Excess Hospitalization and Mortality Associated with Respiratory Syncytial Virus in Hong Kong, 1998-2019

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Background

Respiratory syncytial virus (RSV) widely circulates, while the associated disease burden was not well characterized in Hong Kong. We aimed to estimate the age-specific and cause-specific RSV-associated hospitalizations and deaths in Hong Kong.

Methods

RSV activity measured by weekly hospitalization rate of acute bronchiolitis associated with RSV in children <1y from 1998 to 2019 was obtained from the Hospital Authority. Influenza sentinel surveillance data was provided by the Centre for Health Protection of Hong Kong, and the age-specific weekly hospitalization and mortality data were obtained from the Hospital Authority and the Census and Statistics Department, respectively. We applied age-specific multiple linear regression models to examine the potential associations between the temporal RSV activity and hospitalization or death rates adjusting for influenza virus activities, meteorological factors including temperature and absolute humidity, possible differences in health seeking behaviors and healthcare during public holidays, potential impact of transition of coding system from ICD-9 to ICD-10. The age-specific RSV-associated excess hospitalization and mortality with 95% credible intervals (CrIs) were estimated in a Bayesian framework using the Markov Chain Monte Carlo method.

Table 1. Average annual RSV-associated excess respiratory hospitalization and death by age group in Hong Kong, 1998-2019.

	RSV-associated excess respiratory hospitalization/death rate, per 100,000 person-years (95% CrI)	Average annual number of RSV-associated excess respiratory hospitalizations/ deaths (95% CrI)	Proportion of respiratory hospitalizations/ deaths associated with RSV (%)
Hospitalization			
0-<1y	2159.0 (1974.3, 2345.1)	1026 (938, 1114)	19.2 (17.5, 20.8)
1-4y	294.5 (178.6, 404.3)	628 (381, 863)	5.1 (3.1, 6.9)
5-14y	-64.2 (-90.3, -36.3)	-427 (-600, -242)	-6.2 (-8.8, -3.5)
15-64y	7.6 (3.5, 11.8)	391 (182, 609)	1.5 (0.7, 2.3)
≥ 65y	235.2 (159.7, 313.2)	752 (398, 1098)	2.8 (1.5, 4.0)
≥ 75y*	434.5 (282.3, 592.1)	506 (289, 720)	2.5 (1.4, 3.6)
≥ 85y*	680.8 (360.0, 994.6)	1025 (647, 1406)	3.0 (1.9, 4.2)
Death			
≥ 65y	16.7 (6.8, 26.3)	159 (65, 251)	2.1 (0.9, 3.3)
≥ 75y*	30.8 (11.3, 50.1)	133 (49, 216)	2.0 (0.7, 3.3)
≥ 85y*	100.1 (44.4, 156.1)	118 (53, 185)	3.0 (1.3, 4.6)

*The results for age groups ≥75y and ≥85y were estimated with the data in 1998-2017.

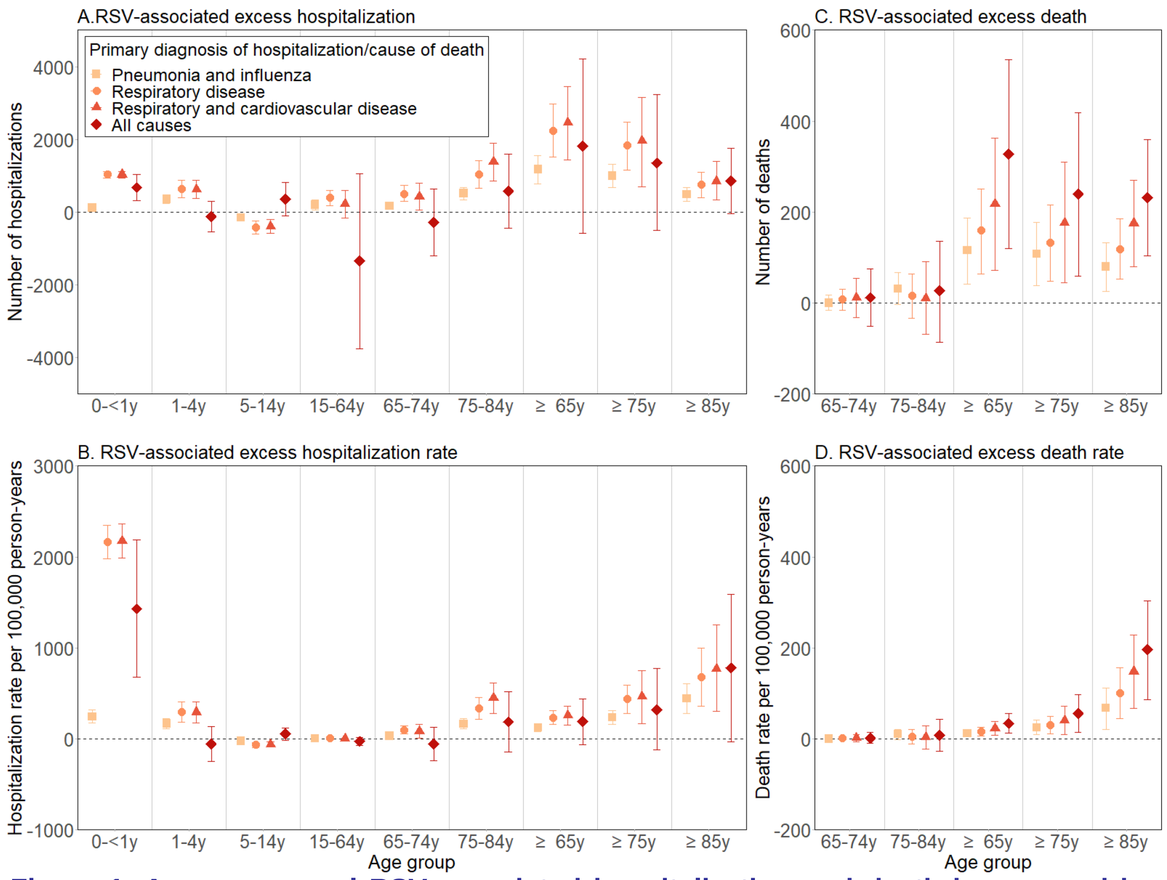

Figure 1. Average annual RSV-associated hospitalization and death by age and by primary diagnosis of hospitalization/cause of death in Hong Kong, 1998-2019.

Results

In Hong Kong, the highest annual excess respiratory hospitalization rate associated with RSV was estimated for individuals at 0-<1y (mean: 2159.0; 95% CrI: 1974.3, 2345.1 per 100,000 person-years) (Table 1), approximately one fifth of the total respiratory hospitalizations every year, followed by 1-4y (294.5; 178.6, 404.3, 5.1%). An age-dependent disease burden was estimated for older adults, with the highest in ≥85y (680.8; 360.0, 994.6), similar estimates for ≥65y (235.2 per 100,000 person-years) and ≥75y (434.5) (Figures 1-2). A reduced respiratory hospitalization (-64.2; -90.3, -36.3 per 100,000 persons-years) potentially related to RSV activities was estimated for children at 5-14y, accounting for 6.2% (-6.2%; -8.8%, -3.5%) of the respiratory admissions in that age group. RSV was associated with 16.7 (6.8, 26.3), 30.8 (11.3, 50.1), and 100.1 (44.4, 156.1) excess respiratory deaths every 100,000 persons per year in individuals ≥65y, ≥75y, and ≥85y, respectively, and a minimal number of excess respiratory deaths was estimated for 65-74y annually in Hong Kong. RSV was mostly associated with hospitalization and mortality from respiratory disease, while notable hospitalizations and deaths from cardiovascular disease and non-respiratory cardiovascular disease were attributed to RSV in the age group ≥75y.

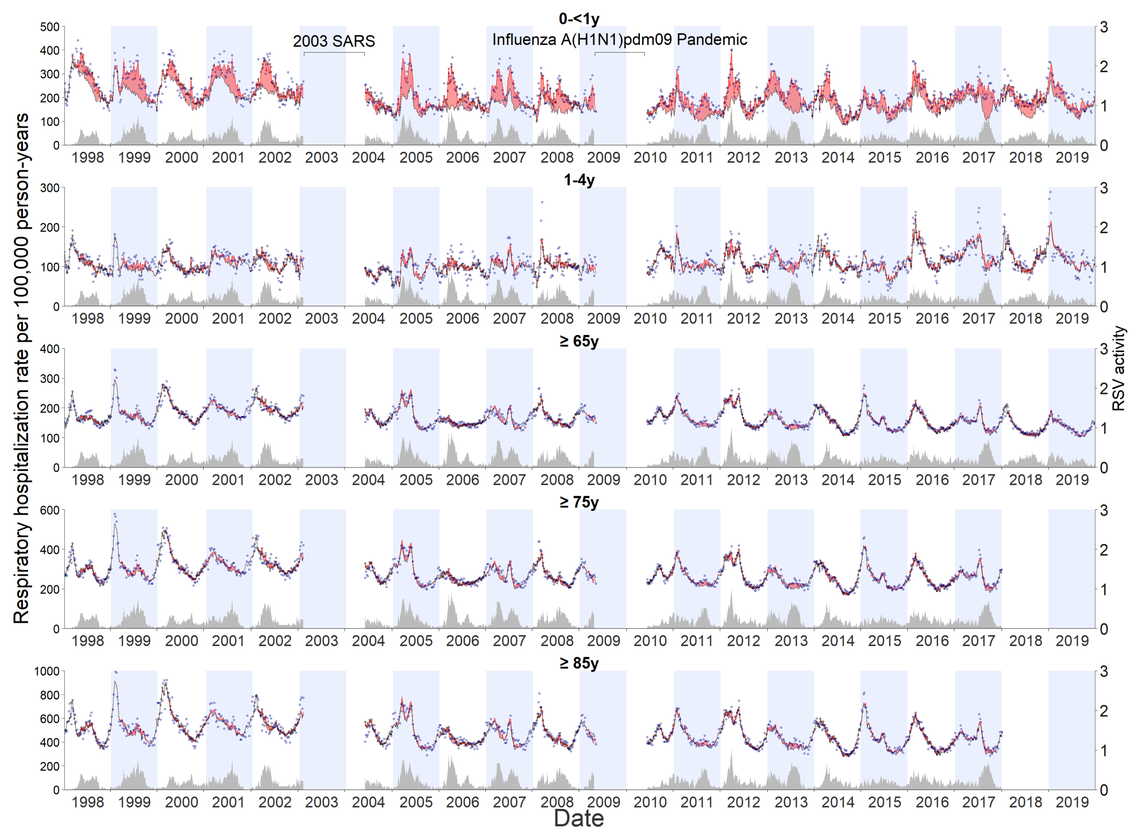

Figure 2 Weekly RSV-associated respiratory hospitalization rates per 100,000 person-years by age group in Hong Kong, 1998-2019. Blue dots are respiratory hospitalization rates per 100,000 person-years. Grey and red lines are the means of the baseline (without RSV activity) and the fitted respiratory hospitalization rates (with RSV circulation), respectively. Pink shaded areas denote expected respiratory hospitalization rates higher than the baseline while areas in blue for expected hospitalization rates lower than the baseline. Grey shaded area shows the weekly RSV activity, measured by the hospitalization rate of acute bronchiolitis associated with RSV in children <1y.

Conclusion

RSV infection was associated with a high respiratory hospitalization burden in children under five particularly infants and in the elderly while the majority of the RSV-associated deaths likely occurred in persons ≥ 75y. Our findings highlighted the importance of applying preventive and control measures against RSV infection in high-risk population and suggested potential priority groups for preventive interventions in Hong Kong.

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