

ORIGINAL ARTICLE

Diagnostic Implications of Long-Term Polymerase Chain Reaction Data for Human Metapneumovirus

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ABSTRACT

Background: The aim of this study was to systematically examine the annual, seasonal, age-specific, and gender-specific epidemiological trends of human metapneumovirus (hMPV) infections, utilizing extensive real-world data collected over 18 years through a consistent testing methodology and analytical protocol.

Methods: Real-time reverse transcription polymerase chain reaction assay results of patients admitted to Dankook University Hospital (2007 - 2024) were retrospectively analyzed. Descriptive statistics were used to assess annual, age-specific, and seasonal trends in hMPV positivity rates. We further evaluated the feasibility of using these data to establish robust epidemiological surveillance systems and standardized monitoring metrics.

Results: Among 23,284 specimens, 991 (4.2%) were positive for hMPV. The highest annual positivity rates were recorded in 2007 (7.7%) and 2011 (8.1%). Children aged 2 - 11 years exhibited the highest positivity rate (6.0%), with positivity rates declining with increasing age, except for a slight increase in individuals aged ≥ 65 years. Seasonally, infections peaked in spring (11.1%), followed by summer (2.8%), winter (1.4%), and autumn (0.8%). Since the onset of the coronavirus disease 2019 (COVID-19) pandemic (2020 - 2024), the overall positivity rate dropped to 1.6% from 4.7% before the pandemic, accompanied by notable changes in seasonal patterns.

Conclusions: This study revealed significant shifts in hMPV epidemiology following the COVID-19 pandemic, including reduced overall circulation, disrupted spring seasonality, and persistent impacts on high-risk pediatric populations. These findings provide evidence to optimize diagnostic testing for hMPV while providing actionable evidence to adjust optimal diagnostic testing windows, enhance infection prevention strategies, and implement focused monitoring of high-risk populations. Specifically, hMPV testing should be prioritized for pediatric patients during the typical peak months (March - May) and expanded to include atypical winter peaks (December - February) in the post-pandemic era. For older adults (≥ 65 years), targeted testing during winter months may enhance diagnostic yield and support timely clinical management.

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Supplementary Data:**Table S1. Annual distribution of total tests performed, observed and expected human metapneumovirus-positive and -negative cases, and positivity rates from 2007 through 2024.**

Year	Total (n)	Positive (observed)	Positive (expected)	Negative (observed)	Negative (expected)	Positivity rate (%)	χ^2	p
2007	1,057	82	44.9	975	1,012.0	7.7	225.0	< 0.001
2008	1,504	46	64.0	1,458	1,439.9	3.0		
2009	1,265	64	53.8	1,201	1,211.1	5.0		
2010	1,657	55	70.5	1,602	1,586.4	3.3		
2011	1,568	128	66.7	1,440	1,501.2	8.1		
2012	1,345	79	57.2	1,266	1,287.7	5.8		
2013	1,545	74	65.7	1,471	1,479.2	4.7		
2014	1,674	117	71.2	1,557	1,602.7	6.9		
2015	1,388	42	59.0	1,346	1,328.9	3.0		
2016	1,645	51	70.0	1,594	1,574.9	3.1		
2017	1,436	66	61.1	1,370	1,374.8	4.5		
2018	1,834	69	78.0	1,765	1,755.9	3.7		
2019	1,432	53	60.9	1,379	1,371.0	3.7		
2020	792	11	33.7	781	758.2	1.3		
2021	613	0	26.0	613	586.9	0		
2022	860	16	36.6	844	823.3	1.8		
2023	1,016	25	43.2	991	972.7	2.4		
2024	653	13	27.7	640	625.2	1.9		

Overall chi-squared (χ^2) and p-values are presented.

Table S2. Annual number of human metapneumovirus-positive cases by season from 2007 through 2024.

Year	Spring (n)	Summer (n)	Autumn (n)	Winter (n)
2007	64	17	0	1
2008	37	7	0	2
2009	51	4	1	8
2010	40	14	1	0
2011	100	19	7	2
2012	65	8	0	6
2013	65	2	2	5
2014	85	19	6	7
2015	29	6	3	4
2016	34	5	1	11
2017	45	0	5	16
2018	54	6	3	6
2019	29	10	7	7
2020	0	0	0	11
2021	0	0	0	0
2022	0	2	12	2
2023	10	13	2	0
2024	4	3	0	6

Table S3. Age-specific distribution of tested individuals and human metapneumovirus-positive cases and positivity rate (%) by gender.

Age group	Male tested (n)	Male positive (n)	Male positivity rate (%)	Female tested (n)	Female positive (n)	Female positivity rate (%)
0 - 1 year	5,548	312	5.6	3,873	176	4.5
2 - 11 years	3,079	156	5.0	2,456	180	7.3
12 - 18 years	405	3	0.7	296	7	2.3
19 - 64 years	1,893	33	1.7	1,042	24	2.3
≥ 65 years	3,036	59	1.9	1,656	41	2.4

Table S4. Annual distribution of human metapneumovirus-positive cases by age group from 2007 through 2024.

Year	0 - 1 year (n)	2 - 11 years (n)	12 - 18 years (n)	19 - 64 years (n)	≥ 65 years (n)
2007	52	29	1	0	0
2008	27	16	0	2	1
2009	38	13	1	3	9
2010	29	24	0	0	2
2011	68	58	0	0	2
2012	43	22	0	4	10
2013	25	21	3	11	14
2014	60	40	1	7	9
2015	23	13	1	3	2
2016	28	18	1	0	4
2017	40	21	2	2	1
2018	28	31	0	2	8
2019	22	14	0	4	13
2020	0	0	0	6	5
2021	0	0	0	0	0
2022	3	7	0	4	2
2023	2	9	0	5	9
2024	0	0	0	4	9