



Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.jfma-online.com



Brief Communication

Changes in pediatric seizure-related emergency department attendances during COVID-19 – A territory-wide observational study

Ting Gee Annie Chiu ^{a,1}, William C.Y. Leung ^{b,1}, Qiqi Zhang ^c, Eric H.Y. Lau ^c, Ryan Wui-hang Ho ^d, Hoi-Shan Sophelia Chan ^a, Richard Shek-kwan Chang ^{b,*}

^a Department of Paediatrics and Adolescent Medicine, Queen Mary Hospital, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong

^b Division of Neurology, Department of Medicine, Queen Mary Hospital, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong

^c School of Public Health, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong

^d Department of Medicine, Queen Mary Hospital, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong

Received 24 August 2020; received in revised form 28 October 2020; accepted 15 November 2020

KEYWORDS

COVID-19;
Epilepsy;
Respiratory tract infections;
Medical help seek-behaviour;
Febrile seizures

A territory-wide retrospective observational study was conducted in Hong Kong between January 23 to April 22, 2020 to demonstrate changes in pediatric seizure-related accident and emergency department (A&E) visits during the COVID-19 pandemic. Parallel periods from 2015 to 2019 were used as control.

All-cause A&E attendances in all paediatric age groups decreased significantly during the study period. Seizure-related attendances decreased across all pediatric age-groups in 2020 (RR 0.379, 95% CI 0.245–0.588), with a disproportionately large decrease in the 0–6 years age group (RR 0.303, 95% CI 0.174–0.526) compared with the 7–18 years age group (RR 0.534, 95% CI 0.393–0.719). Decrease in RTI-related A&E attendances was also more drastic in the 0–6 age group. The two time trends are congruent in the 0–6 years but not the 7–18 years age group. Such a trend is suggestive of the usefulness of infection control measures in seizure prevention, especially amongst young children.

* Corresponding author. 4/F, Professorial Block, Department of Medicine, Queen Mary Hospital, Pokfulam, Hong Kong. Fax: +852 2555322.

E-mail address: changsk@ha.org.hk (R.S.-k. Chang).

¹ These authors contributed equally to this study.

Introduction

The worldwide pandemic of Coronavirus Disease 2019 (COVID-19) has brought about an unprecedented public health challenge on a global basis,¹ and impacted heavily on the workload of the Accident & Emergency Department around the world.^{2,3} Drops in A&E visits has been observed amongst patients seeking medical care for reasons other than suspected COVID-19,^{3,4} including that amongst children⁵ and patients with epilepsy.⁶

Seizure is one of the commonest cause for Accident & Emergency Department (A&E) visits in children.^{7,8} The pandemic offers a unique timeframe to better understand the dynamics of health seeking behaviour amongst children with seizure. We thus examined paediatric seizure-related A&E visits through conducting a territory-wide observational study during the first wave of COVID-19 pandemic in Hong Kong, during which there was relatively low burden of COVID-19 cases but a series of strict infection control measures were implemented by the health authorities.^{9,10}

Methods

The Hospital Authority (HA) provides over 80% of hospital services in Hong Kong; relevant clinical data from the HA was retrieved via the Clinical Data Analysis and Reporting System (CDARS). Fourteen out of the eighteen A&Es and all inpatient services operated by HA register diagnostic codes in CDARS according with International Classification of Diseases, 9th revision (ICD-9).

The study period was defined as January 23 – April 22, 2020, i.e. the first three months after the first COVID-19 case was confirmed in Hong Kong, during which there was relatively low burden of COVID-19 cases but vigilant infection control measures were enforced within the community. Parallel intervals from 2015 to 2019 were selected as control periods. Statistics for all-cause A&E attendance, respiratory tract infections (RTIs)-related A&E attendance, and seizure-related A&E attendance and ward admissions were retrieved from CDARS (see [Supplementary Table 1](#) for detailed search criteria). This included age of admission, diagnoses, acute ward and ICU admissions, lengths of stay (LOS), mortality rate, and early A&E readmission (within 28 days) rate. The total number of seizure-related A&E visit was further compared with that of RTI-related and all-cause A&E visits.

Linear and negative binominal regression models were used to estimate the long-term time trend and potential changes during the first three month after the first imported COVID-19 case in Hong Kong, in A&E attendances and admission parameters during the period of interest. *P*-values for comparison of relative risks across groups were calculated by the Monte Carlo simulation using 10,000

samples. Statistical significance is considered $p < 0.05$. Statistical analysis was performed with IBM SPSS 22.0 for Windows and R version 4.0.2 (R Development Core Team, Vienna, Austria).

This study was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster.

Results

Among the hospitals with computerized A&E attendance records, there was a total of 437,111 A&E visits between January 23 and April 22 in 2015–2020, of which 2530 were seizure-related and 70,282 were related to RTIs. The number of all-cause A&E attendances has been decreasing from 2015 to 2019 (RR 0.959, 95% CI 0.921–0.999, $p = 0.043$), with a significant decrease in 2020 in all age groups (RR 0.331, 95% CI 0.274–0.399, $p < 0.001$).

A significant drop in seizure-related A&E attendances was noted across all paediatric age groups in 2020 (RR 0.379, 95% CI 0.245–0.588, $p < 0.001$). Subgroup analysis showed a disproportionately larger decrease in seizure-related A&E attendances in the 0–6 years age group (RR 0.303, 95% CI 0.174–0.526, $p < 0.001$) than the 7–18 years age group (RR 0.534, 95% CI 0.393–0.719, $p < 0.001$), though the difference did not reach statistical significance ([Fig. 1A](#)).

Similar age group discrepancies were noted in RTI-related A&E attendances. The number of RTI-related A&E attendances decreased in 2020 when compared to the overall trend from 2015 to 2019 ([Fig. 1B](#)), with a drastic decrease in the 0–6 years age group (RR 0.208, 95% CI 0.141–0.310, $p < 0.001$), and a smaller decrease in the 7–18 age group (RR 0.335, 95% CI 0.210–0.536, $p < 0.001$).

The time trends of seizure- and RTI-related A&E attendances were congruent in the 0–6 years age group (test for difference in time trends, $p = 0.650$) but not in the 7–18 age group ([Fig. 1A and B](#)).

In view of the above findings, seizure-related admissions from children aged 0–6 years old were further divided into febrile and afebrile subgroups for subgroup analysis. Whilst the afebrile seizure-related admissions were halved, the febrile seizure-related admission dropped to less than 20% of the previous year, and was disproportionately greater ([Supplementary Fig. 1A and B](#)).

Admission outcomes

A total of 2241 seizure-related admissions during the study period were included. The acute ward in-patient admission rate, mortality rate, and rate of early A&E re-admissions remained stable between 2015 and 2020 ([Table 1](#)), and the LOSs in acute ward and ICU did not change significantly during COVID-19.

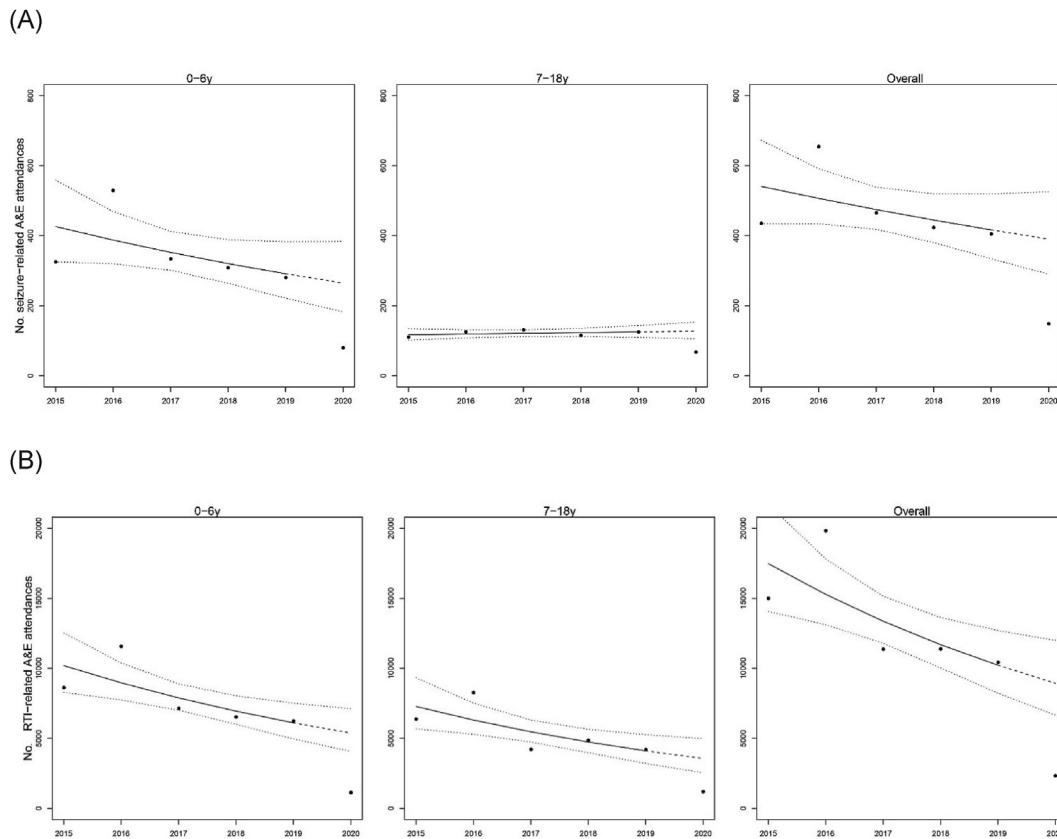


Figure 1 Annual trend of seizure-related A&E attendances (A) and RTI-related A&E attendances (B) in the period from January 23 to April 22 (2015–2020). Solid lines are the fitted time trend, while dashed lines are the predicted number of attendances following the same time trend.

Table 1 Hospital inpatient parameters in seizure-related admissions from January 23 to April 22, 2015–2020, using linear regression.

	Coef	95% CI	<i>p</i> -value
Acute ward admission rate			
Time trend (per year)	−0.010	−0.028–0.008	0.182
Year 2020	−0.012	−0.096–0.071	0.670
Mortality rate			
Time trend (per year)	0.0003	0.000–0.001	0.182
Year 2020	−0.001	−0.003–0.001	0.228
Acute ward LOS			
Time trend (per year)	−0.063	−0.314–0.188	0.482
Year 2020	−0.210	−1.361–0.941	0.603
ICU LOS			
Time trend (per year)	−0.027	−0.073–0.018	0.152
Year 2020	0.194	−0.015–0.403	0.060
Early A&E re-admission rate			
Time trend (per year)	−0.003	−0.014–0.008	0.437
Year 2020	−0.009	−0.057–0.040	0.618

(Coef = coefficient; LOS = length of stay; ICU = intensive care unit).

Discussion

The COVID-19 pandemic has deeply affected many aspects of people's lives, including personal hygiene practices, suspension of schools and social activities, quarantine

policies and travel restrictions. This study demonstrated change in seizure-related health seeking behavior, and the possible effect of social distancing on the incidence of seizure-related complaints in children during this global public health crisis.

We found that seizure-related A&E attendances decreased significantly during the periods of vigilant social distancing under COVID-19, with a disproportionately large effect on the 0–6 years age group compared to older pediatric age groups. A similar trend was found for A&E attendances for RTI during the same period.

The observed trend may be due to both an actual reduction in seizure occurrences and changes in health-seeking behavior. Social distancing and hygienic precautions reduced the risk of virus transmission, as evident by the significantly reduction in RTI occurrences. The disproportionate drop in seizure-related admissions in children 0–6 years, particularly febrile seizure-related admissions during this period of increased infection control suggests that intercurrent illnesses are a more significant risk factor of seizure occurrences in younger children, amongst whom the predominant cause of seizures is febrile seizure that are frequently associated with respiratory infections.^{11,12} It is therefore a reasonable postulation that strict infection control measures, including the use of facemasks, improved personal hygiene, social distancing, and homestay measures reduced RTI incidences and hence lowered incidences of febrile seizures.^{13,14} While it is beyond of scope of this observational study to demonstrate a causal relationship between the drop in RTI and febrile seizures during the COVID-19 pandemic, these findings may shed light on how febrile seizures and other related epileptic disorders can be prevented using approaches focusing on infection control measures and immunization programs.

Infection outbreaks, in particular pandemics, are a cause for altered medical help seeking behaviour,^{15–17} and large drops in A&E visits have also been observed in other pediatric populations around the world during the current pandemic.⁵ The possibility of nosocomial COVID-19 cross-infections, prohibition of family visits, and attempts to avoid overloading the healthcare system may have discouraged patients or parents from attending the A&E. While the spectrum of seizure severities did not show significant changes during the COVID-19 outbreak, it is not known whether these unmet medical needs may emerge later, causing a surge in service demand after the epidemic. Moreover, the COVID-19 pandemic is ongoing; our observations raise the need for further studies to better understand the trends observed and their causes in relation to the severity of the pandemic.

Conclusion

We demonstrated a significant reduction in emergency service utilization for seizures during the first wave of COVID-19 pandemic in Hong Kong, during which there was relatively low burden of COVID-19 cases but strict infection control measures were in place within the community. This reduction was more drastic in children aged 0–6 years old, who are prone to febrile seizures. This trend was congruent with that of RTI-related A&E attendances. Future studies are warranted to explore the approaches of infection control measures and immunization programs in preventing febrile seizures in younger children.

Sponsorship or funding

This study does not involve sponsorship or funding.

Declaration of competing interest

All authors have nothing to disclose.

Acknowledgement

The authors would like to acknowledge Mrs. R. Wong for her assistance with English editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jfma.2020.11.006>.

References

- Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: a review of the 2019 novel coronavirus (COVID-19). *Int J Surg* 2020;76:71–6. <https://doi.org/10.1016/j.ijsu.2020.02.034>.
- Bjornsen LP, Naess-Pleyem LE, Dale J, Laugsand LE. Patient visits to an emergency department in anticipation of the COVID-19 pandemic. *Tidsskr Nor Laegeforen* 2020;140(8). <https://doi.org/10.4045/tidsskr.20.0277>.
- Hartnett KP, Kite-Powell A, DeVies J, Coletta MA, Boehmer TK, Adjemian J, et al. Impact of the COVID-19 pandemic on emergency department visits - United States. *MMWR Morb Mortal Wkly Rep* 2020;69(23):699–704. <https://doi.org/10.15585/mmwr.mm6923e1>. January 1, 2019-may 30, 2020.
- Metzler B, Siostrzonek P, Binder RK, Bauer A, Reinstadler SJ. Decline of acute coronary syndrome admissions in Austria since the outbreak of COVID-19: the pandemic response causes cardiac collateral damage. *Eur Heart J* 2020;41(19):1852–3. <https://doi.org/10.1093/eurheartj/ehaa314>.
- Li H, Yu G, Duan H, Fu J, Shu Q. Changes in children's healthcare visits during COVID-19 pandemic in Hangzhou, China. *J Pediatr* 2020. <https://doi.org/10.1016/j.jpeds.2020.05.013> [published Online First: 2020/05/18].
- Granata T, Bisulli F, Arzimanoglou A, Rocamora R. Did the COVID-19 pandemic silence the needs of people with epilepsy? *Epileptic Disord* 2020. <https://doi.org/10.1684/epd.2020.1175>.
- Wong V. Study of seizure and epilepsy in Chinese children in Hong Kong: period prevalence and patterns. *J Child Neurol* 2004;19(1):19–25. <https://doi.org/10.1177/088307380401900104011>.
- Sogawa Y, Maytal J. Emergency department admission of children with unprovoked seizure: recurrence within 24 hours. *Pediatr Neurol* 2006;35(2):98–101. <https://doi.org/10.1016/j.pediatrneurol.2006.01.007> [published Online First: 2006/08/01].
- Centre of Health Protection DoH. *The Government of the Hong Kong special administrative region. Latest situation of coronavirus Disease (COVID-19) in Hong Kong*. Available from: <https://chp-dashboard.geodata.gov.hk/covid-19/en.html>. [Accessed 15 April 2020].
- Authority HKH. *Press Releases*. Available from: https://www.ha.org.hk/visitor/ha_visitor_text_index.asp?Content_ID=254422&Lang=ENG&Dimension=100&Parent_ID=10000&Ver=TEXT. [Accessed 15 April 2020].
- Francis JR, Richmond P, Robins C, Lindsay K, Levy A, Effler PV, et al. An observational study of febrile seizures: the importance of viral infection and immunization. *BMC Pediatr* 2016;

- 16(1):202. <https://doi.org/10.1186/s12887-016-0740-5> [published Online First: 2016/12/05].
12. Carman KB, Calik M, Karal Y, Isikay S, Kocak O, Ozcelik A, et al. Viral etiological causes of febrile seizures for respiratory pathogens (EFES Study). *Hum Vaccines Immunother* 2019;15(2): 496–502. <https://doi.org/10.1080/21645515.2018.1526588> [published Online First: 2018/09/21].
13. MacIntyre CR, Chughtai AA. Facemasks for the prevention of infection in healthcare and community settings. *BMJ* 2015; 350:h694. <https://doi.org/10.1136/bmj.h694> [published Online First: 2015/04/11].
14. Jefferson T, Del Mar C, Dooley L, Ferroni E, Al-Ansary LA, Bawazeer GA, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses: systematic review. *BMJ* 2009;339:b3675. <https://doi.org/10.1136/bmj.b3675> [published Online First: 2009/09/24].
15. Feng S, Grepin KA, Chunara R. Tracking health seeking behavior during an Ebola outbreak via mobile phones and SMS. *NPJ Digit Med* 2018;1:51. <https://doi.org/10.1038/s41746-018-0055-z> [published Online First: 2019/07/16].
16. Person B, Sy F, Holton K, Govert B, Liang A, National Center for Infectious Diseases SCOT. Fear and stigma: the epidemic within the SARS outbreak. *Emerg Infect Dis* 2004;10(2):358–63. <https://doi.org/10.3201/eid1002.030750> [published Online First: 2004/03/20].
17. Lau JT, Yang X, Tsui H, Kim JH. Monitoring community responses to the SARS epidemic in Hong Kong: from day 10 to day 62. *J Epidemiol Community Health* 2003;57(11):864–70. <https://doi.org/10.1136/jech.57.11.864> [published Online First: 2003/11/06].