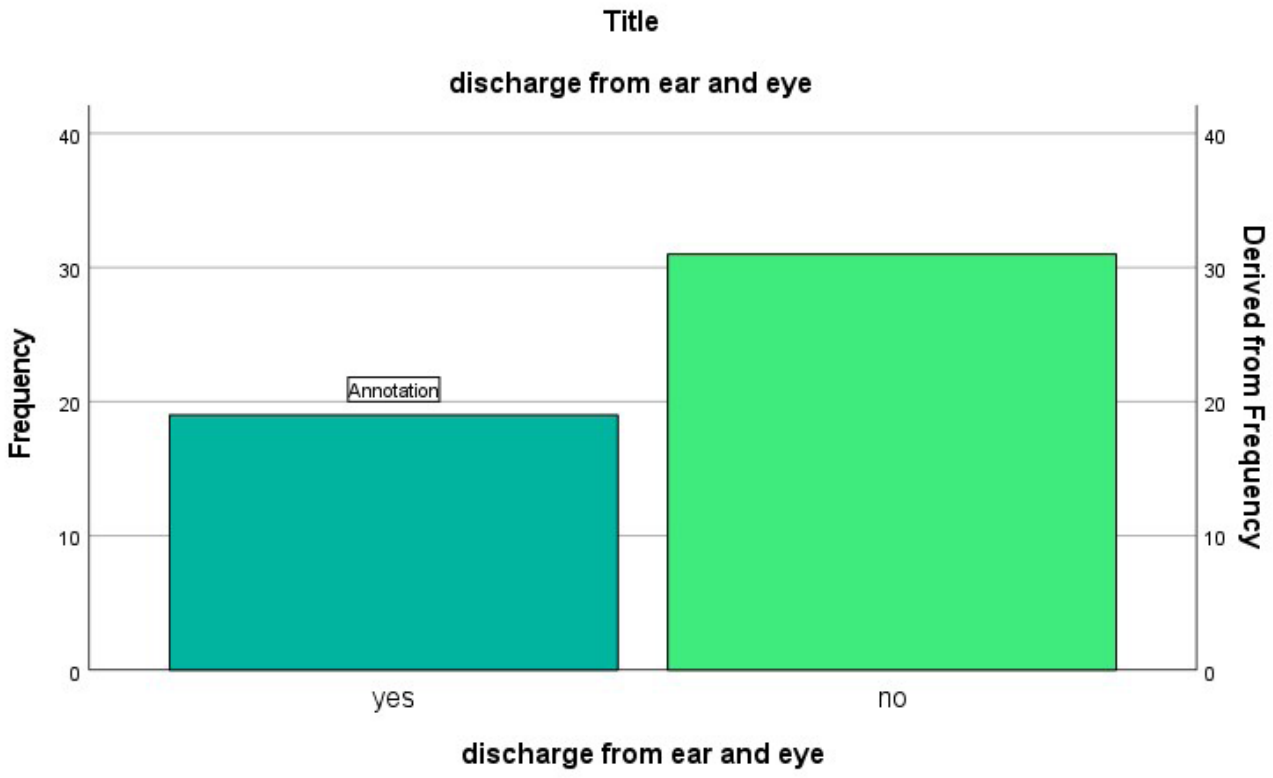

Figure 14: Distribution of Respondents on discharge from ear or eye

According to observation and data , 82% children have cough in measles due to complications of pneumonia. There is histogram explaining 41 respondents have cough and 9 of them didn't complain for cough .

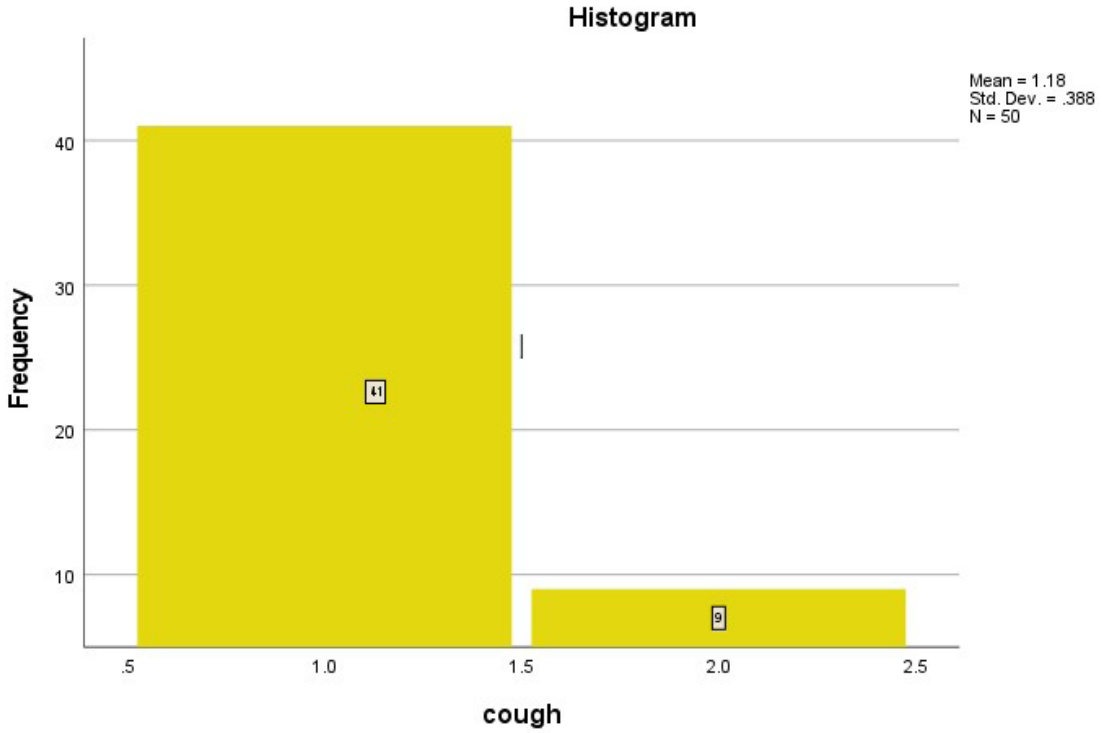

Figure 15: Distribution of Respondents on symptoms of Cough

90 % of respondents loss their appetite and 10% didn't have much effect on appetite.

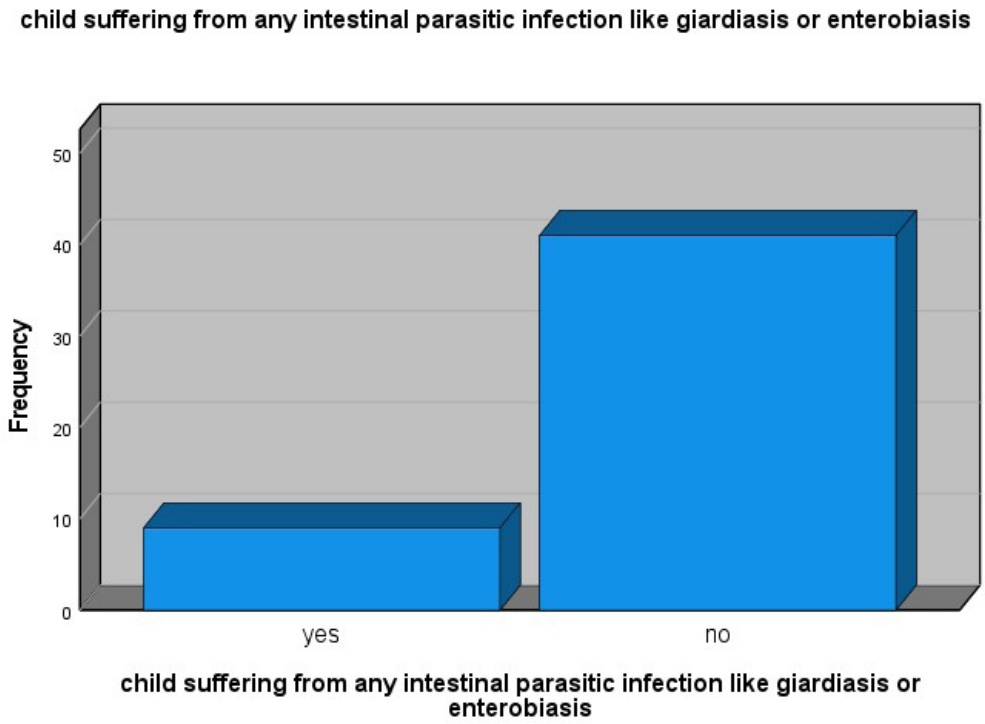

Figure 16: Distribution of Respondents on association with intestinal parasitic infection

• *Table 8 : Distribution of Respondents on appetite*

Response	Frequency
Yes	45
No	05
Total	50

There are 18% of children have parasitic infection like giardiasis or enterobiasis that cause the deficiency of Vitamin A that increase the chance of child to effect with measles. There is 3D graph representation of parasitic infection increase the chance for measles infection .

Due fluid imbalance, loss of vitamin, malnutrition because intestinal parasitic infection lead to diarrhea, malabsorption.

Due to pneumonia and COPD related to measles cause difficulty in breathing , about 86% children have shortness of breath in measles , during observation, nasal flaring , involvement of intercoastal muscles clearly observed.

	Frequency	Percent
yes	43	86.0
no	7	14.0
Total	50	100.0

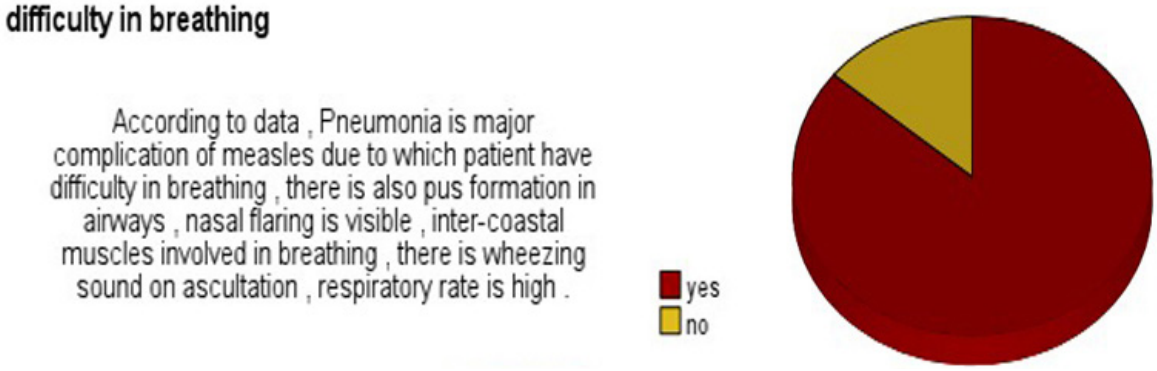

Figure 17 : Distribution of Respondents on difficulty in breathing

There is 2% association of congenital heart disease with measles , out of 50 there is one respondent having tetralogy of Fallot suffered from measles that is complicated with pneumonia.

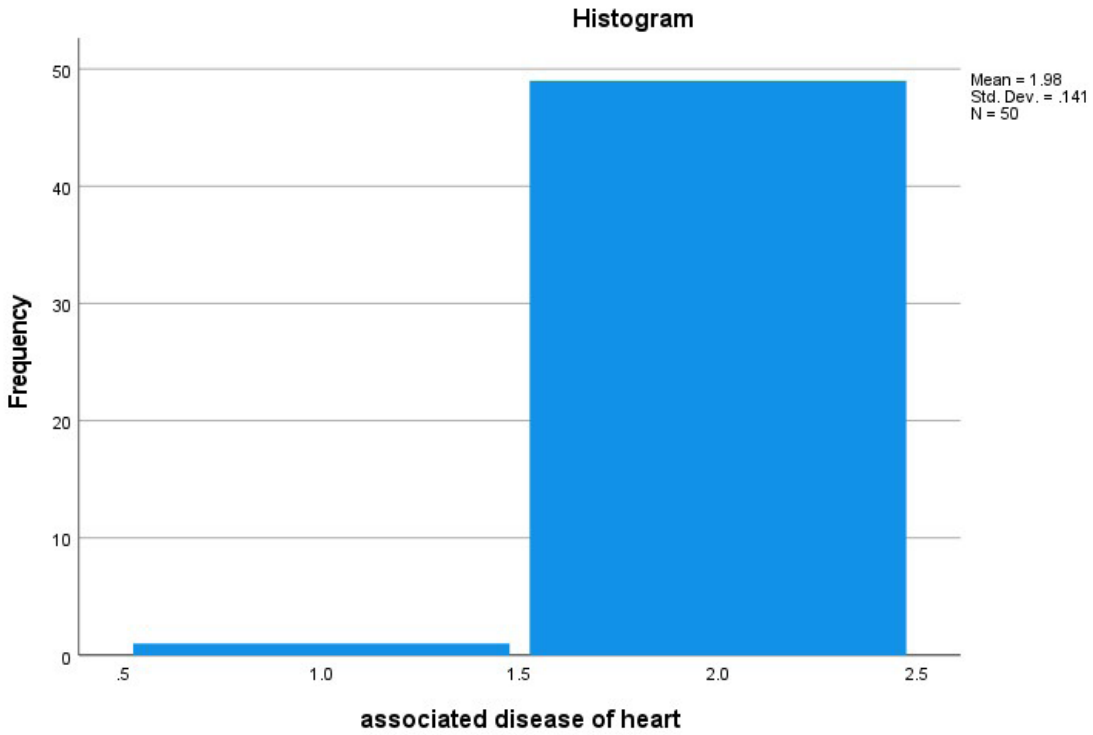

Figure 18: Distribution of Respondents according to association with heart diseases

Discussion

The study elucidated the multifactorial drivers of measles resurgence in Jalalabad, including vaccine hesitancy, misinformation, and demographic vulnerabilities. Of the 50 respondents, 60% (n=30) were infants aged 1 month to 2 years, 18% (n=9) were 2–4 years, 12% (n=6) were 4–8 years, and 10% (n=5) were over 8 years. Gender distribution showed 60% males (n=30) and 40% females (n=20). Hospitalization duration varied, with 58% (n=29) recovering in 5–7 days, 24% (n=12) in 2–4 days, 12% (n=6) in 8–10 days, and 6% (n=3) in 11–13 days. Malnutrition was a significant risk factor, with 56% (n=28) of children underweight and 60% (n=30) stunted. Among infants aged 1 month to 2 years, 93% (n=28/30) had weights below 10 kg, indicating severe malnutrition. Cross-tabulation of weight and height with age and gender revealed that 63% of males (n=19/30) and 55% of females (n=11/20) were underweight or stunted, reflecting widespread nutritional deficits.

A striking 86% (n=43) of respondents were unvaccinated, primarily due to religious beliefs and misinformation. Among the unvaccinated, many were infected before the recommended vaccination age, exacerbated by inadequate breastfeeding and contact with measles patients. Common symptoms included maculopapular rashes (94%, n=47), fluid loss via loose stools, diuresis, or vomiting (60%, n=30), cough (82%, n=41), loss of appetite (90%, n=45), and shortness of breath (86%, n=43). Pneumonia was the predominant complication (80%, n=40), followed by otitis media (10%, n=5), intestinal infections (4%, n=2), and residual encephalopathy (4%, n=2). Anemia affected 34% (n=17), with 28% (n=14) moderate and 6% (n=3) severe cases.

Parasitic infections (e.g., giardiasis, enterobiasis) were present in 18% (n=9), contributing to vitamin A deficiency and increased measles susceptibility. Direct contact with measles patients was reported in 40% (n=20) of cases, while 60% (n=30) of parents were uncertain of exposure sources, suggesting low herd immunity as a key driver of transmission.

The resurgence of measles in Jalalabad aligns with global trends of declining vaccination coverage [6]. Infants under 2 years (60%) were disproportionately affected, likely due to suboptimal breastfeeding and delayed vaccination [7]. The high prevalence of pneumonia (80%) as a complication corroborates its role in measles-related morbidity [4]. Malnutrition, affecting over half the cohort, amplified disease severity, consistent with evidence linking nutritional deficits to adverse outcomes [8].

Vaccine hesitancy, driven by religious beliefs and misinformation, reflects broader cultural barriers to immunization [9]. The 86% unvaccinated rate underscores the failure to achieve herd immunity, as evidenced by 40% direct transmission [6]. Co-morbidities such as parasitic infections (18%) and anemia (34%) highlight the need for integrated health interventions [10]. Gender disparities (60% male) may suggest differential healthcare access, warranting further exploration [11].

Study limitations include Berkson bias, as only hospitalized cases were included, and recall bias among parents of older children regarding vaccination history. These factors may limit generalizability but do not undermine the urgency of the findings.

Conclusion

This study highlights the critical determinants of measles resurgence in Jalalabad, with 573 cases reported between December 2023 and March 2024. Infants aged 1 month to 2 years (60%) were most vulnerable, driven by inadequate vaccination (86% unvaccinated), religious barriers, and malnutrition (56% underweight, 60% stunted). Pneumonia (80%) dominated complications, compounded by anemia (34%) and parasitic infections (18%). Gender disparities (60% male) and low herd immunity (40% direct transmission) further exacerbate the outbreak.

These findings emphasize the need for urgent, multifaceted interventions, including intensified vaccination campaigns, nutritional support, and community education to address misinformation and cultural barriers. Without such measures, measles will continue to impose a significant health burden in Jalalabad.

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