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Emergence of Kawasaki disease related to SARS-CoV-2 infection in children, a time-series analysis

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Panel: Research in context

Evidence before this study

The rapid spread of COVID-19 caused by SARS-CoV-2 has led to a global pandemic. In recent weeks physicians from several countries had the impression the number of children with multi system inflammatory symptoms, including Kawasaki disease (KD) were increasing. This led to alerts by several health authorities in Europe and North America.

PubMed research for articles using the terms “Kawasaki disease” AND “coronavirus” OR “COVID-19” OR “virus involvement” OR "SARS-CoV-2", performed the 31st of May 2020, identified scattered case reports and an observational cohort study from Italy.

Moreover, in the literature it has been suggested that viral infections could be the trigger of KD. Thus, there is an urgent need for epidemiological studies to enlighten the potential link between SARS-CoV-2 and the emergence of KD.

Added value of this study

We conducted a time series analysis based on a prospective surveillance of KD in a French tertiary paediatric centre, located in an epicentre of the current COVID-19 outbreak, over the past years. We found an important increase of Kawasaki disease during the COVID19 pandemic. During this period, the circulation of all other respiratory viruses experienced an unprecedented drop since the national lockdown. Our observations strengthen the persuasion that there is an association between SARS-CoV-2 infection and KD. Interestingly, a second significant peak of KD was observed in December 2009, in the context of major H1N1 pandemic. This study is novel from using a time series analysis of KD over a 15-year period and the concurrent determination of other viral investigations during the COVID-19 pandemic period.

Implications of all the available evidence

The ongoing SARS-CoV-2 pandemic is followed by a rapid emergence of KD, shattering the idea that children do not develop severe forms of COVID-19. This rise, mirrors with a second peak of KD occurring after the H1N1 major pandemic, providing unique evidence of the role of viral infections in triggering KD. Physicians should prepare to manage an increase of KD, depending on the local COVID-19 outbreak magnitude.

Abstract:

Background: Kawasaki disease (KD) is an acute febrile systemic childhood vasculitis which has been known to be triggered by respiratory viral infections. Here, we examined whether the ongoing COVID-19 epidemic is associated with an increase of Kawasaki disease.

Methods: We conducted a quasi-experimental interrupted time series analysis over the last 15 years in a tertiary center in a French epicenter of COVID-19. The main outcome was the number of KD cases over time, estimated by quasi-Poisson regression. In the same center, we described the evolution (2005-2020) of hospital admissions from the emergency department and the evolution of the respiratory pathogens identified by nasopharyngeal multiplex PCR (2017-2020). These data were compared with the evolution of daily admissions due to confirmed COVID-19 in the same region, recorded by Public Health France.

Findings: We included 230 patients with KD. On April 2020, we identified a rapid emergence of KD related to SARS-CoV-2 (+497% increase, 95% CI [+72; +1082], p=0.0011), starting two weeks after the peak of the COVID-19 epidemic. SARS-CoV-2 was the only virus circulating at high levels during this period, and was found in 80% (8/10, SARS-CoV-2 positive PCR or serology) of KD patients since April 15th. A second peak of KD hospitalizations was observed in December 2009 (+365% increase, 95% CI [+31; +719], p=0.0053), concomitant with the influenza A (H1N1) pandemic.

Interpretation: Health care providers should be prepared to manage an increased surge of patients with severe KD, particularly in countries where the peak of COVID-19 has just been reached.

Funding: French National Research Agency ANR-16-CE17-0009.

Introduction:

The rapid spread of Coronavirus disease 2019 (COVID-19) caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) has led to a global pandemic.[1] The pediatric population appears to be much less affected than adults with less than 3% of reported cases under 20 years of age.[1] To a recent date available data suggested that compared with adult patients, pediatric patients have milder symptoms and a better prognosis.[2,3]

In recent weeks, physicians from several countries had the impression that the numbers of children with multi system inflammatory symptoms, including Kawasaki disease (KD) and features of shock with intensive care unit admissions were increasing.[4] This led to alerts by several health authorities in Europe and North America.[5,6] A link between Covid-19 and KD has been suggested by scattered case reports[7–9] and a very recent observational cohort study reported an outbreak of severe Kawasaki-like disease at the Italian epicenter of the SARS-CoV-2 epidemic.[10] Acute heart failure in multisystem inflammatory syndrome in the context of SARS-CoV-2 has also been reported in a multicenter cohort.[11] It is currently not known whether these various manifestations should be considered as the clinical spectrum of a novel disease or as an association of various suspected post infectious diseases triggered by SARS-CoV-2. As this increase of KD related to COVID-19 needs to be confirmed by epidemiological data and longitudinal analysis, we undertook a study focusing on patients fulfilling the established diagnostic criteria of KD.

KD is an acute febrile systemic childhood vasculitis that affects medium and small-sized blood vessels with a coronary artery tropism.[12,13] It is one of the leading causes of acquired heart disease in industrialized countries.[12,13] There is no specific test to confirm the diagnosis. The diagnosis of KD is based on internationally accepted clinical criteria[14,15], combining a fever lasting five days or more with at least four of the following clinical signs:

bilateral conjunctival injection, changes affecting the lips and oral cavity (inflammation of the oral and pharyngeal mucosa), polymorphic exanthema, changes in the peripheral extremities or perineal area, and cervical lymphadenopathy ≥15 mm. Patients who meet the case definition based on principal clinical findings are said to have complete KD. Patients who do not have sufficient principal clinical findings may be diagnosed with incomplete KD.

The cause of KD disease remains unknown.[16] Regions of the extratropical northern hemisphere experience two seasonal peaks in winter and spring and some outbreaks have been observed in Japan, even if no clear cause has been underlined.[17] A correlation between this bimodal seasonality and viruses such as influenza, RSV in winter and enterovirus in summer has been suggested.[18–20] This has led to the speculation that viral infections could be the trigger of KD. To date, it is unknown whether SARS-CoV-2 can lead to KD.

Here, we examined whether the outbreak of COVID-19 is associated with an increase of KD in a tertiary hospital in the French epicenter of COVID-19.

Methods:

We conducted a quasi-experimental interrupted time series analysis based on data prospectively collected of all KD patients admitted over the past 15 years to a tertiary center, Robert Debré University Hospital, in Paris, France. This center is a pediatric hospital that mainly receives patients from the north and north-eastern part of Paris and its region, which has been one of the epicenters of COVID-19 epidemic in France (www.santepubliquefrance.fr). Robert Debré Hospital provides pediatric care support and retrieval to approximately 2 million inhabitants and the proportion of children remained stable over the study period (www.insee.fr). Referring hospitals and patient orientation to Robert Debré Hospital remained unchanged during the observation period and during the COVID-19 epidemic.

We recorded the number of patients diagnosed with KD using the validated diagnostic criteria[15] from 2005 to 2020. Patients for whom another diagnosis was confirmed during the follow-up were excluded. For each patient, demographic and clinical data were recorded. All collected data was anonymous. This study followed national ethic guidelines and has been approved by French data protection authorities (CNIL/No.2014908 & No1980120). Furthermore, we recorded the number of hospital admissions of pediatric patients from the emergency department in the same center between January 2017 and April 2020. The results of the respiratory pathogens identified by multiplex nasopharyngeal PCR over the period between January 2017 and April 2020 were also filed. These time-series were compared with the evolution of daily admissions due to confirmed COVID-19 in the same region, recorded by Public Health France (www.santepubliquefrance.fr).

The main outcome was the monthly number of KD cases over the study period. Secondary outcomes were the number of hospital admissions following pediatric emergency department visits, and the proportion of positive nasopharyngeal multiplex PCR over time. We also

analyzed the evolution of monthly KD rate per 100 hospital admissions following pediatric emergency department visits over time. The multiplex PCR, FilmArray® Respiratory Panel 2 plus (Biomérieux), tested the following respiratory pathogens: Adenovirus, Coronavirus 229E, Coronavirus HKU, Coronavirus NL63, Coronavirus OC43, Metapneumovirus, Rhinovirus/Enterovirus, Influenza A, Influenza B, Parainfluenza I, Parainfluenza II, Parainfluenza III, Parainfluenza IV, VRS, *Bordetella parapertussis*, *Bordetella pertussis*, *Chlamydophila pneumoniae* and *Mycoplasma pneumoniae*. Furthermore, all KD cases diagnosed since April 1st 2020 were tested with SARS-CoV-2 nasopharyngeal PCR using the Xpert® Xpress SARS-CoV-2 (Cepheid).

The outcomes were analyzed by quasi-Poisson regression, accounting for seasonality, secular trends, and overdispersion of data.[21–23] Seasonality was taken into account by including harmonic terms (sines and cosines) with 12-months and 6-months periods.[21] To provide optimal precision to the model the chosen time unit was one month.[23] As a delay between respiratory viral infection and KD is expected, we hypothesized that the COVID-19 outbreak would have an impact a month (i.e., one time unit) after the peak. Thus, the COVID-19 impact assessment involved a dummy variable in the model estimating the immediate post-outbreak change in April 2020. The only previous major respiratory virus pandemic identified over the study period was the influenza A (H1N1) pandemic in winter 2009. Thus, another dummy variable was included in the model to allow for the immediate effect of influenza A (H1N1) on Kawasaki occurrence in December 2009. The validity of the quasi-Poisson regression model was assessed by visual inspection of the correlograms (Auto Correlation and Partial Auto Correlation Functions) and analysis of the residuals. All statistical tests were two-sided, and we considered a result as “significant” when the p-value was <0.05. All statistical analysis was performed using R v3.6.1 (http://www.R-project.org).

Role of the funding source

The French National Research Agency had no role in the study design, data collection, analysis, data interpretation, and writing of the report. The first author had full access to all data and final responsibility for the decision to submit for publication.

Results

During the 2005-2020 period, 230 patients were hospitalized with KD. The median number of KD hospitalizations estimated by the quasi-Poisson model was 1.2 per month (interquartile [1.1; 1.3]).

In April 2020, we observed a significant increase of KD (+497% increase, 95% CI [+72; +1082], p=0.0011, quasi-Poisson regression model). Similar results were obtained when analyzing KD rate per 100 hospitalizations over time (Figure 1 and appendix Table 1) with an occurrence between April 15th and May 15th. Thus, the increase of KD hospitalizations started two weeks after the first peak of the COVID-19 epidemic in the Paris region, which occurred around March 31st-April 1st 2020 (Figure 2).

The increase in KD observed in April 2020 was not related to an increase in overall hospital admissions, which on the contrary significantly dropped since March 2020 (-31% decrease, 95%CI [-42; -18], appendix figure 1B) due to the lockdown. Furthermore, this increase coincided with an unprecedented decrease of other respiratory viruses in our population since March 2020 (Figure 3), probably as a consequence of the reduction of social contacts after the lockdown. The only virus circulating at high levels during this period was the SARS-CoV-2 (Figure 2), reinforcing the link between this virus and the KD increase.

The characteristics of patients with KD during the SARS-CoV-2 epidemic are shown in Table 1. Among the ten children presenting with KD from April 15th to May 20th 2020, 8 had a

positive nasopharyngeal SARS-CoV-2 PCR and or a positive SARS-CoV-2 serology (Table 1). One patient had a prolonged exposure with a confirmed COVID-19 individual but had negative SARS-CoV-2 PCR and serological testings. Among these patients, five had a complete KD and 5 patients had fever with only 3 other KD criteria. The age of KD patients ranged from 18 months to 15.8 years. Six children (60%) had cardiac abnormalities, including one major coronary aneurysm (Z score: 12) and five myocarditis. Six patients (60%) required intensive care and five had inotrope treatment (50%). None required mechanical ventilation, and no fatal outcome was observed.

A second peak of KD hospitalizations was detected by the model in December 2009 (+365% increase, 95% CI [+31; +719], p=0.0053), concomitant with the influenza A (H1N1) outbreak,[27] peaking in November-December 2009 in France (Figure 1A and appendix Table 1). The increase of KD hospitalizations occurred approximately 1 to 3 weeks after the peak of the influenza A (H1N1) epidemic in the Paris region.

A comparison between patients with KD hospitalized in our center during the SARS-CoV-2 epidemic, during the H1N1 epidemics and out of these major epidemics is shown in Table 2. Furthermore, we compared these patient groups to patients from a recent publication that were hospitalized during the SARS-CoV-2 epidemic in Bergamo, Italy[10] (Table 2). The characteristics from KD patients hospitalized during the SARS-CoV-2 epidemic in our center were similar to patients hospitalized during the SARS-CoV-2 epidemic in Bergamo with a high proportion of severe KD with cardiac involvement and the need for a second line of treatment. In contrast, the characteristics of KD patients during SARS-COV-2 epidemics appeared to be different from those diagnosed during the H1N1 epidemics, (median age 11.8 vs 2.1 years, p=0.034; median CRP 23.6 vs 8.4 mg/dL, p=0.042; median lymphocytes count 1042 vs 3410 × 10^9 per L, p=0.028, respectively).

Discussion

Our study linked an emergence of KD to the ongoing COVID-19 pandemic. Several findings support this association. First, we observed that the unexpected high emergence of KD occurred 2 to 4 weeks after the peak of the COVID epidemic, in line with the previously reported post-infection mechanism of KD.[15] Second, following the nationwide lockdown in March 2020, SARS-CoV-2 was the only respiratory virus with intense circulation in the weeks before the emergence of KD, as confirmed by our results from respiratory multiplex PCR. Third, almost all patients with KD in April 2020 had a positive nasopharyngeal SARS-CoV-2 PCR or exposure to a confirmed COVID-19 individual.

The only other peak in KD observed during the 15-year observation period occurred during the context of the H1N1 influenza A pandemic, suggesting that SARS-CoV-2 is not the only virus capable of triggering such an emergence of KD. These findings are in line with observations in the literature, reporting seasonality and outbreaks of KD, especially in Japan, where nationwide epidemics were observed in 1979, 1982 and 1986.[12,17,28] Seasonal patterns of KD have also been observed in many other countries, including European countries and North America. This has led to the speculation that viral infections may underline KD pathogenesis. However, large outbreaks of KD seem to be a rare event. The significant surges of KD following two different major epidemic outbreaks, observed in our study, provide a unique, quasi-experimental condition, confirming the crucial role of viral infections in the trigger of KD in susceptible patients.

In both observed epidemic peaks the increase was very sudden. Further studies will be necessary to understand the immunological reasons leading to this strong and sudden increase in the context of SARS-CoV-2 and H1N1 epidemics when compared to seasonal viral infections. One could speculate that the sudden exposure to totally new antigens may trigger a particular uncontrolled immune response in susceptible children. In contrast,

frequent seasonal viruses are encountered by children with "trained" immune systems, after exposures to similar antigens during precedent seasons, and therefore only a minority of them develop KD. Although our article shows an emergence of KD associated with COVID-19, it is important to insist that even in the current epidemic context this strong inflammatory disease is very rare.

The strength of our study was that it was performed over a large period of time (15 years) on a stable population of multiethnic origins, living in a defined area, with stable medical orientation to our tertiary center. This allowed us to observe a substantial stability of the KD patients flow over time, enabling the detection of outbreaks. Our study also had some limitations. Although the sample size was sufficient to reach a high statistical significance, our study is limited by its monocenter nature and a relatively small number of patients. However, we performed our analysis in a tertiary center localized in an epicenter of COVID-19 in order to increase the sensitivity of SARS-CoV-2 associated KD. This approach may have led to an over evaluation of the increased risk for KD (+497% increase). Our study design allowed to provide a "proof of concept" of the link between COVID-19 pandemic and KD. Larger population-based studies are required to evaluate the exact additional risk of KD associated to SARS-CoV-2 infections.

The clinical spectrum of pediatric multi-system inflammatory diseases observed recently in the COVID-19 context is believed to include features of KD (complete or incomplete), and/or toxic shock syndrome and/or myocarditis.[4,11,29] Pediatric and scientific societies in several countries are currently gathering information to provide a detailed clinical description. In order to reduce bias due to heterogenous clinical presentations, we decided to only focus on patients with clinical presentation of KD according to established criteria.[29] Further studies will be necessary to understand whether these patients should be classified as SARS-CoV-2 infection with a KD phenotype or SARS-CoV-2 triggered KD.

Our observations may have practical implications for clinicians and health care providers. Indeed, the clinical characteristics of KD patients hospitalized during the COVID-19 epidemic in our center in France resembled those of patients hospitalized in an epicenter of COVID-19 in Italy[10] with a relatively high proportion of severe KD with cardiac involvement (abnormal echocardiography, coronary aneurysm, myocarditis), ICU admissions, inotrope requirement and need for additional treatments after a first IVIG. In contrast, KD occurring during the only other observed KD peak in the context of H1N1 epidemic resembled that of classical KD cohorts.[15,30,31] These observations suggest that in the context of SARS-CoV-2 circulation a higher proportion of KD patients may present a severe phenotype. Furthermore, these observations indicate that in such a pandemic, healthcare systems should be prepared to manage an increased influx of patients with KD and potential severe cardiac involvement, particularly in countries where the peak of COVID-19 has just been reached.

Conclusion

Our study provides evidence of a rapid emergence of KD in children related to SARS-CoV-2, starting approximately two weeks after the peak of COVID-19 epidemic. Health care providers and health authorities need to be prepared to manage a potential increased influx of children with severe KD.

Contributors

UM and NO designed the study. NO, MP, PM, CB, AB, SB, KD, MC, LM, FLB, MC, JG, JP, RC, LT, AF, IM and UM analysed and interpreted the data and drafted the article. NO and MP performed the statistical analysis. SB and PM performed the microbiological analysis. All authors revised and approved the manuscript.

Declaration of interests

The other authors declared no conflicts of interest.

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Figure 1: Evolution of monthly Kawasaki disease rate per 100 admissions to hospital over time.

KD: N=230. Hospital admission following pediatric emergency department visits, N=110,824. The black line depicts the observed data. The bold red line depicts the model estimates based from the quasi-Poisson regression model. The vertical black arrows indicate the H1N1 and COVID-19 outbreak (respectively: November-December 2009 and March-April 2020).

Figure 2. Evolution of the COVID-19 outbreak in the Ile-de-France region, Public health France data, N=35,732.

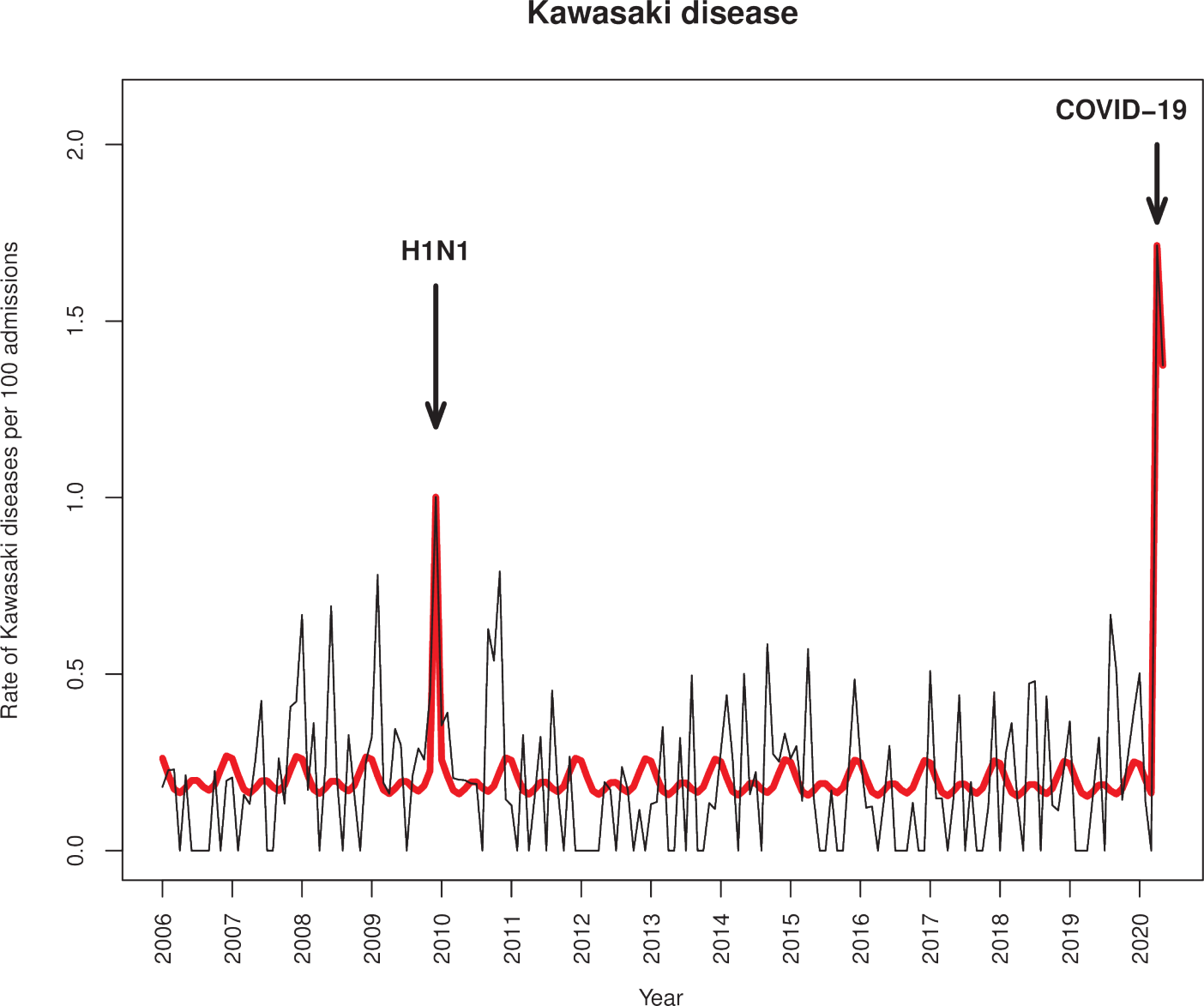
The black line depicts the daily number of new admissions in hospital for all-age confirmed COVID-19 in Ile de France. Source: Santé publique France.

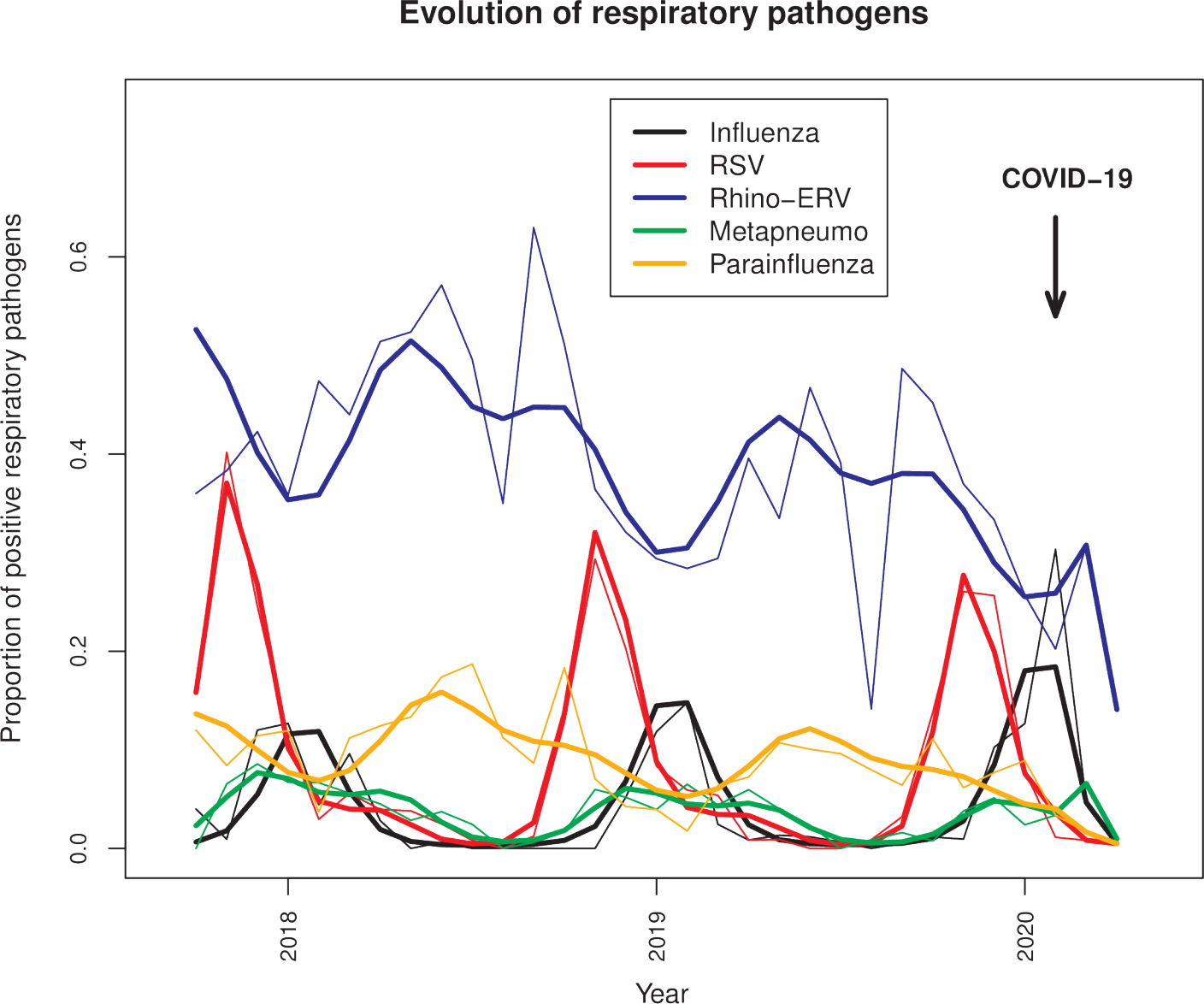
Figure 3. Evolution of respiratory pathogens from 2017 to 2020, N=4,662.

The black, red, blue, green, and orange lines depict observed data for Influenza, RSV, Rhino-enterovirus, Metapneumovirus and Parainflunza. The bold black, red, blue, green, and orange slope shows the model estimates from the final quasi-Poisson regression models. Abbreviations: PEDs: Pediatric emergency departments. Rhino-ERV: rhino-enterovirus, Metapneumo: metapneumovirus.

Table 1. Characteristics of patients with Kawasaki disease who presented during SARS-CoV-2 epidemic (April-May 2020).

Table 2. Comparison between patients with Kawasaki disease (KD) presenting during the SARS-CoV-2 epidemic in Paris region, France, in Bergamo, Italy, during the H1N1 epidemics and out of major viral epidemics.


Kawasaki disease
COVID–19
H1N1
Rate of Kawasaki diseases per 100 admissions
0.0
0.5
1.0
1.5
2.0
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Year


Evolution of respiratory pathogens
Influenza
RSV
Rhino–ERV
Metapneumo
Parainfluenza
COVID–19
Proportion of positive respiratory pathogens
0.0
0.2
0.4
0.6
2018
2019
2020
Year

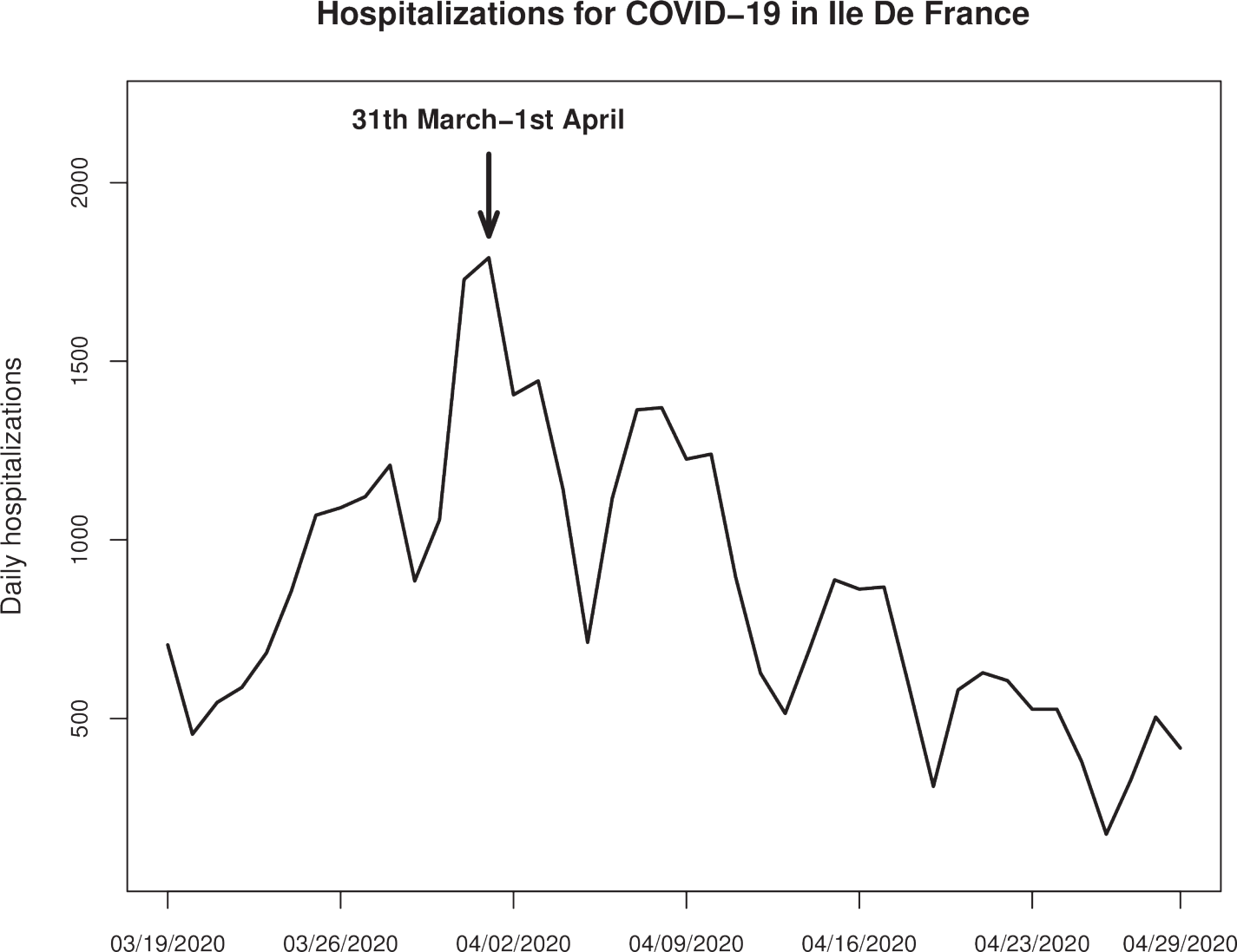

Hospitalizations for COVID−19 in Ile De France
31th March−1st April
Daily hospitalizations
2000
1500
1000
500
03/19/2020
03/26/2020
04/02/2020
04/09/2020
04/16/2020
04/23/2020
04/29/2020

Table 1: Characteristics of patients with Kawasaki disease who presented during SARS-CoV-2 epidemic (April-May 2020)

Characteristics	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7	Patient 8	Patient 9	Patient 10
Age, years	12	1·8	11·5	1·5	15·5	13·5	9·8	14·5	15·8	6·3
Sex	Female	Female	Male	Male	Female	Female	Female	Female	Male	Male
SARS-CoV-2 nasopharyngeal PCR	Positive	NA	Positive	Negative	Positive	Positive	Negative	Positive	Negative	Negative
SARS-CoV-2 serology	NA	NA	IgG+	Negative	IgG+	NA	IgG+	NA	IgG+	IgG+
Contact with suspected or confirmed case	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Complete Kawasaki disease	Yes	Yes	Yes	No	No	Yes	No	Yes	No	No
Kobayashi score[1]	8	1	4	0	4	8	7	6	8	6
KDSS[2]	No	No	No	No	No	Yes	Yes	Yes	Yes	No
Cardiac involvement	Myocarditis	No	No	Coronary dilatation (Z=12)	No	Myocarditis	Myocarditis	Myocarditis, Pericarditis	Myocarditis	No
First line treatment	IVIG	IVIG	None	IVIG	IVIG	IVIG	IVIG	IVIG	IVIG	IVIG
Failure of first line treatment	Yes	No	No	Yes	No	Yes	Yes	No	Yes	Yes
Second line treatment	IVIG+ mPDN	No	No	IVIG+ mPDN	No	Tocilizumab	IVIG+ mPDN	No	IVIG+ mPDN	IVIG+ mPDN
Admission to PICU	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Inotropes treatment	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Lengths of hospital stay (days)	14	5	4	27	5	18	19	13	9	17

Abbreviations: mPDN: methylprednisolone. KDSS: Kawasaki disease shock syndrome. IVIG: intravenous immunoglobulin. PICU: paediatric intensive care unit. SARS-CoV-2=severe acute respiratory syndrome
coronavirus 2. NA: not availabl

Table 2. Comparison between patients with Kawasaki disease (KD) presenting during the SARS-CoV-2 epidemic in Paris region, France, in Bergamo, Italy, during the H1N1 epidemics and out of major viral epidemics.

Symptom/clinical sign	SARS-CoV-2 epidemics in Robert Debré Hospital, France**	SARS-CoV-2 epidemics in Bergamo, Italy[10]	H1N1 epidemics in in Robert Debré Hospital, France	KD out of major viral epidemics in Robert Debré Hospital, France
Time of presentation	April-May 2020*	March-April 2020	December 2009	From 2005 to 2020
Number of patients	10	10	6	214
Incidence	6 per month	10 per month	6 per month	1 per month
Rate of KD per 100 hospitalizations	1.5	NA	1.0	0.2
Sex				
Female	4 (40%)	3 (30%)	5 (83%)	87 (41%)
Male	6 (60%)	7 (70%)	1 (17%°	127 (59%)
Median age (years)	11·8 [7·4; 14·3]	7·2 [5·5; 8·1]	2·1 [1·7; 3·8]	2·1 [1·1; 3·7]
Complete Kawasaki disease	6/10 (60%)	5/10 (50%)	4/6 (67%)	138/214 (64%)
CRP, mg/dL	23·6 [13·2; 30·9]	24·1 [13·0; 29·5]	8·4 [5·1; 13·3]	14·4 [9·9; 19·8]
Lymphocytes, $\times 10^9$ per L	1042 [650; 1150]	832 [543; 960]	3410 [2010; 4590]	3044 [1855; 4770]
Platelets, $\times 10^9$ per L	274 [192; 715]	130 [120; 142]	613 [454; 715]	379 [285; 484]
Sodium, mEq/L	130 [129; 135]	131·5 [129; 133]	137·5 [136; 139]	135 [133·5; 137]
AST, U/L	35 [35; 53]	57 [35; 112]	30 [28; 37]	35 [28; 57]
ALT, U/L	33 [27; 38]	55 [34; 79]	20 [15; 28]	40 [19; 97]
Kobayashi score ≥5[1]	7/10 (70%)	7/10 (70%)	0/6 (0%)	39/153 (25%, NA=61)
KDSS[29]	4/10 (40%)	5/10 (50%)	0/6 (0%)	NA
Abnormal echocardiography	6/10 (60%)	6/10 (60%)	3/6 (50%)	51/214 (24%)
Need for additional treatment to first dose of IVIG	6/10 (60%)	8/10 (80%)	1/6 (17%)	44/203 (22%, NA=9)
Admission to PICU	6/10 (60%)	NA	0/6 (0%)	14/160 (9%, NA=54)
Inotropes treatment	5/10 (50%)	2/10 (20%)	NA	NA

Quantitative data are presented as median [Q1–Q3] and categorical data as number (%). *: Data after May 20th not available. Abbreviations: KD: Kawasaki disease. CRP: C-reactive protein. ALT: alanine aminotransferase. AST: aspartate aminotransferase. KDSS: Kawasaki disease shock syndrome. IVIG: intravenous immunoglobulin. PICU: paediatric intensive care unit. NA: not available. **the total number of pediatric COVID19 patients that have been referred to our hospital was N=39.