Original Article

Dynamic change of *Mycoplasma pneumoniae* pneumonia in hospitalized children in a general hospital: a 3-year retrospective analysis

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Background: The epidemiology and economic burden of hospitalized community-acquired pneumonia (CAP) children due to *MP* is still poorly understood. This study aimed to investigate the dynamic changes of *Mycoplasma pneumoniae* pneumonia (MPP) in children in a general hospital.

Methods: A total of 2011 CAP children aged 1–16 years hospitalized at Peking University Third Hospital from 2017 to 2019 were enrolled by cross-sectional study for the retrospective analysis of the clinical data mainly including seasonal distribution of MPP, hospital stay, severity, complications, use of flexible bronchoscopy, and hospitalization costs. The dynamic changes of CAP and MPP children within 3 consecutive years and the differences between the MPP group and non-MPP groups were compared.

Results: The proportion of CAP children among hospitalized children was 32.4%, 38.5%, and 39.5% in 2017, 2018, and 2019, respectively, showing an upward trend ($P<0.05$).The prevalence rate of MPP was highest in the third quarter (30.2%) and the fourth quarter (39.2%) and lowest in the second quarter (13.2%) ($\chi^2=51.8$, $P<0.05$). Compared with the non-MPP group, the MPP group had significantly higher incidence of severe pneumonia (19.4% *vs.* 12.0%, $\chi^2=20.99$), incidence of complications (16.1% *vs.* 6.5%, $\chi^2=48.24$), proportion of patients undergoing flexible bronchoscopy (38.4% *vs.* 9.0%, $\chi^2=252.79$), and hospitalization costs (all $P<0.05$), along with significantly longer hospital stay (6 *vs.* 4 days, $z=-11.131$). A dynamic comparison of the clinical characteristics of MPP in 3 years showed that the number of children with MPP increased significantly in preschoolers in 2018 (37.3%) and in school-aged or older children in 2019 (53%) ($P<0.05$). MPP peaks occurred in August 2018 and November 2019. The total hospitalization costs, examination fees, and non-medication treatment costs increased significantly (the z values were 35.24, 46.79, and 9.64, respectively; $P<0.05$) year by year among MPP children; there was no significant difference in the medication cost over these 3 years ($z=4.81$, $P>0.05$).

Conclusions: The proportions of severe pneumonia, complications, and use of flexible bronchoscopy as well as the hospitalization days and costs are higher in MPP children. General hospitals should develop integrated clinical quality control programs for MPP children, so as to optimize the allocation of medical resources.

Keywords: Community-acquired pneumonia (CAP); *Mycoplasma pneumoniae* pneumonia (MPP); health economy; general hospitals

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Introduction

Mycoplasma pneumoniae (MP) is a major cause of community-acquired pneumonia (CAP). In recent years, the incidence and severity of *Mycoplasma pneumoniae* pneumonia (MPP) cases have been increasing (1-3), posing new challenges to clinical diagnosis and treatment. Untreated or severe MPP can affect multi-organs injury, such as the brain, heart, peripheral nervous system, skin, and kidneys as well as hemolytic anemia. In general, children are more susceptible to MP infections than adults. This is aggravated by the fact that they're often surrounded by large groups of other infectious children. As such, children may be at a higher risk for *MPP* than adults. Compared with children specialist hospital, most of children admitted to the pediatric wards in general hospitals have respiratory infections, especially CAP, and a large proportion of them are MPPs. CAP children, especially MPP children, are the main population of pediatric inpatients in general hospital. Generally, the basic diagnosis and treatment of MPP in children is clear. Some studies have analyzed clinical features and epidemiological characteristics of MPP in children (4-6). However, the epidemiology and economic burden of hospitalized CAP due to *MP* is still poorly understood and may change year by year. Therefore, in this study we analyzed the relevant features of the dynamic changes of 2,011 pediatric patients with CAP over 1 year of age admitted to our center within the past 3 years, with an attempt to inform the clinical diagnosis and management of MPP.

We present the following article in accordance with the STROBE reporting checklist (available at http://dx.doi.org/10.21037/tp-20-149).

Methods

Subjects

A total 2011 of CAP children aged 1–16 years hospitalized at the Department of Pediatrics of Peking University Third Hospital from January 1, 2017 to December 31, 2019 were enrolled in this retrospective analysis. The diagnostic criteria for CAP included the following: (I) pneumonia occurring in otherwise healthy children before hospitalization or within 48 hours of hospitalization; (II) with respiratory sign/symptoms including fever, cough, increased respiratory rate, difficulty breathing, inspiratory retraction of the chest wall, wet rales, tubular breath sounds, and others; and (III) abnormal changes in chest imaging. MPP was further diagnosed among these CAP patients by using the passive agglutination (PA) method (Fujirebio, Japan) (1,2). An MP infection was confirmed if the MP antibody titer increased or decreased by 4 times or more during the recovery period or acute period.

The inclusion criteria for enrolled cases were: (I) the age range of children between 1 year to 16 years; (II) hospitalized children who meet the above CAP diagnostic criteria; (III) hospitalized children who had done test for *MP* infection. The exclusion criteria were: (I) hospitalized children who are younger than 1 year and older than 16 years; (II) hospitalized children who were diagnosed with nosocomial pneumonia.

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the ethics committee of our center (Ethical approval number: IRB00006761-M2020097). Because of the retrospective nature of the research, the requirement for informed consent was waived.

Diagnosis and treatment standards

The severity of CAP or MPP (mild or severe) was evaluated according to the *Guidelines for the Management of Community Acquired Pneumonia in Children (2013 edition)* (7). The assessment of intrapulmonary and extrapulmonary complications was based on the *Criteria for Diagnosis and Treatment of Community-acquired Pneumonia in Children (2019 edition)* (8). The use (or not) of flexible bronchoscopy was based on the *Guidelines for the Management of Community-acquired Pneumonia in Children (2013 edition)* (7), and the *2015 Expert Consensus on the Diagnosis and Treatment of Mycoplasma pneumoniae Pneumonia in Children* (9).

Data collection and grouping

The clinical data including age, sex, seasonal distribution of MPP, duration of hospital stay, etiologies, severity of disease, complications, use of flexible bronchoscopy, and

Table 1 Clinical features of CAP children between 2017 and 2019

Clinical features	n (%)			χ^2	P
	2017	2018	2019		
Pediatric inpatients	1,735	1,789	1,921		
Pediatric CAP patients	563 (32.4)	689 (38.5)	759 (39.5)	22.37	0.000
Males	297 (52.8)	345 (50.1)	372 (49.0)	1.86	0.394
Age grouping					
Early childhood group	270 (48.0)	244 (35.4)	310 (40.8)	20.17	0.000
Preschool group	134 (23.8)	240 (34.8)	195 (25.7)	22.66	0.000
School-age or older group	159 (28.2)	205 (29.8)	254 (33.5)	4.61	0.100
Complications	58 (10.3)	62 (9.0)	90 (11.9)	3.17	0.205
Severe CAP	85 (15.1)	97 (14.1)	120 (15.8)	0.38	0.829
Use of flexible bronchoscopy	111 (19.7)	147 (21.3)	166 (21.9)	0.94	0.624
Use of heated and humidified high-flow oxygen therapy	15 (2.7)	18 (2.6)	24 (3.2)	0.48	0.787

CAP, community-acquired pneumonia.

use of heated and humidified high-flow oxygen therapy were collected from electronic medical record information system by blind method. According to their ages, these patients were divided into an early childhood group (1–3 years), preschool group (4–6 years), and school-age or older group (7–16 years). Also, based on the pathogens, they were divided into MPP group and non-MPP group.

The differences of the above indicators in the CAP group and MPP group were compared across 3 consecutive years (2017, 2018, and 2019); also, these differences were compared between the MPP group and non-MPP group.

Statistical analysis

Statistical analysis was performed using SPSS 19.0 software. Measurement data with skewed distribution were described by median (M) and interquartile range (P25, P75), and count data were expressed as cases and percentages. Chi-square test, Kruskal-Wallis nonparametric test, and Mann-Whitney U test were used for inter-group comparisons. A P value of <0.05 was considered statistically significant.

Results

Clinical features of CAP children

A total of 2,011 pediatric inpatients were diagnosed with CAP in three years. These children included 1,014 males and 997 females, with a male to female ratio of 1.02:1.00; the median age was 4 years (range, 2–7 years). Among these children, 824 were in the early childhood group, 569 were in the preschool group, and 618 were in the school-age or older group. The proportion of CAP patients significantly increased in the 3 consecutive years (P<0.05). It was highest in 2017 for the early childhood group and highest in 2018 for the preschool group, and the differences were statistically significant for both groups (both P<0.05); CAP incidence showed a rising trend over these 3 years, but the difference was not statistically significant (P>0.05). The incidence of complications, incidence of severe CAP, use of flexible bronchoscopy, and use of high-flow oxygen treatment were not statistically different over these 3 years (all P>0.05) (*Table 1*). CAP was caused by a single pathogen in 1,998 patients (99.3%) and by 2 pathogens in 13 cases (0.7%). All CAP children were successfully cured and discharged, and no death was noted.

Overall clinical features of MPP children

Of 2,011 CAP patients, 825 MPP cases (41%) were confirmed over these 3 years, with a median age of 6 years (range, 4–8 years). The male-to-female ratio was not significantly different between the MPP group and

Table 2 Seasonal distribution of cases in the MPP group and non-MPP group

Group	n	n (%)			
		Q1	Q2	Q3	Q4
MPP group	825	144 (17.5)	109 (13.2)	249 (30.2)	323 (39.2)
Non-MPP group	1,186	259 (21.8)	282 (23.8)	301 (25.4)	344 (29.0)
χ^2			51.80		
P value			0.000		

MPP, *Mycoplasma pneumoniae pneumonia*.

Table 3 Clinical features of patients in the MPP group and non-MPP group

Group	n	n (%)			
		Severe pneumonia	Complications	Use of flexible bronchoscopy	Use of heated and humidified high-flow oxygen therapy
MPP group	825	160 (19.4)	133 (16.1)	317 (38.4)	24 (2.9)
Non-MPP group	1,186	142 (12.0)	77 (6.5)	107 (9.0)	33 (2.8)
χ^2		20.99	48.24	252.79	0.028
P value		0.000	0.000	0.000	0.886

MPP, *Mycoplasma pneumoniae* pneumonia.

non-MPP group (χ^2=3.62, P>0.05). The positive rate of MPP was 22.3% (184/824), 43.4% (247/569), and 63.8% (394/618) in the early childhood group, preschool group, and school-age or older group (χ^2=252.33, P<0.05). Further pairwise comparisons also showed statistically significant differences (all P<0.05), and the positive rate was highest in the school-age or older group and lowest in the early childhood group. Compared with the non-MPP group, the MPP group showed significant difference in seasonal incidences (P<0.05; Chi-square test). Further Chi-square tests between these two groups showed the incidences of MPP were significantly higher in Q3 and Q4 than in Q1 (both P<0.05); Q2 had the lowest incidence, and the difference was statistically significant (χ^2=5.64, P<0.05); the difference between Q3 and Q4 was not statistically significant (χ^2=1.20, P>0.05) (*Table 2*). Compared with non-MPP group, MPP group had a significantly increased incidence of severe pneumonia, incidence of complications, and use of flexible bronchoscopy (all P<0.05). The use of heated and humidified high-flow oxygen therapy was not significantly different between these two groups (P>0.05) (*Table 3*).

Dynamic changes of clinical features in the MPP group over 3 years

The positive rate of MPP and male-to-female ratio showed no significant change from 2017 to 2019 (both P>0.05), although the difference in the age composition was statistically significant (P<0.05). Further inter-group comparisons by using chi-square test showed that the number of MPP patients increased significantly in 2018 in the early childhood group (χ^2=11.32, P<0.05) and in 2019 in the school-age or older group (χ^2=9.313, P<0.05). The changes in the incidence of complications, severe CAP, use of flexible bronchoscopy, and use of heated and humidified high-flow oxygen therapy were not statistically significant across these 3 years in MPP patients (all P>0.05) (*Table 4*). The seasonal distribution of MPP also showed no significant change over 3 years (χ^2=12.178, P>0.05) (*Figure 1*). The distribution of MP infection in different months over 3 years was further compared, which showed the incidence of MP infection significantly differed across the different months in 2018 (χ^2=39.539, P<0.05) and reached its peak in August (MPP cases accounted for 60.3% of all CAP inpatients). In 2019, the incidence

Table 4 Comparison of clinical characteristics of the MPP group across 3 years

Clinical features	n (%)			χ^2	P value
	2017	2018	2019		
CAP	563	689	759		
MPP	217 (38.5)	287 (41.7)	321 (42.3)	2.05	0.359
Males	107 (49.3)	144 (50.2)	144 (44.9)	1.96	0.376
Age grouping					
Early childhood group	54 (24.9)	63 (22.0)	67 (20.9)	13.756	0.008
Preschool group	56 (25.8)	107 (37.3)	84 (26.1)		
School-age or older group	107 (49.3)	117 (40.7)	170 (53.0)		
Severe pneumonia	48 (22.1)	57 (19.9)	55 (17.1)	2.120	0.346
Complications	35 (16.1)	46 (16.0)	52 (16.2)	0.003	0.998
Use of flexible bronchoscopy	82 (37.8)	116 (40.4)	119 (37.1)	0.768	0.681
Use of heated and humidified high-flow oxygen therapy	4 (1.8)	10 (3.5)	10 (3.1)	1.257	0.533

MPP, *Mycoplasma pneumoniae* pneumonia.

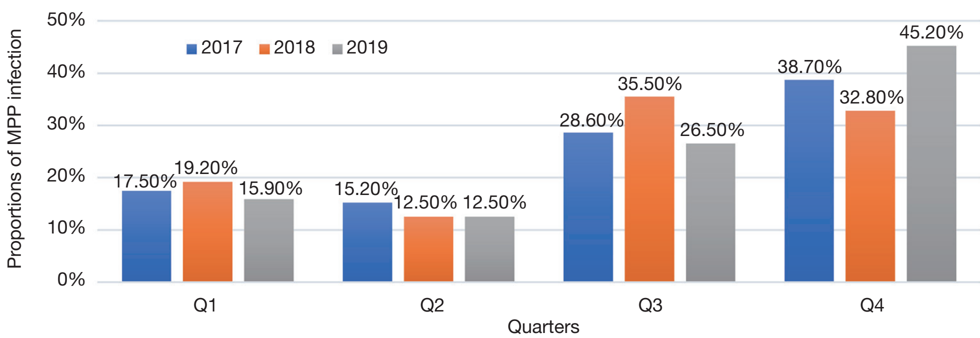

Figure 1 Seasonal distribution of MPP between 2017 and 2019. MPP, *Mycoplasma pneumoniae* pneumonia. Q1: the first quarter; Q2: the second quarter; Q3: the third quarter; Q4: the fourth quarter.

of MP infection also significantly differed across the different months (χ^2=45.698, P<0.05) and reached its peak in November (MPP cases accounted for 64% of all CAP inpatients) (*Figure 2*).

Dynamic changes in economic indicators in CAP and MPP children

Over these 3 years, the median hospital stay was 5 days (range, 3–7 days) in CAP children, which significantly decreased from 5 days (range, 3–6 days) in 2017 to 5 days (range, 4–7 days) in 2018 and 5 days (range, 3–7 days) in 2019 (z=6.295, P<0.05); for MPP children, the median hospital stay was 5 days (range, 4–8 days) in 2017, 6 days (range, 4–8 days) in 2018, and 6 days (range, 4–8 days) in 2019, showing no significant difference (P>0.05); for non-MPP children, the median hospital stay was 5 days (range, 3–6 days) in 2018, 4 days (range, 3–6 days) in 2017, and 4 days (range, 3–6 days) in 2019, showing significant difference (z=6.068, P>0.05). The median hospital stay was 6 days (range, 4–8 days) in the MPP group and 4 days (range, 3–6 days) in the non-MPP group (z=−11.131, P<0.05) (*Figure 3*).

The total hospitalization costs (5,869 yuan in 2017, 6,829

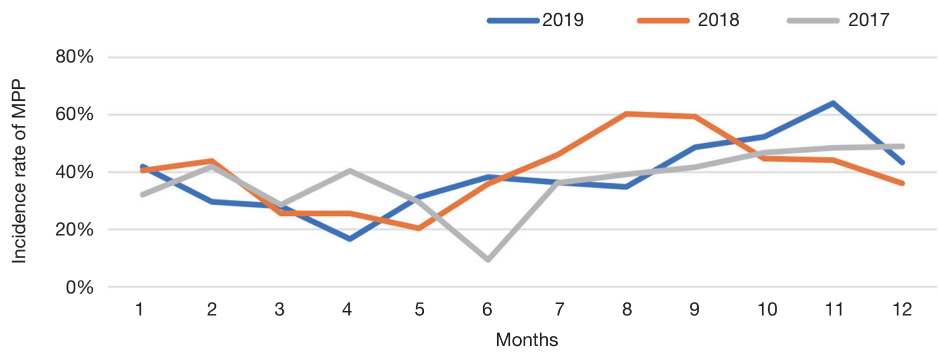

Figure 2 The MPP monthly trend between 2017 and 2019. MPP, *Mycoplasma pneumoniae pneumonia*.

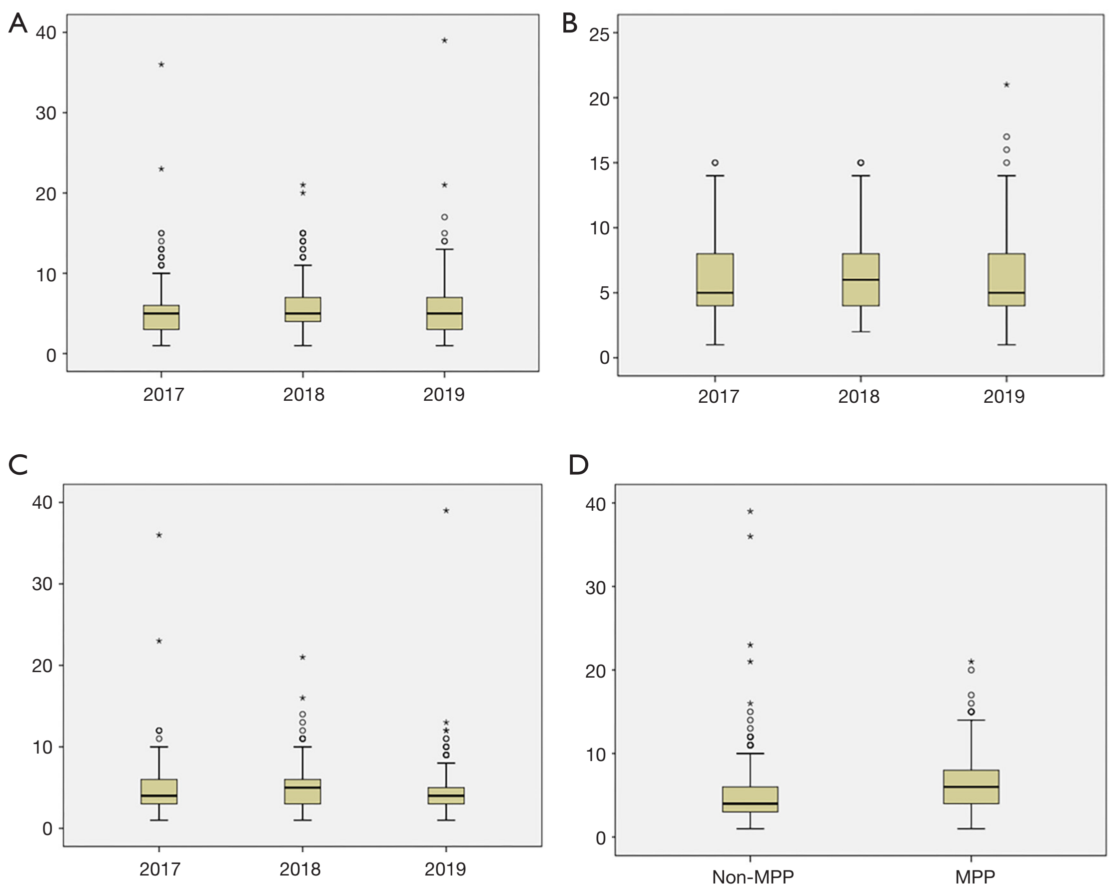

Figure 3 Distribution of hospitalization days. (A) Distribution of hospitalization days among CAP patients; (B) distribution of hospitalization days in the MPP group; (C) distribution of hospitalization days in the non-MPP group; (D) distribution of hospitalization days in the MPP and non-MPP groups. *, outlier; °, discrete value. CAP, community-acquired pneumonia; MPP, *Mycoplasma pneumoniae pneumonia*.

yuan in 2018, and 7,071 yuan in 2019), examination fees, non-medication treatment costs, and medication treatment costs increased year by year among CAP children in 3 consecutive years, and the differences were statistically significant (the z values were 35.24, 46.79, and 9.64, respectively; $P<0.05$). Compared with the non-MPP group, the MPP group had a significantly larger increase in total hospitalization costs, examination fees, non-medication treatment costs, and medication treatment costs (the z values were −14.82, −14.85, and −12.821, respectively; $P<0.05$). Dynamic comparisons inside the MPP group showed that the total hospitalization costs, examination fees, and non-medication treatment costs significantly increased each year (the z values were 11.51 and 15.20; both $P<0.05$), whereas the medication treatment costs showed no significant change [1,696.21 yuan (1,163.37, 2,785.15) in 2017, 2,003.18 yuan (1,351.18, 2,851.89) in 2018, and 2033.40 yuan (1,221.14, 3,051.06) in 2019] ($z=4.81$, $P>0.05$).

Discussion

The results from the current study show that CAP patients account for about one-third of the pediatric hospitalized children in general hospitals, and the proportion of CAP patients has risen over the past 3 years. Although young children (1–3 years) remain the most susceptible age group to CAP, the proportion of the school-age or older group is gradually increasing. This may be explained by the fact that the incidence of MPP is also increasing among school-age children; in addition, the school-age children and adolescents currently have a lower resistance to CAP, mainly due to various social factors such as high school stress and small living spaces. Despite the increase in CAP prevalence, the proportion of severe CAP, the incidence of complications, and the use of flexible bronchoscopy and oxygen therapy did not increase accordingly, and all the patients were cured and discharged without difficulty, suggesting that the diagnosis and treatment capabilities have also progressed and have lowered the incidences of severe CAP and complications.

Our current study showed that MPP accounted for 41% of all hospitalized CAP children. The incidence of MPP and the proportion of MPP cases among CAP patients have been rising over the past 3 years, but the difference was not statistically significant. This might be due to the single-center design and small sample size of our current study but might also suggest that the number of MPP patients have not increased dramatically over the past years. We also found that school-age children and adolescents had a highest incidence rate of MPP, which reached 63.8%. An Indian study showed that 59.5% of children ≥5 years were positive for *Mycoplasma pneumoniae* infection (10), which was similar to our current finding; a recent study in the United States also reported a similar result (11). *Mycoplasma pneumoniae* typically spreads through droplets, and school-age children and adolescents are more susceptible to *Mycoplasma pneumoniae* infection as they spend more time in closed or semi-closed learning environments. Therefore, the learning and living environments of school-age children and adolescents should be improved if conditions allow. MPP showed no gender difference in our current study; however, two previous studies in two areas in China reported the incidence of MPP to be higher in girls than in boys, which might be explained by the difference of the age of the studies and the sources of patients: both studies were based on the clinical data collected 5 years ago, and all the cases were from the respiratory departments of children's hospitals (12,13).

Our current study also demonstrated that there was no seasonal variation in the incidence of CAP in the non-MPP group; in contrast, the incidence of MPP was highest in the Q3 and Q4 (with no statistically significant difference between these two quarters). Although MPP may occur year round, it is more common in the winter and spring. However, our current study revealed that the incidence of MPP in Q3 was higher than that in Q1 but did not differ from that in Q4. Further analysis showed that the higher incidence of MPP in Q3 might be linked to the increased MPP patients in the third quarter of 2018. It was reported that MPP outbreaks occurred in several elementary schools in the Haidian and Shunyi districts of Beijing in August 2018 (14,15), supporting the results of our current study. We also found that MPP was highly active in Q4 in 2017 and 2019, which was consistent with the high prevalence of MPP in winter reported by other studies (16). As a result, the proportion of MPP cases in Q3 of 2018 accounted for two-thirds of all MPP cases in 2018, suggesting an MPP outbreak might have occurred in Q3 of 2018, which also supports the epidemic cycles of MP infection. The previous epidemics of MP infection occurred in 1984, 1988, 2006, 2010, and 2015, respectively, and the epidemic reached its peak approximately every 3–7 years (17,18). Since the proportion of preschool children remarkably increased among MPP children in 2018, the preschool children were the main affected population during the MPP outbreak in

Q3 of 2018.

In addition, the MPP group had a higher proportion of severe pneumonia cases, and the incidence of complications was higher than that in the non-MPP group; however, the need for heated and humidified high-flow oxygen therapy was not significantly different between these two groups, suggesting dyspnea was not a major problem in children with severe MPP. According to the 2013 and 2019 *China Guidelines for the Management of Community-acquired Pneumonia in Children*, pulmonary infiltrate on chest radiographs or lung computed tomography (CT) is one of the diagnostic criteria for severe CAP (7,8). After MP infects the human body, it causes diseases through direct damage and/or immune-mediated injuries. As the risk population of MPP, school-aged children and adolescents have a relatively mature immune system and thus will experience severe systemic inflammatory response to MP infection and are more likely to suffer from conditions such as segmental and lobar consolidations of the lungs (19). Accordingly, these patients are more likely to meet the diagnostic criteria for severe CAP. Compared with the 2013 guidelines, the 2019 revision describes more accurately the criteria for lung infiltrate of severe CAP, has stricter requirements for the scope of lung infiltrate and is easier to apply; thus, the new guidelines are particularly instructive for severe MPP.

In addition, although studies have shown that the proportion of severe MPP is rising, our current analysis of data over 3 years did not find an increasing trend of severe MPP, which might be explained by the proactive use of macrolides and flexible bronchoscopy in our center. In fact, up to 38.4% of MPP patients underwent flexible bronchoscopy in our current study, which, as shown in another study (20), effectively shortened the disease course of MPP and improved the prognosis. The proportion of MP with resistance to antibiotics has increased annually since the first macrolide-resistant MP strain was isolated in 1968. It was reported that the proportion of the macrolide-resistant MP strain reached up to 90% between 2008 and 2012 (21). The positive rates of drug-resistant MP strains are also rising in Japan (22), which increases the difficulty of MPP treatment. Nevertheless, macrolides remain the preferred empirical treatment for CAP (especially MPP). Shah *et al.* (23) suggested that there was a window for detection of MP after infection; before the detection results became positive, early use of macrolides was associated with a short duration of fever and lower risk of serious complications. According to the clinical practice guidelines released by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America, macrolides are the preferred antibiotics for CAP (24). Meanwhile, the incidence of intrapulmonary and extrapulmonary complications was similar across these 3 years in MPP children, which was consistent with our finding that severe MPP did not increase over 3 years. Therefore, active empirical use of macrolides based on the epidemiological features of MPP helps to lower the severity of MPP.

Our current study showed that the average hospital stay of CAP children has decreased annually; however, the average hospitalization days showed no significant change from 2017 to 2019 in the MPP group but significantly decreased in the non-MPP group, suggesting the decrease in the average hospital stay of non-MPP children was the main cause of the decreased hospital stay among CAP children. Also, there was an increasing trend in the cost of CAP treatment. The treatment costs were higher in the MPP group than in the non-MPP children, which seemed to be related to the higher proportions of severe cases, complications, and use of flexible bronchoscopy in the MPP group. However, although the cost of MPP treatment has increased annually, the proportions of severe cases, complications, and use of flexible bronchoscopy showed no rising trend in the MPP group, suggesting that the annual increase in total hospitalization costs and examination/non-medication treatment costs cannot be solely attributed to the increased proportion of the use of flexible bronchoscopy. Therefore, the analysis of the average hospitalization days and treatment costs suggests that the average hospitalization period has not increased significantly during the increase in the incidence of MPP, which is an important component of CAP; meanwhile, the proportion of examinations and non-pharmacological treatments has increased, indicating that the early use of macrolides and flexible bronchoscopy may be a more reasonable and economical health protocol for MPP management.

According to our results, it may be effective to implement the following strategies to prevent MPP and decrease the severe MPP: (I) by improving the living and learning environment of high-risk population (school-age children and adolescents) in high-risk seasons, especially in the third and the fourth quarters; (II) by actively administrating macrolides antibiotics in high-risk population and in high-risk seasons even if MP test has not been carried out or the result of MP test has not been returned.

The limitations of this study were: (I) data coming from single center; (II) data which was retrospectively collected;

(III) CAP children aged from 28 day to 1 year which were not enrolled; (IV) variables which were not very detailed.

In summary, CAP is the most common disease among pediatric inpatients in general hospitals, with MP being the main pathogen. The epidemiological features of MPP are age- and season-specific and may change annually. The proportions of severe pneumonia, complications, and use of flexible bronchoscopy, along with the length of hospital stay and hospitalization costs, are greater in MPP children than in non-MPP children. Therefore, general hospitals should develop integrated clinical quality control programs for MPP children. Active empiric treatments may shorten hospital stay, reduce hospitalization costs, and thus optimize the allocation of medical resources.

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Footnote

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Data Sharing Statement: Available at http://dx.doi.org/10.21037/tp-20-149

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/tp-20-149). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the ethics committee of our center (Ethical approval number: IRB00006761-M2020097). Because of the retrospective nature of the research, the requirement for informed consent was waived.

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