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LETTER TO THE EDITOR

WILEY

Improved treatment adherence and allergic disease control during a COVID-19 pandemic lockdown

To the Editor,

Modern hectic lifestyles have created challenges for parents of allergic children, as treatment adherence and optimal disease control are closely tied to adequate caregiver supervision. Environmental allergen exposures in schools and outdoor environments are also difficult to control but impacts disease outcomes.[1] Improvements in disease symptoms are often reported during school vacations,[2] when children have more time at home under a caregiver's supervision. This study aimed to evaluate the impact of an 8-week (April to June 2020) COVID-19-induced nationwide lockdown in Singapore on allergic disease control in children. Universal masking and movement restrictions (closure of schools, workplaces, retail and entertainment facilities) were implemented. This presented a unique opportunity to evaluate the impact of increased caregiver supervision, school closures, reduction of outdoor exposures and increased indoor time on allergic diseases control.

An anonymous self-administered questionnaire, hosted on a secure online portal (FormSG), was disseminated to the general public through several media platforms in the one month after nationwide lockdown measures were lifted. Parents of 0- to 18-year-old children, or adolescents themselves, with allergic disorders (eczema, asthma and allergic rhinitis (AR)) were invited to complete the questionnaire anonymously. Survey completion implied consent to participate. The study received ethics approval by the NHG Domain Specific Review Board, Singapore (Reference number 2020/00717).

Data on demographics, caregiving arrangements, self-reported symptoms of allergic diseases and self-perceived reasons behind the changes in disease status were collected. Perceived treatment adherence was measured using a 10-point rating scale evaluating adherence before and during lockdown. Disease control was assessed through validated symptom scoring tools—the Patient-Oriented Eczema Measure (POEM) for eczema,[3] Asthma Control Test (ACT) for asthma[4] and Total Nasal Symptom Score (TNSS) for AR.[5]

Data were analysed using SPSS Version 26.0 (IBM Corp). Pearson's chi-square test was used for categorical variables and Wilcoxon sign rank test for symptom score comparisons. Differences in medians between groups reporting different disease outcomes before and during lockdown were analysed with the Kruskal-Wallis test.

A total of 173 parents/adolescents, 89 (51.4%) males and 84 (48.6%) females, aged 2 months to 18 years participated in this survey (Table S1). The majority of subjects (93.1%) received their treatment under adult supervision.

A total of 41.7% of subjects with eczema reported symptomatic improvement (Figure 1A) and improved treatment adherence during the lockdown [median scores 7 (IQR: 5–8) and 8 (IQR: 7–9) before and during lockdown, respectively; $p < .001$]. This was significantly associated with a better overall perception of disease control ($p < .001$) and improved POEM scores: 9 (IQR: 3–13) to 6 (IQR: 3–10) ($p = .001$) (Figure 1B). Significant improvement in itch ($p = .005$), bleeding ($p = .002$), cracked skin ($p = .017$) and flaky skin ($p = .03$) was noted, but frequency of topical steroid use was not significantly reduced ($p = .217$) (Table S2).

Subjects who reported perceived improvement in eczema control had a significantly higher POEM score before lockdown (median 13, IQR 7–18) compared with those who reported worsening (median 5, IQR 1–8) or no change in overall eczema control (median 8, IQR 3–11) ($p < .001$) (Table 1).

Reduced exposure to triggers such as heat/sweat and physical activity (93.8%) and more time for skin care treatment (72.9%) was the most commonly cited reasons for improvement, while increased exposure to indoor triggers such as dust and heat/sweat was the most commonly cited reasons for deterioration (Figure 2).

Asthmatic patients reported an overall significant improvement in perceived treatment adherence during the lockdown [median scores 9 (IQR: 8–10) and 10 (IQR: 9–10), respectively; $p = .011$] (Figure S1) but no improvement in overall asthma control ($p = .12$) or ACT scores ($p = .063$) (Figure 1B). Patients with poorer asthma control before lockdown were more likely to benefit from lockdown and baseline median ACT score was 17 (IQR: 15–21) in those who improved, compared to subjects without improvement (median 24) ($p = .001$) (Table 1). Reduced exposure to infections, better sleep, more time for treatment administration, better diet and more time to seek medical attention were the main reasons for asthma improvement, while deterioration was solely attributed to increase indoor dust exposure.

There was no difference in overall median treatment adherence scores in subjects with AR ($p = .201$), but better adherence was associated with improved overall perception of disease control ($p = .044$). There were no differences in median TNSS scores: [3 (IQR: 2–4 and IQR: 2–5 before and during lockdown, respectively) ($p = .299$)] (Figure 1B), or when stratified by baseline disease status

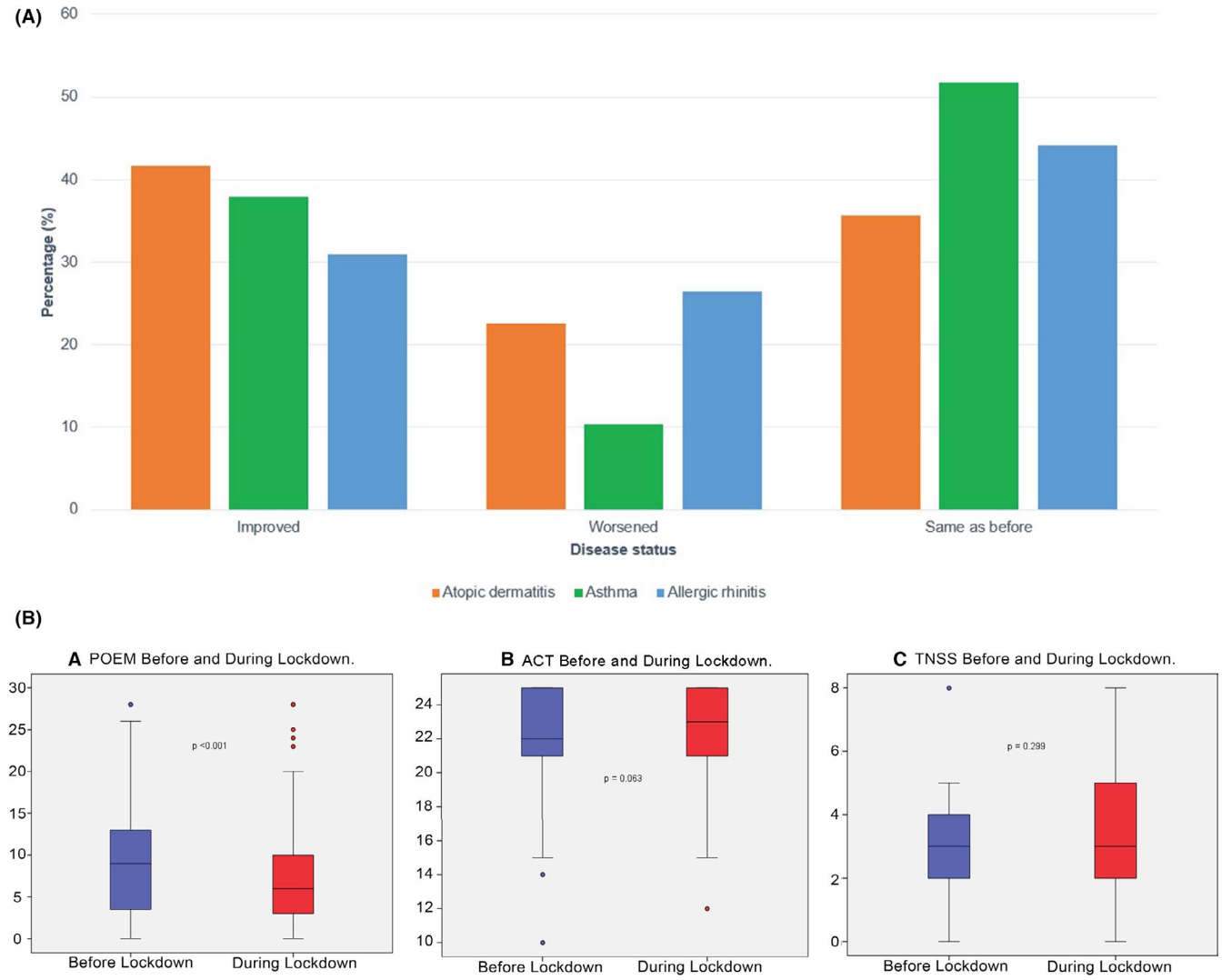

FIGURE 1 Control of allergic disease before and during lockdown. A shows the breakdown of perceived overall changes in allergic disease control before and during the lockdown period by individual allergic disorders. Data are presented by percentages of the total number of individuals with a particular allergic disorder. B show comparisons of the validated symptom scores: Patient-Oriented Eczema Measure (POEM) scores for eczema, Asthma Control Test (ACT) scores for asthma and Total Nasal Symptom Score (TNSS) for allergic rhinitis before and during the lockdown period. POEM scores range from 0 to 28, with a higher score indicating poorer disease control. ACT scores range from 5 to 25 with higher scores indicating better disease control. TNSS scores range from 0 to 12, with higher scores indicating poorer disease control

($p = .149$) (Table 1). All subjects reported reduced indoor dust exposure, better treatment adherence, improved diet and sleep patterns as main reasons for improved AR control. Symptom deterioration was attributed to increased indoor dust exposure, avoidance of medical consultation and lack of caregiver supervision due to remote working demands. Lack of access to medical care was not cited as a reason for poor disease control in any of the allergic disorders.

The COVID-19 lockdown had an unexpected positive impact on treatment adherence and disease symptoms in children with eczema and asthma. Eczema treatment regimens are often complex and time-consuming,[6] and non-adherence to treatment is a major reason for treatment failure.[7] The mandatory home confinement serendipitously afforded flexibility of time and increased caregiver supervision, which likely translated to improved treatment adherence and better eczema control, particularly in those with moderately severe eczema (POEM score 8–16[3]). Reduction of outdoor heat and UVR exposure, humidity, perspiration and exercise, which are known eczema triggers, likely contributed to this improvement as well. While there was no significant reduction in frequency of topical steroid use, this is likely due to enhanced treatment compliance during the study timeframe, but data on long-term steroid requirement were not able to be captured due to the short observation period.

Poorly controlled asthmatics appear to benefit more from reduced exposure to viral respiratory infections, attributable to social distancing, enhanced mask wearing and hand hygiene practices during this lockdown period. Other studies have also observed a

TABLE 1 Patient rated scores before and during lockdown and overall perceived disease status during lockdown

		Improved disease status during lockdown		Worsened disease status during lockdown		Stayed the same during lockdown		
Score (Disease)	**Subjects**	**Median score (IQR)**	***n***	**Median score (IQR)**	***n***	**Median score (IQR)**	***n***	***p*-value***
POEM Score								
Before lockdown	115	13 (7–18)	48	5 (1–8)	26	8 (3–11)	41	**<.001**
During lockdown		6 (2–8)		11 (6–15)		7 (2–10)		
ACT Score								
Before lockdown	29	17 (15–21)	11	24	3	24 (22–25)	15	**.001**
During lockdown		23 (20–25)		24		25 (23–25)		
TNSS								
Before lockdown	68	4 (2–5)	21	3 (2–4)	17	2 (2–5)	30	.149
During lockdown		2 (2–3)		5 (5–7)		2.5 (2–5)		

Note: Bold p values indicate statistical significance ($p < .05$).

Abbreviations: AD, atopic dermatitis; ACT, asthma control test; POEM, patient-oriented eczema measure; TNSS, total nasal symptom score.

*Analysed by Kruskal-Wallis Test.

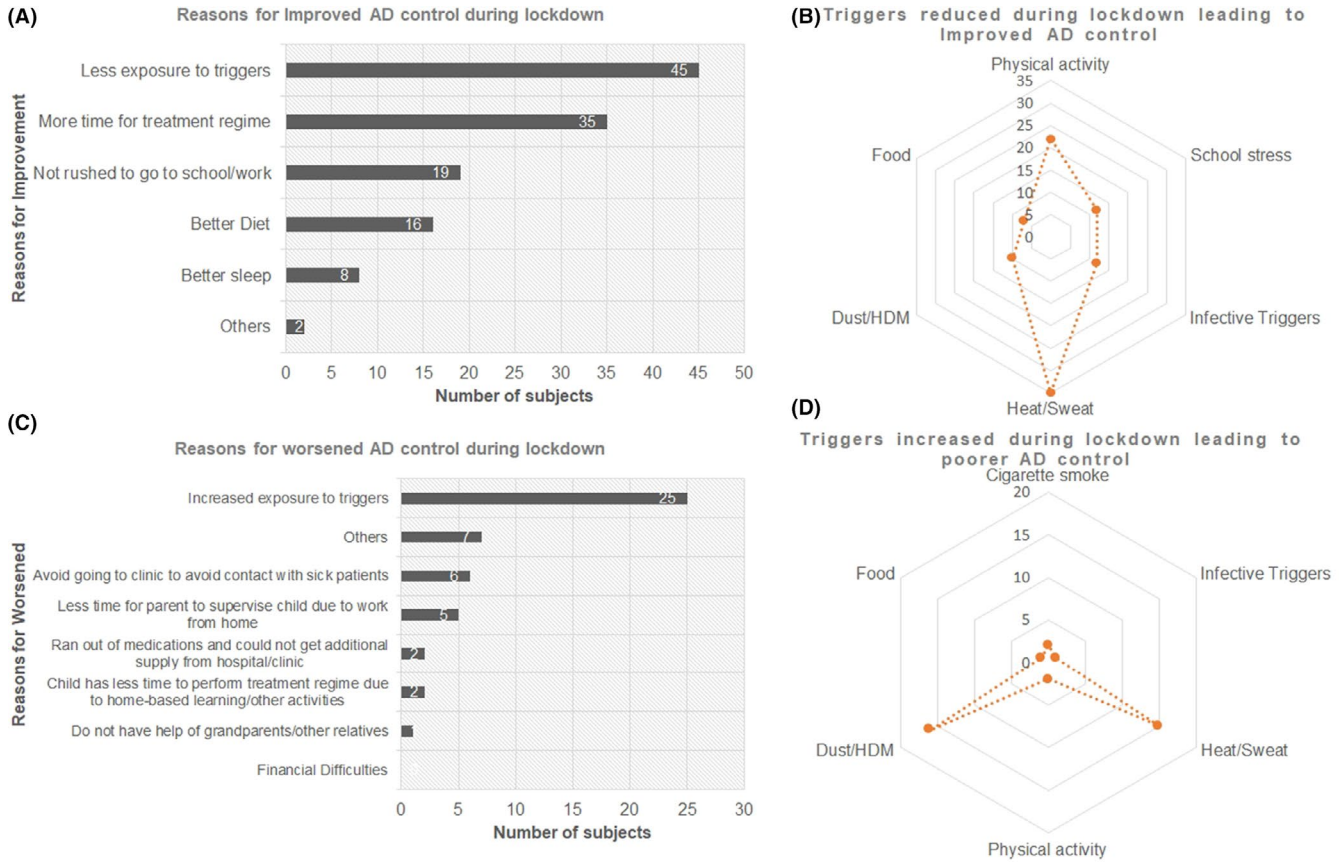

FIGURE 2 Factors implicated in Eczema (AD) control. More time for administration of skin treatment ($n = 35$) and reduced exposure to triggers ($n = 45$) (4A) such as physical activity ($n = 22$) and heat/sweating ($n = 35$) (4B) were the main reasons for improved eczema control during the lockdown period. Increased exposure to indoor triggers (4C) such as house dust mites (HDM) ($n = 16$) and heat/sweat ($n = 15$) (4D) were the main reasons for poor eczema control. Other reported reasons included increased hand washing/hand sanitizers, prolonged exposure to air-conditioning leading to excessive skin dryness and increased stress from being confined indoors and excessive drooling

reduction in viral infections, Emergency Department visits and admissions for wheezing and asthma exacerbations during the COVID-19 pandemic.[8,9]

Reduced healthcare access or medication supply disruptions were not reasons for worsening disease control. Possible reasons may include enhanced telemedicine practices, which is particularly

suitable for stable allergic diseases,[10] and home delivery of medications in the local setting, which may help to ensure continued access to medical care.

This was a small pilot cross-sectional study without a longitudinal component and hence may not be sufficiently powered and does not measure sustainability over time. The use of an anonymous self-administered questionnaire might also introduce recall and selection bias. Data on socio-economic status and objective measures of disease were intentionally omitted from the survey design to minimize subject burden. Survey respondents may also have been self-selected for better disease control at baseline, coping ability or treatment success, thus limiting our ability to measure a tangible improvement in asthma and AR scores. Alternatively, the degree of benefit conferred by lockdown depends on the type of allergic disease.

Although our study had not included objective examinations of disease control to reduce subject burden, the primary aim of the study was to assess self-perception of treatment adherence and disease symptoms, which have a close correlation with quality of life. Mass lockdowns are dependent on pandemic exigencies and rapid government-led responses; therefore, studies evaluating the impact of pandemic lockdowns on various human outcomes are often opportunistic and retrospective.

However, this study has generated important insights into the benefits of extended home-based care on allergic disease control, and the way the COVID-19 pandemic has shaped patient behaviour and its impact on self-perceived allergic disease control, which may in turn influence disease management strategies in the longer term. Extended home-based care can be facilitated by flexible remote school and work arrangements, which are now gaining acceptance worldwide.

Future research outside of the pandemic setting may be designed prospectively to recruit patients with various allergic diseases and randomly assign them to home-based learning versus attending in-person school to evaluate the impact of extended home-based care on allergic disease control. Alternatively, studies to assess disease control during school term versus vacation may be able to evaluate time flexibility on treatment compliance, but may not be able to control for extended indoor time and outdoor exposures and activities.

Data on baseline sensitization information to both indoor and outdoor allergens, rates of exposure to skin barrier irritants, lifestyle practices (eg sleep and diet), demographic data including socio-economic status and home environmental conditions should be collected. Outcomes measures should ideally include quantification of disease flares, healthcare seeking behaviour and treatment, hospitalization rates, and both objective and patient-reported treatment adherence as well as disease control to determine the impact of such interventions on healthcare costs, hospital admissions, quality of life and increased work productivity and its associated economic benefits.

KEYWORDS

allergic disease, COVID-19, quarantine

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

Elizabeth Huiwen Tham: Conceptualization (equal); Methodology (equal); Writing-review & editing (equal). **Poh Lin Pauline Chan Ng:** Formal analysis (equal); Writing-original draft (equal). **Alicia Yi Hui Kang:** Formal analysis (equal); Writing-review & editing (supporting). **Liang Shen:** Methodology (equal); Validation (equal). **Lydia Su Yin Wong:** Conceptualization (equal); Methodology (equal); Writing-review & editing (equal).

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