JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

https://doi.org/10.61919/33geb609

Original Article

Perceived Susceptibility to Viral Illnesses and School Absenteeism Among Children Aged 3.5 to 12 Years: A Health Belief Model-Based Cross-Sectional Study in Karachi, Pakistan

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"Cite this Article" Received: 10 March 2026; **Accepted**: 05 May 2026; **Published**: 19 May 2026

Author Contributions: Concept: MTA; Design: SF and QS; Data Collection: FA and YH; Analysis: RS; Drafting: MTA, SF, QS, FA, YH, and RS.. **Ethical Approval**: Jinnah Post Graduate Medical Centre, Karachi, Pakistan. **Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: N/A.

ABSTRACT

Background: Viral illnesses are an important contributor to school absenteeism among children, yet the role of parental health beliefs in attendance decisions remains insufficiently explored in Karachi, Pakistan. **Objective:** This study aimed to determine the prevalence of viral illness-related school absenteeism among children aged 3.5–12 years and examine its association with parental perceived susceptibility and other Health Belief Model constructs. **Methods:** A cross-sectional, school-based survey was conducted among 616 parent–child pairs from selected private schools in urban Karachi. Parents completed a structured questionnaire assessing sociodemographic characteristics, viral illness-related absenteeism during the preceding 3–6 months, and Health Belief Model constructs, including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action. Descriptive statistics, chi-square tests, and binary logistic regression were used to evaluate associations. **Results:** Overall, 237 children (38.5%) experienced at least one viral illness-related absenteeism episode, with a mean absence duration of 4.2 ± 3.1 days. Respiratory illness was the most common reported cause, followed by gastroenteritis and dengue-like illness. In adjusted analysis, higher perceived susceptibility (aOR = 1.86, 95% CI: 1.41–2.45), perceived severity (aOR = 1.32, 95% CI: 1.03–1.69), and perceived barriers (aOR = 1.72, 95% CI: 1.32–2.23) were associated with higher odds of absenteeism, whereas perceived benefits were protective (aOR = 0.66, 95% CI: 0.51–0.85). **Conclusion:** Viral illness-related absenteeism was common among children in Karachi and was significantly associated with parental Health Belief Model constructs, particularly perceived susceptibility and barriers. Parent-focused school health interventions should provide clear illness and return-to-school guidance to reduce avoidable absenteeism while maintaining infection control. **Keywords:** School absenteeism; viral illness; Health Belief Model; perceived susceptibility; parental beliefs; Karachi; children.

INTRODUCTION

Viral illnesses remain an important and preventable contributor to short-term school absenteeism among children, with respiratory and enteric infections frequently disrupting attendance, learning continuity, and family routines. School-aged children are particularly vulnerable because classrooms provide repeated close-contact exposure, and even brief infectious episodes may lead to missed instructional time, parental work disruption, and delayed academic progress. Evidence from school-aged

populations has shown that medically attended acute viral respiratory infections, including influenza-associated illness, are associated with substantial numbers of missed school days, supporting the educational as well as public health relevance of infection-related absenteeism (1). In low- and middle-income urban settings, this burden may be amplified by overcrowding, variable access to hygiene facilities, and inconsistent preventive practices, making school-based infection prevention and attendance decision-making especially important.

In Karachi, the problem has additional local relevance because children are exposed to both respiratory and enteric viral risks in densely populated school and community environments. Earlier community-based evidence from Karachi documented enteric viral infections among preschool children, highlighting the continuing relevance of viral gastroenteritis in young populations (2). School-based environmental evidence from Sindh has also indicated a high risk of hepatitis A virus exposure through drinking-water sources in primary schools, reinforcing concerns about enteric viral transmission in educational settings (3). Although these studies support the plausibility of viral illness as a contributor to school absence, the local literature has not adequately quantified viral illness-related absenteeism among younger school-going children or examined how parents interpret illness risk when deciding whether a child should remain at home.

Parental decision-making is central to school attendance during childhood illness because children aged 3.5–12 years depend largely on caregivers to assess symptoms, judge contagiousness, seek care, and determine when school return is appropriate. These decisions may not be based only on clinical severity; they may also reflect perceived risk, fear of worsening illness, concern about transmission to other children, school policies, and the perceived academic cost of absence. The Health Belief Model provides a suitable theoretical framework for examining these decisions because it explains health-related behavior through perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy (4,5). Within this framework, perceived susceptibility is especially relevant because parents who believe their child is highly likely to acquire or transmit viral illness may be more inclined to keep the child at home, even when symptoms are mild or resolving.

Previous HBM-based research has shown that parental beliefs can influence infection-prevention and child-health behaviors. In regional infectious-disease contexts, HBM constructs such as perceived susceptibility and perceived severity have been associated with preventive practices for dengue, indicating that perceived risk can shape household-level protective behavior (6). Similarly, studies applying the HBM to vaccination-related decision-making have shown that parents' perceptions of disease risk and seriousness are important determinants of acceptance of preventive action for children (7). In school settings, absenteeism surveillance has also been discussed as a reflection of infectious-disease activity and household responses to perceived illness risk, suggesting that parental interpretation of symptoms and susceptibility may influence whether children attend school during periods of viral transmission (8). However, most available evidence focuses on infection surveillance, vaccination, or broad absenteeism rather than the specific association between parental perceived susceptibility to viral illness and school absenteeism among children in Karachi.

This gap is important because unnecessary absenteeism can widen learning gaps, while premature return to school during contagious illness can increase transmission risk. A balanced school-health approach therefore requires evidence on both the burden of viral illness-related absenteeism and the belief-based factors associated with parental attendance decisions. For children aged 3.5–12 years attending selected private schools in Karachi, the relevant PICO framework is as follows: the population is school-going children and their parents; the exposure is higher parental perceived susceptibility to viral illnesses, considered within the broader HBM framework; the comparison is lower perceived susceptibility or lower HBM risk perception; and the outcome is viral illness-related school absenteeism over the preceding 3–6 months. Accordingly, this study aimed to determine the prevalence and pattern of viral illness-related absenteeism and to examine whether parental perceived susceptibility to viral

illnesses, together with other HBM constructs, was associated with school absenteeism after adjustment for relevant sociodemographic and health-related factors.

MATERIALS AND METHODS

This cross-sectional, school-based observational study was conducted to estimate the prevalence of viral illness-related school absenteeism and to examine its association with parental Health Belief Model constructs among children aged 3.5–12 years attending selected private schools in urban Karachi, Pakistan. The cross-sectional design was selected because it allowed simultaneous assessment of absenteeism history, parental perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and relevant sociodemographic and health-related characteristics at a single time point. The Health Belief Model was used as the conceptual framework because it provides a structured explanation of how perceived risk, illness seriousness, perceived advantages and obstacles of action, and external cues may influence parental decisions about keeping a child home during viral illness (9).

The study population comprised school-going children aged 3.5–12 years enrolled from Montessori/Pre-1 to Class 8 in participating private schools in Karachi. Children were eligible if they were within the specified age range, were enrolled in a participating school, and had a parent or guardian available to provide written informed consent and complete the study questionnaire. Children were excluded if they had documented non-viral chronic conditions that regularly caused absenteeism unrelated to viral illness, including severe neurological, congenital, or long-term medical conditions, or if parental consent was not provided. The sampling frame included eligible children from selected schools, and a two-stage school-based sampling approach was used. At the first stage, schools were selected to represent different school levels and urban socioeconomic catchment areas. At the second stage, classes within participating schools were selected systematically, and all eligible children in selected classes were invited until the required sample size was achieved.

The sample size was calculated using a single-population proportion formula for cross-sectional studies, with a 95% confidence level, an assumed prevalence of viral illness-related absenteeism of 40%, and a 5% margin of error. The initial minimum sample size was 369. Because recruitment was school-based and participants were clustered within schools/classes, a design effect of 1.5 was applied, increasing the required sample to 554. A 10% allowance was then added for non-response, producing a final target sample of approximately 616 parent–child pairs (10). This final sample size provided sufficient precision for prevalence estimation and adequate data for multivariable modeling of Health Belief Model constructs and selected confounders.

Data were collected over a 4–6-week period using a parent-reported questionnaire administered at school premises through face-to-face interviews. Written permission was obtained from school authorities before recruitment. Parents or guardians were informed about the purpose of the study, voluntary participation, confidentiality protections, and their right to withdraw before written consent was obtained. The questionnaire was bilingual in Urdu and English to improve comprehension and reduce information bias. Data collectors followed a standardized interview procedure to ensure consistency in question delivery, response recording, and clarification of Likert-scale options.

The data collection instrument was titled “Parent Reported Questionnaire on Viral Illness Related Absenteeism and Health Belief Model Constructs among Children Aged 3.5–12 Years.” It contained four sections. The first section recorded sociodemographic and school-related characteristics, including child age, sex, class level, school type, parental education, parental occupation, and household income bracket. The second section assessed viral illness-related absenteeism during the preceding 3–6 months, including whether the child had missed school because of flu-like illness, respiratory infection, dengue-like illness, gastroenteritis, or other parent-reported viral illness, as well as the number of absence days and main reported illness category. The third section assessed Health Belief Model constructs, including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action.

Perceived susceptibility, perceived severity, perceived benefits, and perceived barriers were measured using 5-point Likert-scale items ranging from 1 = strongly disagree to 5 = strongly agree. Cues to action were measured as categorical indicators, including doctor advice, school message, media alert, family influence, or peer-related information. The fourth section assessed health-related factors, including vaccination status, availability of vaccination card where applicable, hand-hygiene practices, and the number of parent-reported viral illness episodes in the preceding 3–6 months.

Viral illness-related absenteeism was operationally defined as at least one day of school absence during the preceding 3–6 months directly attributed by the parent or guardian to flu-like illness, respiratory infection, dengue-like illness, gastroenteritis, or another viral illness. Absence of three or more days during the same period was treated as an indicator of higher absenteeism burden. The primary exposure was parental perceived susceptibility to viral illness, defined as the parent's belief, measured on a 5-point Likert scale, that the child was likely to acquire viral illnesses. Perceived severity referred to the parent's belief that viral illness could be serious or harmful for the child. Perceived benefits referred to the parent's belief that school attendance after mild or improving illness had educational or social value, whereas perceived barriers referred to perceived obstacles to attendance, including fear of worsening illness, fear of transmitting infection, school policy concerns, supervision difficulty, transport constraints, and financial or caregiving burden. Sociodemographic covariates included child age, sex, class level, parental education, parental occupation, and household income category. Health-related covariates included vaccination status, hand-hygiene practices, and reported frequency of recent viral illness episodes.

The questionnaire was pilot tested in approximately 10% of the calculated sample size from a non-participating school to assess clarity, language appropriateness, face validity, flow, and feasibility of administration. Minor wording refinements were made after pilot testing while retaining the core Health Belief Model constructs, item structure, and Likert response format. To reduce measurement bias, interviewers used standardized wording, parents were asked to recall a defined 3–6-month period, and absenteeism questions were framed around specific illness categories rather than general absence. School-record verification of absenteeism was used where available to support parent-reported absence data. Selection bias was addressed by recruiting all eligible children from selected classes after parental consent, while confounding was addressed analytically through multivariable regression.

Data were entered into SPSS version 26.0 using a predefined coding framework. A 10% random subset of questionnaires underwent double-entry validation to identify transcription errors and improve data integrity. Data cleaning included range checks, logical consistency checks, assessment of duplicate entries, and review of missing or implausible values. Continuous variables were examined for distributional characteristics before selection of summary statistics. Categorical variables were coded using predefined numeric categories, and Likert-scale items were coded so that higher values represented stronger endorsement of the construct being measured. Composite scores for Health Belief Model domains were calculated from relevant items, and higher versus lower categories were created using predefined scale thresholds where categorical comparison was required.

Descriptive statistics were used to summarize the study population and key variables. Categorical variables, including sex, class level, income category, vaccination status, illness category, absenteeism status, and Health Belief Model construct categories, were reported as frequencies and percentages. Continuous variables, including age and number of absence days, were summarized as means and standard deviations when approximately normally distributed, or medians and interquartile ranges when skewed. The prevalence of viral illness-related absenteeism was calculated with 95% confidence intervals.

Univariate analysis was performed to examine crude associations between viral illness-related absenteeism and Health Belief Model constructs. Chi-square tests were used for categorical comparisons, including high versus low perceived susceptibility, perceived severity, perceived benefits, perceived

barriers, and presence versus absence of cues to action. Binary logistic regression was then used to model viral illness-related absenteeism as the dependent variable. Independent variables included perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, child age, sex, socioeconomic status, and health-related covariates. Adjusted odds ratios with 95% confidence intervals and p-values were reported to quantify the strength and direction of associations. Multicollinearity among predictors was assessed using variance inflation factors, with values below 2.0 considered acceptable. Model performance was assessed using overall model significance and Nagelkerke R^2. Age-stratified analysis was conducted for children aged 3.5–6 years, 7–9 years, and 10–12 years to explore whether the association between perceived susceptibility and absenteeism differed across developmental age groups. Statistical significance was set at $p < 0.05$. Analyses were conducted using SPSS version 26.0, with sensitivity checks performed in STATA version 17.0.

Ethical procedures were followed throughout the study. Written informed consent was obtained from one parent or guardian for each participating child. Participation was voluntary, and parents were informed that refusal or withdrawal would not affect the child's schooling. Data were anonymized before analysis, and no child names or unique school identifiers were retained in the analytic dataset. Completed questionnaires and electronic data files were stored securely with access limited to the research team. Questions were framed neutrally to avoid blame toward parents, schools, teachers, or children. At the end of data collection, participating schools received brief health education material on hand hygiene, vaccination importance, and reasonable school attendance decisions during mild viral illness.

RESULTS

A total of 616 parent–child pairs were included in the analysis. The mean age of participating children was 7.8 years (SD = 2.1). Males represented 51.5% of the sample (n = 317), while females represented 48.5% (n = 299). Children were distributed across early, middle, and upper school levels, with 28.1% enrolled in Montessori/Pre-1 to Class 2, 34.2% in Classes 3–5, and 37.7% in Classes 6–8. Maternal education was most commonly graduate level (41.2%), followed by secondary education (31.6%), while 12.7% of mothers had postgraduate education. Most families were in the lower- and middle-income categories, with 42.4% reporting monthly income below PKR 30,000 and 37.7% reporting PKR 30,000–60,000.

Table 1. Sociodemographic Characteristics of the Study Participants (n = 616)

Variable	Category / Measure	n (%) or Mean ± SD
Child age	Mean ± SD	7.8 ± 2.1 years
Child sex	Male	317 (51.5%)
	Female	299 (48.5%)
Class level	Montessori/Pre-1 to Class 2	173 (28.1%)
	Classes 3–5	211 (34.2%)
	Classes 6–8	232 (37.7%)
Maternal education	No formal education	37 (6.1%)
	Primary	52 (8.4%)
	Secondary	195 (31.6%)
	Graduate	254 (41.2%)
	Postgraduate	78 (12.7%)
Paternal education	Graduate	282 (45.8%)
	Postgraduate	113 (18.3%)
Monthly household income	< PKR 30,000	261 (42.4%)
	PKR 30,000–60,000	232 (37.7%)
	> PKR 60,000	123 (19.9%)

Overall, 237 children experienced at least one episode of viral illness-related school absenteeism during the preceding 3–6 months, giving a prevalence of 38.5%. The mean number of absence days due to viral illness was 4.2 days (SD = 3.1), with reported absence ranging from 1 to 18 days. A higher absenteeism burden, defined as three or more days missed during the same recall period, was observed in 142 children, representing 23.0% of the total sample. Among children with viral illness-related absenteeism, respiratory illness was the most frequently reported cause, accounting for 162 cases (68.4%), followed by

gastroenteritis in 102 cases (43.0%) and dengue-like illness in 29 cases (12.2%). Parental Health Belief Model responses showed moderately high perceived susceptibility and severity, with mean scores of 3.8 (SD = 0.9) and 4.1 (SD = 0.7), respectively. Most parents agreed or strongly agreed that their child was likely to acquire viral illnesses (72.4%) and that viral illness could be serious for their child (78.9%).

Table 2. Viral Illness-Related Absenteeism and Health Belief Model Construct Levels

Variable	Denominator	n (%) or Mean ± SD
Children with ≥1 viral illness-related absenteeism episode	616	237 (38.5%)
Mean absentee days due to viral illness	Children with absenteeism	4.2 ± 3.1 days
Range of absentee days	Children with absenteeism	1–18 days
Absentee days ≥3 days in last 3–6 months	616	142 (23.0%)
Main reported cause: respiratory illness	237	162 (68.4%)
Main reported cause: gastroenteritis	237	102 (43.0%)
Main reported cause: dengue-like illness	237	29 (12.2%)
Perceived susceptibility score	616	3.8 ± 0.9
Perceived severity score	616	4.1 ± 0.7
Agree/strongly agree child is likely to get viral illness	616	446 (72.4%)
Agree/strongly agree viral illness can be serious	616	486 (78.9%)

Bivariate analysis showed statistically significant associations between viral illness-related absenteeism and all examined Health Belief Model constructs. Among children with absenteeism, 182 cases (76.8%) were in the high perceived susceptibility group compared with 55 cases (23.2%) in the lower perceived susceptibility group; this association was statistically significant ($\chi^2 = 9.84$, df = 1, $p = 0.002$).

High perceived severity was also associated with absenteeism, with 176 absenteeism cases (74.3%) in the high severity group compared with 61 (25.7%) in the lower severity group ($\chi^2 = 7.32$, df = 1, $p = 0.007$). The strongest bivariate association was observed for perceived barriers, where 194 absenteeism cases (81.9%) were in the high-barrier group and 43 (18.1%) were in the lower-barrier group ($\chi^2 = 11.45$, df = 1, $p < 0.001$). Low perceived benefits of school attendance despite mild illness were also significantly associated with absenteeism ($\chi^2 = 5.89$, df = 1, $p = 0.015$), and the presence of cues to action was associated with increased absenteeism during illness ($\chi^2 = 4.73$, df = 1, $p = 0.030$).

Table 3. Univariate Associations Between Health Belief Model Constructs and Viral Illness-Related Absenteeism

Health Belief Model Construct	Category Among Children With Absenteeism	n (%)	χ^2	df	p-value
Perceived susceptibility	High score ≥4	182 (76.8%)	9.84	1	0.002
	Lower score <4	55 (23.2%)			
Perceived severity	High score ≥4	176 (74.3%)	7.32	1	0.007
	Lower score <4	61 (25.7%)			
Perceived barriers	High barriers	194 (81.9%)	11.45	1	<0.001
	Lower barriers	43 (18.1%)			
Perceived benefits	Low benefits ≤3	149 (62.9%)	5.89	1	0.015
	Higher benefits >3	88 (37.1%)			
Cues to action	Present	153 (64.6%)	4.73	1	0.030
	Absent	84 (35.4%)			

Binary logistic regression was performed to identify independent predictors of viral illness-related absenteeism. The final model was statistically significant ($\chi^2 = 42.36$, df = 8, $p < 0.001$), with a Nagelkerke R^2 of 0.21, indicating that the model explained approximately 21% of the variance in absenteeism. Perceived susceptibility was the strongest independent predictor: each unit increase in susceptibility score was associated with 1.86 times higher odds of viral illness-related absenteeism (95% CI: 1.41–2.45, $p < 0.001$).

Perceived barriers were also independently associated with absenteeism, with 1.72 times higher odds (95% CI: 1.32–2.23, $p < 0.001$). Perceived benefits showed a protective association; children whose parents reported higher perceived benefits of school attendance had lower odds of absenteeism (OR = 0.66, 95% CI: 0.51–0.85, $p = 0.001$).

Perceived severity remained statistically associated with absenteeism after adjustment (OR = 1.32, 95% CI: 1.03–1.69, $p = 0.032$), whereas cues to action showed borderline association (OR = 1.25, 95% CI: 0.92–1.69, $p = 0.056$). Child age, female sex, and SES composite score were not statistically significant predictors.

Table 4. Multivariable Logistic Regression Predicting Viral Illness-Related Absenteeism (n = 616)

Predictor	B	SE	Wald χ^2	Adjusted OR	95% CI	p-value
Perceived susceptibility	0.62	0.14	19.02	1.86	1.41–2.45	<0.001
Perceived severity	0.28	0.13	4.60	1.32	1.03–1.69	0.032
Perceived benefits	−0.41	0.12	11.56	0.66	0.51–0.85	0.001
Perceived barriers	0.54	0.13	16.64	1.72	1.32–2.23	<0.001
Cues to action	0.22	0.11	3.64	1.25	0.92–1.69	0.056
Age, years	−0.03	0.05	0.36	0.97	0.88–1.07	0.548
Female sex	−0.11	0.10	1.21	0.90	0.71–1.13	0.271
SES composite score	−0.08	0.07	1.30	0.92	0.80–1.07	0.254
Constant	−1.45	0.25	33.64			<0.001

Age-stratified analysis showed that perceived susceptibility remained positively associated with viral illness-related absenteeism across age categories, but the strength of association decreased with increasing age. The association was strongest among children aged 3.5–6 years, where higher perceived susceptibility was associated with 2.10 times higher odds of absenteeism (95% CI: 1.42–3.10, $p < 0.001$). Among children aged 7–9 years, the association remained statistically significant, with an OR of 1.90 (95% CI: 1.28–2.82, $p = 0.001$). In children aged 10–12 years, the association was weaker and did not reach statistical significance, with an OR of 1.55 (95% CI: 0.95–2.53, $p = 0.081$). This gradient indicates that parental perceived susceptibility had the greatest association with absenteeism among younger children and a progressively smaller association among older children.

Table 5. Age-Stratified Association Between Perceived Susceptibility and Viral Illness-Related Absenteeism

Age Group	Odds Ratio	95% CI	p-value
3.5–6 years	2.10	1.42–3.10	<0.001
7–9 years	1.90	1.28–2.82	0.001
10–12 years	1.55	0.95–2.53	0.081

Together, these findings show that viral illness-related absenteeism affected more than one-third of children in the study sample, with respiratory illness and gastroenteritis accounting for the largest reported illness categories. The Health Belief Model constructs were meaningfully associated with absenteeism in both univariate and adjusted analyses. In the multivariable model, perceived susceptibility, perceived severity, and perceived barriers increased the odds of absenteeism, while perceived benefits of school attendance showed a protective association. The age-stratified results further showed that perceived susceptibility was most strongly associated with absenteeism among younger children aged 3.5–6 years, suggesting a stronger role of parental risk perception in attendance decisions for younger school-going children.

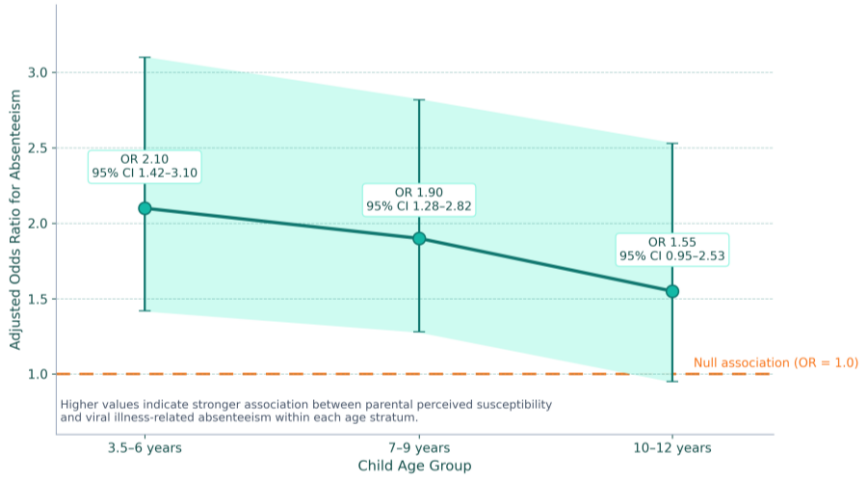

Figure 1. Age-Related Gradient in the Association Between Parental Perceived Susceptibility and Viral Illness-Related School Absenteeism

Figure description: The figure demonstrates a clear age-related attenuation in the association between parental perceived susceptibility and viral illness-related school absenteeism. The adjusted odds ratio was highest among children aged 3.5–6 years (OR 2.10, 95% CI 1.42–3.10), declined modestly in those aged 7–9 years (OR 1.90, 95% CI 1.28–2.82), and was lowest in the 10–12 years group (OR 1.55, 95% CI

0.95–2.53). Across all strata, the effect estimates remained above the null value of 1.0, indicating a consistently positive direction of association, although the confidence interval for the oldest age group crossed the null threshold, reflecting weaker statistical certainty. Clinically, this pattern suggests that parental risk perception exerts the strongest influence on school absence decisions in younger children, with a progressively smaller impact as children grow older.

DISCUSSION

This study found that viral illness-related school absenteeism was a substantial burden among children aged 3.5–12 years in selected private schools of Karachi, with 38.5% of children experiencing at least one episode of absence during the preceding 3–6 months and a mean absence duration of 4.2 days among affected children. Respiratory illness was the leading reported cause, followed by gastroenteritis and dengue-like illness, indicating that both respiratory and enteric viral syndromes contributed meaningfully to missed school days in this population. This pattern is consistent with previous evidence showing that acute viral respiratory infections are a frequent cause of school absence among children and that absenteeism can serve as an indirect marker of infectious disease burden in school communities (8,11). In the Karachi context, where children may be exposed to crowded classrooms, variable hygiene conditions, and seasonal viral transmission, these findings support the relevance of integrating infection prevention with attendance-preservation strategies rather than treating absenteeism solely as an educational issue (12,13).

The most important finding was the independent association between parental perceived susceptibility and viral illness-related absenteeism. After adjustment for Health Belief Model constructs and sociodemographic factors, children whose parents reported higher perceived susceptibility had 1.86 times higher odds of absenteeism (95% CI: 1.41–2.45; $p < 0.001$). This finding aligns closely with the Health Belief Model, which proposes that perceived vulnerability to illness influences protective or avoidance-related behavior (14). In practical terms, parents who believe their child is highly likely to acquire, worsen, or transmit viral illness may adopt a more cautious attendance decision, especially when symptoms are ambiguous or when school return criteria are unclear. This interpretation is particularly relevant for younger children, who may be viewed as less able to self-monitor symptoms, maintain hygiene, or communicate worsening illness during the school day. The finding also extends prior HBM-based evidence from infectious disease prevention contexts by showing that perceived susceptibility is not only related to preventive actions such as vaccination or vector-control behavior but may also influence day-to-day parental decisions about school attendance (15,16).

Perceived severity also showed a meaningful relationship with absenteeism. In univariate analysis, high perceived severity was significantly associated with absenteeism, and in the adjusted model it remained statistically associated with higher odds of absence (adjusted OR: 1.32; 95% CI: 1.03–1.69; $p = 0.032$). Although the magnitude of association was smaller than that observed for perceived susceptibility and perceived barriers, the direction of effect suggests that parents who regard viral illness as potentially serious may be more likely to keep children at home. This finding is theoretically coherent because perceived severity contributes to overall perceived threat within the Health Belief Model (4,5). However, the relatively modest effect size indicates that perceived seriousness alone may not fully explain absenteeism decisions; rather, severity appears to operate alongside perceived likelihood of illness, perceived obstacles to attendance, and perceived value of continued schooling.

Perceived barriers were among the strongest independent predictors of absenteeism, with higher perceived barriers associated with 1.72 times higher odds of viral illness-related school absence (95% CI: 1.32–2.23; $p < 0.001$). These barriers may include fear of spreading infection, uncertainty about school illness policies, limited school-based health support, transport difficulties, parental work constraints, or concern that teachers may not adequately monitor an unwell child. Within the Health Belief Model, barriers are often powerful determinants of behavior because they influence whether families can

translate knowledge or intention into action (5,9). In this study, the association between barriers and absenteeism suggests that parents may not simply be responding to the child's symptoms; they may also be responding to the perceived difficulty of safely sending a mildly ill or recently recovered child to school. This has practical relevance because barriers are potentially modifiable through clearer school guidance, non-punitive attendance policies, improved communication with parents, and visible infection-control practices within schools.

In contrast, higher perceived benefits of school attendance despite mild illness showed a protective association, with reduced odds of absenteeism (adjusted OR: 0.66; 95% CI: 0.51–0.85; p = 0.001). This suggests that parents who recognize the educational, social, and routine-preserving value of timely school return may be less likely to keep children absent for prolonged or low-severity illness episodes. This finding does not imply that children with contagious or clinically significant symptoms should attend school; rather, it indicates that parental recognition of the benefits of attendance may reduce avoidable absence once symptoms are mild, improving, or no longer compatible with exclusion from school. The balance between infection control and educational continuity is therefore central. HBM-informed parent education should not simply reduce perceived susceptibility or severity; it should help parents distinguish between situations requiring home isolation and situations where safe school return is reasonable.

Cues to action were associated with absenteeism in univariate analysis and showed a borderline adjusted association (adjusted OR: 1.25; 95% CI: 0.92–1.69; p = 0.056). This pattern suggests that external triggers such as physician advice, school messages, media alerts, family influence, or peer reports may influence parental decisions, although their independent effect may overlap with perceived susceptibility, severity, and barriers. In school-health practice, cues to action can be beneficial when they provide clear, evidence-based guidance, but they may also increase unnecessary absence if messages are vague, fear-based, or inconsistent. During periods of seasonal viral transmission, communication from schools and health authorities should therefore be specific, symptom-based, and age-appropriate, helping parents decide when a child should remain at home and when return to school is appropriate.

The age-stratified findings provide an important developmental interpretation of the results. The association between perceived susceptibility and absenteeism was strongest among children aged 3.5–6 years (OR: 2.10; 95% CI: 1.42–3.10; p < 0.001), remained significant among those aged 7–9 years (OR: 1.90; 95% CI: 1.28–2.82; p = 0.001), and was weaker and statistically uncertain among children aged 10–12 years (OR: 1.55; 95% CI: 0.95–2.53; p = 0.081). This gradient indicates that parental risk perception may be especially influential for younger children, who are often perceived as more vulnerable and less capable of independent symptom management. Older children may have different attendance dynamics, including academic pressure, peer influence, greater autonomy, and parental expectations that they can tolerate mild symptoms. The age-related pattern supports targeted school-health messaging for parents of younger children, particularly those in Montessori, pre-primary, and early primary grades, where parental caution may be greatest and where return-to-school guidance may have the largest impact.

The findings also contribute to the local evidence base by linking absenteeism with parental belief constructs rather than only documenting absence frequency. Previous local work has recognized infectious illness and school absenteeism as relevant concerns, and HBM-based studies in infectious disease prevention have demonstrated that perceived risk and seriousness can shape preventive behavior (6,17). This study adds a school-attendance dimension by showing that the same belief structure may be associated with whether parents keep children home during viral illness episodes. The model explained approximately 21% of the variance in absenteeism, indicating that HBM constructs captured a meaningful but incomplete portion of the decision-making process. Other unmeasured factors, such as school-specific exclusion rules, parental employment flexibility, access to healthcare, number of siblings, classroom attendance culture, and actual symptom severity, may explain additional variation.

From a public health and educational perspective, the results support a balanced intervention approach. Schools should avoid messages that minimize viral illness risk, because infection control remains important; however, they should also avoid vague or overly cautious policies that may unintentionally increase unnecessary absenteeism. Practical guidance should distinguish symptoms requiring absence, such as high fever, persistent vomiting or diarrhea, breathing difficulty, or acute systemic illness, from mild or resolving symptoms that may allow safe return. Parent-facing materials can be structured around HBM constructs by addressing realistic susceptibility, clarifying severity thresholds, increasing perceived benefits of timely return, reducing perceived barriers through supportive school policies, and using cues that are clear rather than alarmist. Such an approach may reduce avoidable absenteeism while preserving appropriate infection-control behavior.

Several strengths support the interpretation of the findings. The study used a theory-based framework, included a relatively large sample of 616 parent–child pairs, assessed multiple HBM constructs rather than perceived susceptibility alone, and adjusted for key sociodemographic factors in multivariable analysis. The use of age-stratified analysis added clinically and educationally relevant insight by showing that the susceptibility–absenteeism association was not uniform across developmental stages. At the same time, the findings should be interpreted within the constraints of the cross-sectional design, which does not establish temporal direction between beliefs and absenteeism. It is possible that previous absenteeism experiences increased parental perceived susceptibility, rather than susceptibility preceding absence decisions. Parent-reported illness and absence data may also be affected by recall bias or social desirability bias, particularly over a 3–6-month recall period. In addition, restriction to selected private schools in urban Karachi may limit transferability to public schools, rural settings, and families with different socioeconomic or healthcare-access profiles.

Overall, the study demonstrates that viral illness-related absenteeism among children aged 3.5–12 years in Karachi is associated not only with illness occurrence but also with parental beliefs about susceptibility, severity, barriers, and benefits. The findings suggest that school-health interventions should move beyond generic infection-prevention advice and include structured parental guidance on risk appraisal and safe return-to-school decisions. By addressing both infection-control needs and the educational consequences of avoidable absence, HBM-informed school health programs may offer a practical pathway for reducing unnecessary absenteeism while maintaining child safety and public health responsibility.

CONCLUSION

This study demonstrated that viral illness-related school absenteeism was common among children aged 3.5–12 years in selected private schools of Karachi, affecting 38.5% of participants during the preceding 3–6 months, with respiratory illness and gastroenteritis emerging as the leading reported causes of absence. Parental Health Belief Model constructs showed a meaningful association with absenteeism, particularly perceived susceptibility and perceived barriers, which increased the likelihood of school absence, while perceived benefits of school attendance despite mild illness showed a protective association. The association between perceived susceptibility and absenteeism was strongest among younger children, indicating that parental risk perception may play a greater role in attendance decisions during early childhood. These findings suggest that viral illness-related absenteeism is shaped not only by illness occurrence but also by parental beliefs about vulnerability, severity, barriers, and the value of continued schooling. School health strategies in Karachi should therefore combine infection-control measures with clear, age-appropriate return-to-school guidance and parent-focused HBM-based education to reduce avoidable absenteeism while maintaining child safety, limiting transmission risk, and supporting educational continuity.

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