

Original Article

Prevalence of Measles in Children 06 Months to 5 Years at Saidu Group of Teaching Hospital Swat SGTH

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ABSTRACT

Background: Measles remains an important vaccine-preventable childhood infection in Pakistan, particularly where immunization gaps permit continued transmission. **Objective:** To determine the hospital-based prevalence of measles and examine selected factors associated with measles diagnosis among children aged 6 months to 5 years at Saidu Group of Teaching Hospital, Swat. **Methods:** A descriptive cross-sectional study was conducted in the Pediatric Isolation Ward. During the study period, 329 children formed the hospital population and 175 were included in detailed analysis using non-probability consecutive sampling. Data was collected using a structured questionnaire and analyzed using IBM SPSS Statistics version 27. Categorical variables were summarized as frequencies and percentages, and bivariate associations were assessed using chi-square tests; an exact test was used for the sparse sex-by-diagnosis table. **Results:** Of 329 children, 154 had confirmed measles, giving a hospital-based prevalence of 46.81% (95% CI 41.48–52.21%). In the analytic sample, 154/175 (88.0%) were confirmed cases. Sex was not associated with diagnostic classification (exact $p=0.231$). The reason for non-vaccination or a missed vaccine dose was associated with diagnosis ($\chi^2=13.860$, $p=0.031$), whereas the other investigated factors were not statistically significant. **Conclusion:** Measles represented a substantial hospital-based burden, and vaccination barriers were the principal measured factor associated with diagnostic classification. **Keywords:** Measles; Children; Vaccination; Immunization; Prevalence; Swat; Pakistan.

INTRODUCTION

Measles is a highly contagious viral disease and remains an important cause of preventable morbidity among children, particularly in populations where vaccination coverage is incomplete. Transmission occurs primarily through respiratory droplets and airborne spread, and susceptible children may develop fever, cough, coryza, conjunctivitis, and a characteristic maculopapular rash. Although most affected children recover, measles can lead to serious complications, including pneumonia, diarrhea, dehydration, otitis media, encephalitis, visual impairment, and death, particularly among young, unvaccinated, immunologically vulnerable, or malnourished children. Effective measles-containing vaccines have substantially reduced measles-related morbidity and mortality; however, sustained high vaccination coverage is required to prevent continued transmission and outbreaks (1–4).

Measles remains a persistent public-health concern in Pakistan, where gaps in routine immunization, missed vaccination opportunities, limited access to vaccination services, and clusters of susceptible children continue to

facilitate transmission. Recent outbreak information from Pakistan has demonstrated a substantial burden among young children and a particularly high proportion of cases among individuals who had not received measles-containing vaccine doses (5). Globally, progress toward measles elimination has also remained vulnerable to disruptions in immunization coverage and the accumulation of susceptible populations, emphasizing the importance of maintaining effective surveillance and routine vaccination programmes (6). Because measles is highly transmissible, timely recognition of suspected cases, appropriate clinical assessment, infection-prevention measures, and rapid public-health responses are also essential components of measles control (7).

Evidence from Khyber Pakhtunkhwa further illustrates the continuing burden of measles and the importance of vaccination status. A serological and molecular investigation conducted among 336 suspected measles cases in Khyber Pakhtunkhwa reported that 205 (61.0%) were positive for measles-specific IgM antibodies, with a substantial proportion of IgM-positive individuals having received no measles vaccine dose (8). Disruptions in routine childhood immunization have also been documented within the province. A study from District Dir Lower reported reduced measles vaccination coverage during the COVID-19 period, demonstrating how interruptions in routine immunization services can create immunity gaps among young children (9). These findings indicate that both disease surveillance and continuity of routine immunization remain important for measles prevention in the region.

National evidence additionally suggests that reported vaccine receipt does not always correspond directly to measurable population immunity. A recent study of 3,596 Pakistani children aged 18–24 months found high reported receipt of measles-containing vaccine doses but substantially lower measles IgG seropositivity, with antibody positivity associated with factors including vaccination source, documentation, residence, place of delivery, and previous measles infection (10). Surveillance-based time-series research from Pakistan has also demonstrated temporal and seasonal variation in measles occurrence and an overall increasing pattern in reported cases during the period studied, further highlighting the need for continued epidemiological surveillance and locally responsive preventive strategies (11). Collectively, these studies demonstrate that measles occurrence in Pakistan is influenced by complex patterns of vaccination coverage, immunity gaps, healthcare access, and population susceptibility.

Despite the available national and provincial evidence, recent data specifically characterizing measles among children aged 6 months to 5 years presenting to Saidu Group of Teaching Hospital (SGTH), Swat, remain limited. Evidence from national surveillance systems, serological studies, or studies conducted in other districts cannot directly describe the pattern of disease among children presenting to this hospital because study populations, diagnostic approaches, healthcare-seeking patterns, and underlying vaccination coverage may differ. Hospital-based data from SGTH are therefore important for describing the local burden among children presenting to the Pediatric Isolation Ward and for examining whether selected socio-demographic, vaccination-related, environmental, nutritional, and feeding-related characteristics are associated with measles diagnosis.

Accordingly, this descriptive cross-sectional study was conducted to determine the hospital-based prevalence of measles and examine selected factors associated with measles diagnosis among children aged 6 months to 5 years presenting to or admitted to the Pediatric Isolation Ward of Saidu Group of Teaching Hospital, Swat. The study specifically sought to answer the question: what is the prevalence of measles in this hospital-based population, and which measured socio-demographic, vaccination-related, environmental, nutritional, and feeding-related factors are associated with measles diagnosis?

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in the Pediatric Isolation Ward of Saidu Group of Teaching Hospital (SGTH), Saidu Sharif, Swat, Khyber Pakhtunkhwa, Pakistan, to determine the hospital-based prevalence of measles and examine selected factors associated with measles diagnosis among children aged 6 months to 5 years. Data collection was undertaken over approximately one month (3–4 weeks). The target population comprised children aged 6–60 months who presented to or were admitted to the Pediatric Isolation Ward during the study period. A total of 329 children in the specified age group were recorded in the study population during this period, of whom 175 were included for detailed data collection and analysis using a non-probability consecutive sampling technique.

Children were eligible if they were aged 6–60 months, presented to or were admitted to the selected study setting during the study period, and their parent or guardian agreed to participate. Children younger than 6 months or older than 5 years and those whose parent or guardian did not agree to participate were not included. Age was determined from the child's birth certificate or immunization record where available and otherwise from caregiver report. Before recruitment, permission to conduct the study was obtained from the hospital administration. The purpose and procedures of the study were explained to parents or guardians, and informed consent was obtained before data collection. Participation was voluntary, withdrawal was permitted at any time without affecting the child's treatment or hospital services, and participant information was handled confidentially and used for research purposes only.

Data were collected through face-to-face interviews with mothers or guardians using a structured questionnaire developed for the study. The questionnaire contained 20 items organized into socio-demographic characteristics, measles-related history, vaccination-related factors, environmental characteristics, nutritional status, and feeding practices. Socio-demographic variables included the child's age and sex, maternal educational level, monthly family income, and number of children in the family. Measles-related variables included diagnostic classification, laboratory IgM status, duration since rash onset, and reported disease complications. Diagnosis was recorded in three categories—confirmed measles, suspected measles, and not measles—while laboratory status was recorded separately as measles IgM positive, negative, or pending.

Vaccination-related information included previous receipt of measles/MMR vaccine, number of vaccine doses received, reasons for non-vaccination or missed doses, Vitamin A supplementation during the preceding 6 months, and maternal knowledge regarding measles prevention. Reported reasons for non-vaccination or missed vaccination included lack of awareness, distance from an Expanded Programme on Immunization center, vaccine hesitancy, and other reasons. Environmental and household variables included reported contact with a measles case during the preceding 21 days and family size. Feeding practice at 6 months of age was classified as breastfeeding, formula feeding, or mixed feeding. The questionnaire also recorded a history of severe malnutrition during the previous year and nutritional status. Mid-upper arm circumference was recorded in centimeters and categorized on the study form as normal at ≥ 12.5 cm, moderate acute malnutrition at 11.5–12.4 cm, and severe acute malnutrition at < 11.5 cm.

Each enrolled participant was interviewed once during the study period, and responses were recorded on the structured data-collection form. To promote consistency of data collection, the same questionnaire structure and predefined response categories were used for all participants. Before formal data collection, the questionnaire was reviewed by experts and peers. Internal-consistency analysis was also performed for the five questionnaire items entered into the reliability assessment; all 175 cases were included in this analysis, with no excluded cases, and Cronbach's alpha was 0.803.

The primary descriptive outcome was the proportion of confirmed measles cases among the defined hospital-based study population during the study period. Within the 175 participants included in the detailed analytic sample, measles diagnostic status was further examined in relation to selected socio-demographic, vaccination-related, environmental, nutritional, and feeding-related variables. Because the study used a cross-sectional observational design, these analyses were treated as assessments of statistical association rather than evidence of causal relationships.

Data were entered and analyzed using IBM SPSS Statistics version 27. Categorical variables were summarized using frequencies and percentages, while the number of children in the family was additionally summarized using the mean where reported. Hospital-based measles prevalence was calculated using the number of confirmed measles cases as the numerator and the defined hospital population during the study period as the denominator. Bivariate associations between measles diagnostic category and selected categorical variables were assessed using Pearson's chi-square test. The analyses included child sex, disease complications, measles/MMR vaccination status, reason for non-vaccination or missed vaccination, Vitamin A supplementation, maternal knowledge regarding measles prevention, reported contact with a measles case during the previous 21 days, household-related variables, nutritional status, and feeding practice at 6 months. Statistical significance was evaluated at a two-sided p-value of ≤ 0.05 . The reported association analyses were unadjusted and were therefore interpreted as exploratory bivariate relationships.

Administrative permission was obtained from Saidu Group of Teaching Hospital before data collection, and informed consent was obtained from the participating children's parents or guardians. Parents and guardians were informed that participation was voluntary, that they could withdraw without providing a reason, and that refusal or withdrawal would not affect the clinical care received by their child. Participant confidentiality was maintained throughout the study, and identifiable information was not intended for disclosure in the research report.

RESULTS

During the study period, 329 children aged 6 months to 5 years presented to or were admitted to the Pediatric Isolation Ward of Saidu Group of Teaching Hospital. Of these, 154 were reported as confirmed measles cases, corresponding to a hospital-based prevalence of 46.81% (95% CI 41.48–52.21%). A total of 175 children constituted the detailed analytic sample. Within this sample, 154 (88.0%) were classified as confirmed measles, 19 (10.9%) as suspected measles, and 2 (1.1%) as not measles (Table 2).

Table 1. Sociodemographic Characteristics of the Analytic Sample (N=175)

Characteristic	n (%)
Sex	
Male	98 (56.0)
Female	77 (44.0)
Maternal education	
Illiterate	60 (34.3)
Primary	85 (48.6)
Matric	29 (16.6)
Secondary	1 (0.6)
Monthly family income	
Low	75 (42.9)
Middle	82 (46.9)
High	18 (10.3)

Percentages may not total exactly 100% because of rounding.

Among the 175 participants, 98 (56.0%) were male and 77 (44.0%) were female. Primary education was the most frequent maternal educational category, reported for 85 (48.6%) mothers, followed by illiteracy in 60 (34.3%). Middle monthly family income was reported for 82 (46.9%) families, while 75 (42.9%) were classified in the low-income category.

Table 2. Measles Burden in the Hospital Population and Diagnostic Distribution in the Analytic Sample

Population/outcome	n/N	%	95% CI (%)
Confirmed measles in hospital population	154/329	46.81	41.48–52.21
Confirmed measles in analytic sample	154/175	88.0	82.35–92.02
Suspected measles in analytic sample	19/175	10.9	7.06–16.33
Not measles in analytic sample	2/175	1.1	0.31–4.07

CI, confidence interval. Confidence intervals were calculated using the Wilson score method.

Table 3. Distribution of Measles Diagnostic Classification by Sex (N=175)

Diagnostic classification	Male (n=98), n (%)	Female (n=77), n (%)	Total (N=175), n (%)
Confirmed measles	88 (89.8)	66 (85.7)	154 (88.0)
Suspected measles	8 (8.2)	11 (14.3)	19 (10.9)
Not measles	2 (2.0)	0 (0.0)	2 (1.1)
Total	98 (100.0)	77 (100.0)	175 (100.0)

Table 4. Association Between Sex and Measles Diagnostic Classification

Comparison	Pearson χ^2	df	Pearson p-value	Exact p-value	Cramér's V
Sex × measles diagnostic classification	3.142	2	0.208	0.231	0.134

Exact p-value was obtained using the Fisher–Freeman–Halton exact test. Cramér's V represents the effect-size estimate for the 2×3 contingency table. Statistical significance was evaluated at $p \leq 0.05$.

Confirmed measles accounted for 88 of 98 male participants (89.8%) and 66 of 77 female participants (85.7%). The overall distribution of confirmed, suspected, and non-measles classifications did not differ statistically by sex. The originally reported Pearson chi-square test yielded $\chi^2=3.142$ with 2 degrees of freedom ($p=0.208$). Reanalysis using

the Fisher–Freeman–Halton exact test, which accommodates the sparse diagnostic cells, similarly showed no evidence of an association ($p=0.231$), with Cramér's V of 0.134.

Table 5. Bivariate Associations With Measles Diagnostic Classification

Variable	χ^2	p-value
Number of children in family	8.916	0.984
Disease complications	7.277	0.122
Measles/MMR vaccination status	2.702	0.609
Reason for non-vaccination/missed vaccine dose	13.860	0.031
Vitamin A supplementation in previous 6 months	2.527	0.283
Maternal knowledge regarding measles prevention	6.620	0.157
Contact with a measles case in previous 21 days	3.620	0.164
Family size	41.419	0.324
Nutritional status	0.938	0.919
Feeding type at 6 months	4.714	0.318

χ^2 , Pearson chi-square statistic; MMR, measles-mumps-rubella. Statistical significance was evaluated at $p \leq 0.05$.

Among the remaining reported bivariate analyses, the reason for non-vaccination or a missed vaccine dose was associated with measles diagnostic classification ($\chi^2=13.860$, $p=0.031$). No statistically detectable association was reported for disease complications ($\chi^2=7.277$, $p=0.122$), measles/MMR vaccination status ($\chi^2=2.702$, $p=0.609$), Vitamin A supplementation during the previous 6 months ($\chi^2=2.527$, $p=0.283$), maternal knowledge regarding measles prevention ($\chi^2=6.620$, $p=0.157$), or reported contact with a measles case during the previous 21 days ($\chi^2=3.620$, $p=0.164$).

Similarly, the reported analyses showed no statistically detectable association between measles diagnostic classification and number of children in the family ($\chi^2=8.916$, $p=0.984$), family size ($\chi^2=41.419$, $p=0.324$), nutritional status ($\chi^2=0.938$, $p=0.919$), or feeding type at 6 months of age ($\chi^2=4.714$, $p=0.318$). Thus, among the reported bivariate comparisons, the reason for non-vaccination or a missed vaccine dose was the only variable with a p-value below the prespecified 0.05 threshold.

DISCUSSION

The present study identified a substantial hospital-based burden of measles among children aged 6 months to 5 years presenting to the Pediatric Isolation Ward of Saidu Group of Teaching Hospital, Swat. Almost half of the 329 children recorded during the study period were classified as confirmed measles cases, while confirmed measles constituted a much larger proportion of the 175 children included in the detailed analytic sample. Among the investigated characteristics, the reason for non-vaccination or a missed vaccine dose was the only reported bivariate factor associated with measles diagnostic classification. In contrast, sex, reported measles/MMR vaccination status, Vitamin A supplementation, maternal knowledge, recent contact with a measles case, nutritional status, and feeding practices were not statistically associated with diagnostic classification. These findings should be interpreted as hospital-based observational associations rather than causal relationships.

The observed burden is consistent with evidence that measles continues to circulate substantially in Khyber Pakhtunkhwa. Khalid et al. investigated 336 suspected measles cases in the province and reported measles-specific IgM positivity in 205 (61.0%), with infants and toddlers constituting an important affected group (8). Although that proportion is higher than the hospital-based prevalence observed in the present study, direct numerical comparison is limited because the earlier investigation specifically enrolled suspected measles cases and used serological confirmation, whereas the present study was conducted among children presenting to a Pediatric Isolation Ward and included confirmed, suspected, and non-measles diagnostic categories. Differences in case selection, diagnostic ascertainment, study duration, geographical coverage, and underlying outbreak activity could therefore explain variation between the estimates.

The findings are also consistent with recent national surveillance indicating continued measles transmission among young children in Pakistan. During the first 12 epidemiological weeks of 2024, 12,560 suspected measles cases and 5,208 confirmed cases were reported nationally, with children younger than 5 years accounting for most reported cases and Khyber Pakhtunkhwa contributing the largest provincial proportion of suspected cases (5).

Such surveillance data reinforce the public-health relevance of hospital-based observations from Swat, while also emphasizing that estimates derived from an isolation ward should not be interpreted as community prevalence.

The association between reasons for non-vaccination or missed vaccination and measles diagnosis deserves cautious interpretation. Previous evidence from Khyber Pakhtunkhwa supports the importance of gaps in immunization. Among IgM-positive measles cases studied by Khalid et al., a large proportion had received no measles vaccine dose (8). Similarly, research from District Dir Lower documented disruption of routine childhood immunization during the COVID-19 period, including reduced measles vaccine coverage, illustrating how interruptions in access to routine services may create susceptible groups of children (9). In the present study, reasons such as lack of awareness, distance from immunization services, and vaccine hesitancy were recorded among children with missed or absent vaccination. These factors may represent different pathways through which timely immunization is interrupted; however, the significant overall chi-square result does not establish that any individual barrier independently increased the probability of measles, and the study did not provide an adjusted analysis capable of separating these effects from socioeconomic or other confounding factors.

Interestingly, reported measles/MMR vaccination status itself was not statistically associated with diagnostic classification. This finding should not be interpreted as evidence that vaccination is ineffective. Measles-containing vaccination remains the principal preventive strategy against measles (4,6). Furthermore, reported receipt of vaccination does not necessarily establish complete age-appropriate vaccination, accurate documentation, correct timing, adequate immune response, or sustained protective antibody levels. A recent national survey of vaccinated Pakistani children aged 18–24 months found that although reported vaccine uptake was relatively high, only 65% were seropositive for measles IgG antibodies, with seropositivity varying according to vaccination source, documentation, residence, place of delivery, and previous measles infection (10). Differences between caregiver-reported vaccination history and biological immunity may therefore contribute to apparently weak associations in hospital-based observational studies.

No statistically detectable association was observed between sex and measles diagnostic classification. Although the proportion classified as confirmed measles was numerically higher among boys than girls, the difference was small, and the effect size was weak. This suggests that sex was not an important discriminator of diagnostic classification within this sample. Similarly, the absence of statistically detectable associations for Vitamin A supplementation, maternal knowledge, reported recent measles contact, nutritional status, and feeding practices should not be interpreted as proof that these factors are unrelated to measles risk. The relatively small numbers in some diagnostic categories, particularly the non-measles group, reduce statistical power and precision and may obscure clinically relevant relationships.

The continued occurrence of measles observed in the present study is also compatible with national temporal patterns. Surveillance-based time-series analysis of measles cases in Pakistan from 2014 to 2024 demonstrated an increasing long-term trend together with substantial seasonal variation, indicating persistent epidemiological conditions favorable to recurrent measles transmission (11). In this context, the findings from SGTTH reinforce the importance of maintaining sensitive case surveillance, identifying children with incomplete vaccination, and linking eligible children with routine or catch-up immunization services. These implications are particularly relevant in settings where interruptions in routine vaccination or geographic barriers may permit susceptible children to accumulate (5,9).

An important strength of this study is its focus on a clinically relevant young-child population in a major healthcare setting in Swat and its simultaneous assessment of demographic, vaccination-related, environmental, nutritional, and feeding-related characteristics. Nevertheless, several limitations influence interpretation. The study was conducted at a single hospital over a relatively short period and used non-probability consecutive sampling for the detailed analytic sample, limiting representativeness and generalizability. The 329 children constituting the hospital population and the 175 children included in detailed analysis represent different denominators, and the concentration of confirmed cases within the analytic sample may introduce selection effects. Several variables depended on caregiver report and may therefore be affected by recall or misclassification. The relatively small suspected and non-measles groups generated sparse contingency-table cells, limiting the reliability of conventional chi-square analyses for some variables. In addition, the reported analyses were predominantly unadjusted bivariate comparisons, so potential confounding by age, socioeconomic characteristics, vaccination

history, nutritional status, and other factors was not controlled. Multiple exploratory comparisons were also performed, meaning that the isolated p-value below 0.05 should be interpreted conservatively.

Overall, the findings indicate a substantial burden of measles among young children presenting to the Pediatric Isolation Ward of SGTH and suggest that barriers underlying missed or absent vaccination warrant particular attention. The results support continued measles surveillance and efforts to identify children who have not received age-appropriate vaccination, while further multicenter or community-based studies with clearly defined diagnostic criteria, representative sampling, and adjusted analyses are required to characterize determinants of measles occurrence more precisely.

CONCLUSION

Measles represented a substantial hospital-based burden among children aged 6 months to 5 years presenting to Saidu Group of Teaching Hospital, Swat, with 154 of 329 children classified as confirmed cases during the study period. Within the detailed analytic sample, the reason for non-vaccination or a missed vaccine dose was the only measured factor showing a statistically detectable association with measles diagnostic classification, whereas the other examined demographic, preventive, environmental, nutritional, and feeding-related factors were not significantly associated. These findings highlight the importance of continued surveillance and attention to vaccination gaps while remaining limited to the hospital-based, cross-sectional population studied.

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