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Original Article

Pediatricians' knowledge of pediatric *Mycoplasma pneumoniae* infection in the post–COVID-19 period: A single-center cross-sectional survey from Türkiye

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ABSTRACT

Objective: *Mycoplasma pneumoniae* (MP) remains an important cause of respiratory tract infections and community-acquired pneumonia in children and has regained prominence in the post–COVID-19 period. We aimed to evaluate pediatricians' knowledge of pediatric MP infection across key clinical domains and to compare knowledge according to professional experience.

Materials and Methods: This single-center, cross-sectional, questionnaire-based study was conducted in November–December 2025. A literature-based, face-to-face survey with 29 multiple-choice items (single best answer) assessed knowledge in four domains: risk factors (5 items), clinical manifestations/complications (8 items), diagnostic tests (6 items), and treatment (10 items). Participants were stratified by experience (0–5 years vs. ≥6 years). Item-level correct response rates were compared using chi-square/Fisher's exact tests, and domain scores were compared using the Mann–Whitney U test.

Results: A total of 126 physicians participated (0–5 years: n=93; ≥6 years: n=33). Domain-level knowledge scores were comparable between groups across risk factors, clinical manifestations/complications, diagnostic tests, and treatment. However, several item-level differences were observed; these item-level comparisons were exploratory. Physicians with ≥6 years of experience more frequently answered correctly questions related to the incubation period, cutaneous manifestations, limitations of serologic testing, and identification of an antibiotic ineffective against *M.pneumoniae* infection. In contrast, physicians with 0–5 years of experience more frequently answered correctly items concerning post-infection immunity, the most commonly affected age group, *M.pneumoniae*-associated CNS disease, hospitalization-related knowledge, and management of MP-associated hemolytic anemia.

Conclusion: Overall knowledge of pediatric *M.pneumoniae* infection was comparable across experience strata at the domain level; however, item-level findings should be interpreted cautiously as exploratory. These findings support an institution-wide, high-yield educational package prioritizing diagnostic test interpretation (particularly serology), recognition of extrapulmonary manifestations, and evidence-based antimicrobial selection in the post–COVID-19 period.

Keywords: *Mycoplasma pneumoniae*, children, community-acquired pneumonia, knowledge, pediatricians, surveys and questionnaires

Introduction

Mycoplasma pneumoniae (MP) is an important bacterial pathogen causing respiratory tract infections in children, with a clinical spectrum ranging from mild upper respiratory tract infection to tracheobronchitis and community-acquired pneumonia (CAP) (1,2). Although many infections are self-limited and present as so-called "walking pneumonia," *M. pneumoniae* infection may also cause moderate-to-severe lower respiratory tract disease requiring hospitalization. Common clinical manifestations include fever, persistent cough (often initially non-productive), and dyspnea, while rhinorrhea, pharyngitis, otitis, headache, and chest pain may also accompany the infection. In some children, cough may be prolonged for weeks after the acute phase (3,4).

Mycoplasma pneumoniae is classically recognized as a pathogen affecting school-aged children and adolescents more frequently than younger children, and it is among the leading causes of pediatric CAP in this age group. However, recent surveillance data indicate that age patterns may shift during resurgence periods, with increased detection also

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reported in younger children after the COVID-19 pandemic era (5,6). This changing epidemiology is clinically relevant because it broadens the age range in which pediatricians should consider *M. pneumoniae* infection in the differential diagnosis of respiratory infections (7).

The epidemiology of *M. pneumoniae* infection is characterized by cyclical outbreaks, typically occurring every 3–7 years, partly related to changes in circulating strains and the accumulation of susceptible individuals as post-infection immunity wanes (8,9). In addition, outbreaks tend to be facilitated in crowded settings such as schools and households, and transmission can be sustained by the organism's relatively long incubation period. *M. pneumoniae* infections can occur year-round, but many datasets indicate increased activity in summer and early autumn, with subsequent seasonal spillover into colder months depending on region and outbreak dynamics (10). Beyond respiratory disease, *M. pneumoniae* infection is increasingly recognized as a cause of extrapulmonary manifestations, which may occur with or without prominent respiratory symptoms. Reported manifestations most commonly involve the gastrointestinal and dermatologic systems (e.g., vomiting, diarrhea, non-specific rash), but neurologic and cardiovascular complications have also been described (11,12). Rare but clinically significant presentations such as hepatitis, pancreatitis, and mycoplasma-induced rash and mucositis (MIRM) have been reported. The broad clinical spectrum and the potential for immune-mediated complications make early recognition and appropriate management particularly important in pediatric practice (13).

The COVID-19 pandemic substantially altered the epidemiology of respiratory pathogens, including *M. pneumoniae* infection. Non-pharmaceutical interventions (e.g., masking, distancing, school closures) were associated with a marked decline in *M. pneumoniae* infection circulation during 2020–2022. Following the relaxation of these measures, several countries reported re-emergence and surges of *M. pneumoniae* infections, beginning in 2023 and extending into 2024, likely in part due to an expanded susceptible population after a prolonged period of reduced exposure (5,14). Public health surveillance data from multiple systems have documented this post-pandemic resurgence and highlighted its implications for pediatric respiratory care. From a therapeutic perspective, *M. pneumoniae* infection is clinically important because it lacks a cell wall, rendering beta-lactam antibiotics ineffective. Macrolides remain the first-line treatment in children in many settings, particularly for suspected or confirmed *M. pneumoniae*; however, macrolide resistance has become an important global concern, with substantial geographic variation (5,15). In severe, refractory, or complicated cases, treatment decisions may require escalation and multidisciplinary evaluation, especially when significant neurologic, mucocutaneous, or other extrapulmonary involvement is suspected. These diagnostic and therapeutic complexities underscore the need for pediatricians to maintain updated knowledge on *M. pneumoniae* infection epidemiology, clinical manifestations, diagnostic testing, and treatment principles.

In the post-pandemic period, timely recognition and appropriate management of *M. pneumoniae* infections have become even more critical for pediatricians. Accordingly, this study aimed to evaluate pediatricians' knowledge regarding risk factors, clinical manifestations and complications, diagnostic tests, and treatment approaches for *M. pneumoniae* infection, and to compare knowledge levels according to professional experience in a single-center setting. The questionnaire-based analysis was structured across these four domains, enabling a focused assessment of strengths and knowledge gaps relevant to routine pediatric care.

Materials and Methods

Study design and setting

This was a single-center, cross-sectional, questionnaire-based study conducted to assess pediatricians' knowledge regarding *M. pneumoniae* infection in children. The study evaluated knowledge in four predefined domains: risk factors, clinical manifestations/complications, diagnostic testing, and treatment approaches. The study was conducted over a 2-month period, between November 2025 and December 2025.

Participants

A total of 126 physicians participated in the study. Participants were recruited on a voluntary basis, and only physicians who agreed to participate were included. The study population consisted of pediatrics residents and board-certified pediatric specialists. Physicians with 0–5 years of professional experience were residents, whereas those with ≥6 years of experience were pediatric specialists. The draft questionnaire items were reviewed by a pediatric infectious diseases specialist and a general pediatrics specialist for clinical accuracy, content relevance, and clarity; items were revised by consensus to minimize ambiguity and ensure alignment with current evidence. For comparative analyses, participants were stratified according to professional experience into two groups: 0–5 years and ≥6 years.

Questionnaire development and administration

The questionnaire was developed based on the existing literature on pediatric *M. pneumoniae* infection and was designed to assess knowledge across key domains, including epidemiology, risk factors, clinical manifestations and complications, diagnostic methods, and treatment approaches. To ensure methodological rigor, questionnaire development followed a structured, stepwise process. First, we performed a focused review of post–COVID-19 pediatric M. pneumoniae literature emphasizing changes in incidence, emerging treatment challenges (including concerns about antimicrobial resistance), and extrapulmonary manifestations. Second, an a priori content blueprint was created across four domains (risk factors; clinical manifestations/complications; diagnostic tests; treatment), and an initial pool of items was drafted accordingly. Third, the draft questionnaire was reviewed for clinical accuracy, relevance, and clarity by a panel consisting of a pediatric infectious diseases specialist and a general pediatrics specialist; items were refined by consensus to reduce ambiguity and align wording with current evidence and routine clinical decision points. Fourth, the revised version was pilot-tested face-to-face in a small group of physicians not included in the final analysis to assess feasibility, comprehension, and completion time; minor wording revisions were made based on feedback.

The final instrument consisted of 29 multiple-choice questions, each with a single best correct answer, and was organized into four domains. The risk factor domain (5 items) included questions on epidemiologic and transmission-related characteristics, such as age groups at higher risk, outbreak periodicity, and factors associated with increased susceptibility. The clinical manifestations and complications domain (8 items) covered both common respiratory findings (e.g., fever, persistent cough, and dyspnea) and extrapulmonary involvement, including dermatologic, gastrointestinal, and neurologic complications. The diagnostic tests domain (6 items) assessed knowledge of commonly used diagnostic approaches, including PCR-based testing, serologic methods, and considerations related to test timing and interpretation. The treatment domain (10 items) evaluated knowledge of first-line antimicrobial options, the ineffectiveness of beta-lactam antibiotics due to the absence of a cell wall, and management considerations in severe, refractory, or complicated cases.

Because the instrument was designed as a domain-based knowledge assessment sampling multiple content areas rather than a unidimensional psychometric scale, formal scale validation was not the primary aim; accordingly, content coverage and clarity were ensured through the blueprinting, expert review, and pilot testing steps described above.

The questionnaire was administered face-to-face. There were no missing responses in the completed questionnaires; therefore, no imputation or missing-data handling procedure was required.

Scoring and outcome measures

Each questionnaire item had one correct answer. For item-level analyses, the number and percentage of correct responses were calculated for each participant group.

For domain-level analyses, the number of correctly answered items was calculated separately for each participant in each of the four domains (risk factors, clinical manifestations/complications, diagnostic tests, and treatment). These domain scores were compared between experience groups.

The primary outcome was the difference in domain-specific knowledge scores between the two experience groups. Secondary outcomes included item-level differences in correct response rates.

Statistical analysis

All statistical analyses were performed to compare knowledge performance between physicians with 0–5 years and ≥6 years of professional experience. Descriptive statistics were used to summarize participant characteristics and questionnaire performance. For item-level analyses, responses were coded as correct or incorrect, and each item was summarized as number (n) and percentage (%) of correct responses in each experience group. Between group comparisons for categorical variables were performed using the chi-square test or Fisher's exact test, as appropriate according to expected cell counts.

For domain-level analyses, a score was calculated for each participant in each of the four questionnaire domains (risk factors, clinical manifestations/complications, diagnostic tests, and treatment) by assigning 1 point for each correct answer and 0 points for each incorrect answer, with no penalty for incorrect responses. Thus, higher scores indicated greater knowledge within the relevant domain. The normality of distribution for continuous variables was assessed using the Shapiro–Wilk test. Because domain scores were discrete and not normally distributed, they were summarized as median and interquartile range (IQR) and compared between the two experience groups using the Mann–Whitney U test. If a total knowledge score was also analyzed, it was calculated as the sum of all correctly answered items (possible range: 0–29) and summarized similarly as median (IQR), with between-group comparisons performed using the Mann–Whitney U test. All tests were two-tailed, and a p value <0.050 was considered statistically significant. Statistical significance was interpreted in conjunction with the magnitude and direction of between-group differences in correct response rates and score distributions. Item-level analyses were exploratory and intended to generate hypotheses regarding topic-specific knowledge gaps. There were no missing responses in the completed questionnaires; therefore, complete-case analysis was performed and no imputation method was required.

Results

A total of 126 physicians were included in the study, including 93 with 0–5 years of professional experience and 33 with ≥6 years. As shown in Table I, although overall performance was similar across many items, several significant item-level differences were identified between the two experience groups. In the risk factor domain, physicians with ≥6 years of experience had a higher correct response rate for the question on the average incubation period of *M. pneumoniae* infection (100.0% vs. 67.7%, p<0.001), whereas physicians with 0–5 years of experience performed better on the item regarding immunity to *M. pneumoniae* (80.6% vs. 42.4%, p<0.001). A significant difference was also observed for the question on the age group in which *M. pneumoniae* most commonly causes community-acquired pneumonia, with correct responses observed only in the 0–5 years group (21.5% vs. 0.0%, p=0.009). In the clinical manifestations/complications domain, the 0–5 years group had a higher correct response rate for the item related to *M. pneumoniae*-associated central nervous system disease (90.3% vs. 66.7%, p=0.004), while the ≥6 years group performed better on the item regarding cutaneous manifestations (87.9% vs. 66.7%, p=0.035). In the diagnostic tests domain, the ≥6 years group showed higher correct response rates for the item on laboratory findings not expected in *M. pneumoniae* pneumonia (90.9% vs. 72.0%, p=0.049) and the item assessing knowledge of the limitations of serologic tests (87.9% vs. 61.3%, p=0.009). In the treatment domain, the 0–5 years group had higher correct response rates for the questions on hospitalization rates (73.1% vs. 42.4%, p=0.003) and management of *M. pneumoniae*-associated hemolytic anemia (75.3% vs. 45.5%, p=0.003), whereas the ≥6 years group performed better on the item identifying an antibiotic ineffective against *M. pneumoniae* (100.0% vs. 80.6%, p=0.003).

As presented in Table II, despite these item-specific differences, domain-based knowledge scores did not differ significantly

Table I: Item-level correct response rates to the *Mycoplasma pneumoniae* knowledge questionnaire according to physicians' professional experience

Domain / Questionnaire item	0–5 years (n=93)*	≥6 years (n=33)*	p*
Risk factors			
Transmission route	93 (100.0)	33 (100.0)	–
Household transmission rate	34 (36.6)	13 (39.4)	0.936
Incubation period	63 (67.7)	33 (100.0)	<0.001
Post-infection immunity	75 (80.6)	14 (42.4)	<0.001
Age group most associated with CAP	20 (21.5)	0 (0.0)	0.009
Clinical manifestations and complications			
Most prominent symptom	72 (77.4)	19 (57.6)	0.050
Most common accompanying condition	78 (83.9)	25 (75.8)	0.439
Not an extrapulmonary manifestation	72 (77.4)	22 (66.7)	0.324
CNS involvement (true statement)	84 (90.3)	22 (66.7)	0.004
Least common neurologic complication	63 (67.7)	23 (69.7)	>0.999
Cutaneous manifestations (true statement)	62 (66.7)	29 (87.9)	0.035
Serious cardiac complication	–	–	–
System with most common extrapulmonary complication	6 (6.5)	–	0.339
Diagnostic tests			
Not expected laboratory finding	67 (72.0)	30 (90.9)	0.049
Fastest/most sensitive test	48 (51.6)	19 (57.6)	0.699
Not sufficient alone to confirm diagnosis	39 (41.9)	13 (39.4)	0.961
Incorrect radiologic statement	63 (67.7)	24 (72.7)	0.754
Testing approach for suspected encephalitis without respiratory symptoms	64 (68.8)	19 (57.6)	0.339
Main limitation of serology	57 (61.3)	29 (87.9)	0.009
Treatment			
Hospitalization rate (true statement)	68 (73.1)	14 (42.4)	0.003
When to initiate antibiotics	85 (91.4)	30 (90.9)	>0.999
First-line antibiotic	87 (93.5)	30 (90.9)	0.696
Antibiotic not effective against MP	75 (80.6)	33 (100.0)	0.003
Management of MP-associated CNS disease	79 (84.9)	29 (87.9)	0.780
Management of MP-associated hemolytic anemia	70 (75.3)	15 (45.5)	0.003
Reason for beta-lactam non-susceptibility	69 (74.2)	23 (69.7)	0.786
Trigger of acute chest syndrome	42 (45.2)	16 (48.5)	0.900
Group for which prophylaxis may be considered	59 (63.4)	21 (63.6)	>0.999
Steroid indication	84 (90.3)	33 (100.0)	0.110

***:** *n(%) (Pearson's chi-square test or Fisher's exact test)*

Table II: Domain-based knowledge scores according to physicians' professional experience

Domain	0–5 years (n=93)*	≥6 years (n=33)*	p
Risk factors	3.0 (2.0–4.0)	3.0 (2.0–4.0)	0.195
Clinical manifestations and complications	5.0 (4.0–6.0)	5.0 (3.0–5.0)	0.085
Diagnostic tests	4.0 (2.0–5.0)	4.0 (3.0–4.0)	0.761
Treatment	8.0 (7.0–9.0)	7.0 (7.0–8.0)	0.052

***:** *median (interquartile range [IQR]), Mann–Whitney U test*

between the two experience groups. Median (IQR) scores in the 0–5 years and ≥6 years groups were 3.0 (2.0–4.0) vs. 3.0 (2.0–4.0) for risk factors (p=0.195), 5.0 (4.0–6.0) vs. 5.0 (3.0–5.0) for clinical manifestations/complications (p=0.085), 4.0 (2.0–5.0) vs. 4.0 (3.0–4.0) for diagnostic tests (p=0.761), and 8.0 (7.0–9.0) vs. 7.0 (7.0–8.0) for treatment (p=0.052), respectively.

Discussion

In this study, we evaluated pediatricians' knowledge of *M. pneumoniae* infection according to years of professional experience. To the best of our knowledge, this is the first study conducted in Türkiye to assess clinicians' *M. pneumoniae* infection -related knowledge in this manner. Although no statistically significant differences were observed between experience groups in the domain-based scores, several differences emerged at the individual item level. Given the absence of significant domain-level differences, these item-level findings should be interpreted cautiously as topic-specific variability rather than evidence of overall superiority of one group over another. Physicians with ≥6 years of experience achieved higher correct response rates on items addressing the incubation period, cutaneous manifestations, limitations of serologic tests in diagnosis, and identification of an antibiotic ineffective against *M. pneumoniae* infection. In contrast, physicians with 0–5 years of experience performed better on questions related to post-infection immunity, the most commonly affected age group, the most prominent symptom, *M. pneumoniae* -associated central nervous system disease, hospitalization rates, and the management of *M. pneumoniae* -associated hemolytic anemia. Items regarding the route of transmission, when to initiate antibiotic therapy, treatment approach for *M. pneumoniae* -associated CNS disease, indications for steroid therapy, and overall diagnostic approaches were among the most frequently answered correctly in both groups. Item-level differences should be considered exploratory.

In the post–COVID-19 period, heightened awareness of transmission pathways and diagnostic methods (including radiologic evaluation, serology, and PCR) has likely

increased clinicians' overall alertness to these aspects not only for *M. pneumoniae* infection but also for other respiratory infections, which may partly explain the high correct response rates observed for these items across both experience groups (14).

Although domain-level knowledge scores were comparable between experience groups, the observed item-level differences likely reflect the well-described pattern that certain competencies are strengthened primarily through cumulative clinical exposure, whereas others are reinforced through recent, guideline-oriented training. Importantly, because both experience groups practiced during the COVID-19 era, attributing differences solely to "pandemic exposure" versus "years of practice" would be overly simplistic. For example, higher correct response rates among physicians with ≥6 years of experience for the incubation period, cutaneous manifestations, serologic limitations, and identification of an antibiotic ineffective against *M. pneumoniae* may be explained by repeated real-world encounters requiring test selection and interpretation and basic antimicrobial decision rules (16). Contemporary reviews emphasize that *M. pneumoniae* infection diagnostics are highly timing-dependent and that serology has important limitations (e.g., need for paired samples and interpretive pitfalls), while PCR is generally the most accurate approach when available—topics that often become more salient with longitudinal clinical practice and repeated diagnostic stewardship decisions (17). Current recommendations emphasize that PCR is the most accurate routine diagnostic method for *M. pneumoniae*; however, clinicians should interpret a positive PCR result in the clinical context because molecular detection may also occur in asymptomatic carriage or in co-infections. Conversely, serology is limited by timing (particularly early false-negatives) and by prolonged antibody positivity; therefore, single-sample serology may be misleading and paired serology can be required for confirmation in selected scenarios. Importantly, several guidance documents recommend restricting *M. pneumoniae* infection testing to situations in which the result is likely to change management (e.g., severe disease, outbreak settings, or treatment failure), reinforcing the need for targeted clinician education on test selection and interpretation (3,18).

Conversely, better performance of the 0–5 year group on items related to immunity, the most commonly affected age group, hallmark symptoms, *M. pneumoniae* -associated CNS disease, hospitalization-related knowledge, and hemolytic anemia management may reflect the effect of more recent curricula and exam-focused updates, particularly in the post–COVID-19 period when atypical pathogens and extrapulmonary complications have regained prominence. This interpretation is supported by outbreak-era literature documenting post-pandemic *M. pneumoniae* infection resurgences with notable mucocutaneous disease signals (including increased *M. pneumoniae* -induced rash and mucositis) and evolving epidemiologic patterns that necessitate rapid knowledge refresh across all physician strata (19). In this setting, structured continuing medical education has been shown to improve physicians' application of knowledge, especially when delivered with repeated exposures, suggesting that targeted, institution-wide updates could help harmonize these item-level gaps regardless of seniority (20). Overall, the item-level findings should be considered exploratory signals for potential educational targets rather than definitive evidence of group-level superiority.

This study offers a structured, domain-based assessment of pediatricians' knowledge on pediatric *M. pneumoniae* infection and is, to our knowledge, the first such clinician-focused study from Türkiye. Face-to-face administration and complete questionnaires (no missing data) strengthened data quality, while item- and domain-level analyses enabled identification of topic-specific gaps.

Limitations

The single-center, cross-sectional, voluntary design and the relatively small sample size—particularly in the ≥6 years group—may limit generalizability and introduce selection bias. Knowledge was assessed using a domain-based multiple-choice questionnaire rather than observed clinical practice; therefore, the instrument was intended as a pragmatic knowledge assessment tool rather than a formally validated psychometric scale. Multiple item-level comparisons were conducted without formal adjustment for multiple testing; thus, some statistically significant findings—especially borderline results—may reflect type I error. Accordingly, item-level analyses were exploratory and should be interpreted cautiously, with primary emphasis placed on domain-level comparisons. In addition, participant-level factors such as age, subspecialty exposure, guideline use, and academic affiliation were not measured and may have influenced knowledge performance independently of professional experience. Some epidemiologic items relied on specific numeric estimates (e.g., hospitalization rates), which may partially assess recall of statistics rather than clinically actionable knowledge; future iterations will prioritize clinically oriented phrasing over exact values. Finally, because the questionnaire was administered before peer review, items and the predefined answer key could not be modified retrospectively; therefore, a small number of items (e.g., the cardiac-complication item) may be sensitive to variation in literature emphasis and should be interpreted cautiously.

Conclusion

In this single-center, cross-sectional survey, pediatricians with 0–5 years and ≥6 years of professional experience demonstrated comparable overall knowledge of pediatric *M. pneumoniae* infection across the domains of risk factors, clinical manifestations/complications, diagnostic testing, and treatment. Although several item-level differences were observed, these findings should be interpreted cautiously and do not indicate overall superiority of either group, particularly given the absence of statistically significant domain-level differences. These findings support the need for institution-wide, targeted educational updates focusing on high-yield areas such as diagnostic test interpretation (particularly serology), recognition of extrapulmonary manifestations, and evidence-based antimicrobial selection. Because item-level

analyses were exploratory and multiple comparisons were performed without formal adjustment, borderline findings may reflect chance and should be interpreted alongside the domain-level results. Multicenter studies are warranted to confirm these results and to evaluate whether structured training improves knowledge and clinical decision-making in pediatric practice.

Ethics committee approval

This study was conducted in accordance with the Helsinki Declaration Principles. The study was approved by Ankara Bilkent City Hospital (12 November 2025, reference number: TABED 2-25-1625).

Contribution of the authors

Data collection, Literatüre search: BD, AÖP, DG, EGE, Data analysing: SPY Manuscript editing and review: BD, AÖP

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Conflict of interest

The authors declare that there is no conflict of interest.

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