



Complementary and alternative medicine use in children with asthma

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ABSTRACT

Purpose: To estimate the overall prevalence of complementary and alternative medicine and specific modalities used among children with asthma, identify predictors of use, and perceived positive or negative effects of therapies.

Results: Of the 161 children enrolled in the study, 76.4% had ever used complementary and alternative medicine. Humidifiers, air purifiers, and multivitamins were the most common modalities used. Complementary and alternative medicine use in children was associated with family use, younger child age, and disease severity, indicated by recent asthma exacerbation. The majority of participants perceived benefit from their complementary and alternative medicine use, with very few reporting negative side effects. Only 36.7% of participants reported discussing their complementary and alternative medicine use with the asthma clinic healthcare team.

Conclusions: The prevalence of complementary and alternative medicine use in children with asthma is high, with the majority of families perceiving benefit from its use. This study offers clinicians a reference to inform families regarding the subjective helpfulness of various types of complementary and alternative medicine modalities that can facilitate the dialogue between health care professionals and families interested in complementary and alternative medicine use.

1. Introduction

Asthma is a common, multifactorial respiratory disease characterized by chronic airway inflammation and symptoms of wheeze, cough, shortness of breath, and chest tightness [1–3]. It is the most common chronic respiratory disease in Canada, with a prevalence of 12% in Canadian children [4].

Despite improvement in pharmacologic interventions and international clinical practice guidelines, only one in three Canadians has their asthma well-controlled, in keeping with American and European data [3,5–7]. Increasingly, families are turning to complementary and alternative medicine (CAM) as another option for treating respiratory diseases.

In Canada, CAM use in children with a variety of chronic respiratory illnesses surveyed in two cities was 61.9% [8]. Most recently, we have reported the prevalence of CAM use for respiratory symptoms among children treated for cystic fibrosis (CF) in London, Ontario, Canada to be between 62 and 79% [9].

Studies of CAM use in children with asthma have found a broad prevalence range from 16 to 89% [10–20]. This is likely a reflection of regional variation in CAM use, differences in patient recruitment

settings, differences in the severity of asthma among participants and the comprehensiveness of their conventional asthma care.

While several studies have measured the prevalence of CAM use, only a few have explored clinical factors associated with CAM use in children with asthma. These studies have most commonly identified family CAM use and poor asthma control as predictors of CAM use, but the relationship with factors reflecting socioeconomic status, such as parental education and income, is conflicting [8–12,14,21–24]. Furthermore, these previous studies have not clearly identified whether CAM was used for asthma-related symptoms or general well-being. There are very few studies in children with asthma exploring any negative consequences of CAM use or if users are foregoing conventional asthma therapy for CAM [25].

Our objectives were to estimate the overall prevalence and modalities of CAM used among children with asthma treated at specialized asthma clinics in London, Ontario, Canada, as well as to evaluate possible predictors of CAM use and perceived positive or negative effects of CAM therapies. We hypothesized that CAM use would be higher in children whose family members also use CAM, in those with more severe or persistent asthma, and in children of higher income families as CAM modalities are not paid for under the Canadian health care system.

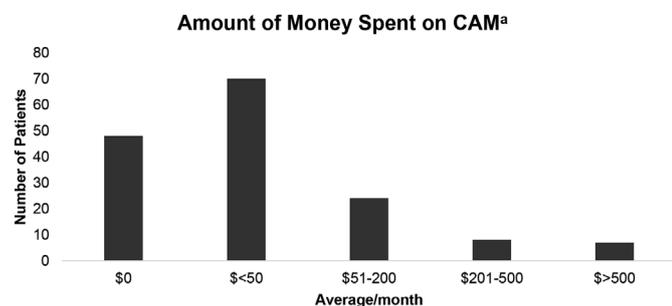
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^a Amount in Canadian dollars.

Fig. 1. Monthly costs of CAM

^a Amount in Canadian dollars.

2. Materials and methods

2.1. Patient recruitment

We administered a questionnaire detailing types, frequency, and reasons for CAM use to parents or primary caregivers of children aged 1–18 years who attended two specialty asthma clinics associated with the Children's Hospital, London Health Sciences Centre, in London,

Table 1

Comparison of demographic characteristics between CAM users and non-users.

Outcome	'Ever' CAM Use		p-value	'Current' CAM Use ^a		p-value
	CAM Users (N = 123) % (N)	CAM Non-Users (N = 38) % (N)		CAM Users (N = 98) % (N)	CAM Non-Users (N = 63) % (N)	
Family Use of CAM	68.6 (83)	32.4 (12)	< 0.01 ^b	72.2 (70)	41.0 (25)	< 0.01 ^b
Income (CAD) ^c			0.60			0.74
< \$20k	9.8 (11)	11.8 (4)		10.0 (9)	10.7 (6)	
\$20-50k	17.0 (19)	23.5 (8)		16.7 (15)	21.4 (12)	
> \$50k	73.2 (82)	64.7 (22)		73.3 (66)	67.9 (38)	
Caucasian ^d	81.0 (98)	81.6 (31)	1.0	20.6 (20)	16.1 (10)	0.54
Female sex	41.5 (51)	39.5 (15)	0.85	39.8 (39)	42.9 (27)	0.74
Acute episode ^e	52.5 (64)	29.0 (11)	0.02 ^b	49.5 (48)	42.9 (27)	0.42
Hospitalizations	13.1 (16)	5.3 (2)	0.25	11.3 (11)	11.1 (7)	1.0
ED visits	33.6 (41)	13.2 (5)	0.02 ^b	32.0 (31)	23.8 (15)	0.29
Oral steroids	41.8 (51)	23.7 (9)	0.06	41.2 (40)	31.8 (20)	0.25
Intermittent asthma	43.4 (53)	30.6 (11)	0.18	45.4 (44)	32.8 (20)	0.14
Persistent asthma ^f	55.7 (68)	72.2 (26)	0.03 ^b	54.6 (53)	67.2 (41)	0.14
Use of combination therapy ^g	70.5 (86)	81.6 (31)	0.21	70.1 (68)	77.8 (49)	0.36
Higher level of guardian education ^h	81.5 (97)	73.0 (27)	0.35	79.2 (76)	80.0 (48)	1.0
Trigger: allergy	36.4 (44)	36.8 (14)	1.0	36.5 (35)	36.5 (23)	1.0
Trigger: colds	76.9 (28)	73.7 (28)	0.67	78.1 (75)	73.0 (46)	0.57
Trigger: exercise	18.2 (22)	29.0 (11)	0.17	17.7 (17)	25.4 (16)	0.32
Trigger: other	4.1 (5)	2.63 (1)	1.0	4.17 (4)	3.17 (2)	1.0
Continuous Variables Mean (SD)			p-value			p-value
Age of child, years	8.5 (4.0)	10.7 (3.8)	< 0.01 ^a	8.2 (3.9)	4.0 (0.5)	< 0.01 ^a
Age of diagnosis	4.3 (3.3)	5.4 (3.7)	0.12	4.4 (3.4)	4.8 (3.5)	0.47
Caregiver's year of birth	1974.0 (7.2)	1970.9 (6.7)	0.02 ^a	1974.3 (7.3)	1971.7 (6.8)	0.02 ^a
FEV1% predicted	88.6 (17.9)	86.3 (15.7)	0.48	87.7 (18.5)	88.3 (15.7)	0.99

CAM = complementary and alternative medicine.

ED = emergency department.

FEV1 = forced expiratory volume in 1 s.

^a 'Current' CAM Use refers to CAM use within the past 6 months.

^b Denotes statistically significant difference at $p < 0.05$.

^c CAD = Canadian currency.

^d Caucasian participants were compared to non-Caucasian participants.

^e An acute episode, a marker of asthma severity, was defined as any occurrence of an asthma-related ED visit or hospitalization, or administration of oral steroids in past year.

^f Persistent asthma = asthma with symptoms occurring outside of acute exacerbations.

^g Combination therapy refers to a patient reporting use of any combination inhaler therapy (Symbicort, Advair, Zenhale) or more than one controller medication (Singulair, Alvesco, Flovent, Pulmicort, QVAR).

^h Higher level of guardian education = university or college.

Ontario, Canada. These are the only asthma referral centres in this region of Ontario which has a catchment area of more than one million persons. Patients with an asthma diagnosis for more than one year were eligible for inclusion in the study. Due to the difficulty in diagnosing asthma in children under one year, this age group was excluded. All participants and caregivers received a letter of information and signed a written consent form. There was no stipend for participation in the study.

2.2. Questionnaire development and validation

Details regarding questionnaire development and validation are similar to those previously published in our study on complementary and alternative medicine use in children with cystic fibrosis [9]. We defined CAM as “any treatment used specifically for asthma excluding what was prescribed by a physician”. We made modifications to the questionnaire from the previous CF study, as shown in Fig. 1 in the Online Supplement [9]. The questionnaire content was kept similar but with a focus on asthma. In brief, we collected information on the types of CAM used (such as natural health products including herbal remedies and homeopathy, nutrition, spiritual and mental treatments, physical treatments including acupuncture and chiropractic, and other therapies including halotherapy), parent/caregiver demographics, indicators of

Table 2
The frequency of CAM modalities used.

Category of CAM	Type of CAM	'Ever' CAM Users (%) ^a (N = 123)	'Current' CAM Users (%) ^a (N = 98)
Natural Health Products	Homeopathy	17.0	8.2
	Echinacea	13.9	5.1
	Chamomile	9.8	2.0
	Garlic	8.9	6.1
	Aloe Vera	7.3	2.0
	Ginger	6.5	3.1
	Bee Pollen	4.8	2.0
	Herbal Enzymes	4.8	2.0
	Multivitamins	43.8	46.0
	Nutritional Products	Honey	29.3
	Probiotics	27.6	22.5
	Omega 3 Fatty Acids	23.6	18.4
	Vitamin C	19.5	17.4
	Vitamin D	17.0	16.3
	B Vitamins	8.9	8.2
	Vitamin E	8.1	6.1
	Special Diets	8.1	4.1
	Flaxseed	6.5	5.1
Spiritual/Mental Treatments	Relaxation/Meditation	8.9	5.1
	Yoga	4.8	3.1
Physical Treatments	Biofeedback	0.8	1.0
	Chiropractic	17.0	13.3
	Massage	9.8	8.2
	Osteopathy	3.3	2.0
	Reflexology	2.5	2.0
Humidifiers/Other	Hydrotherapy	1.6	1.0
	Humidifier	80.5	48.0
	Air Purifier	48.8	38.8
	Salt Lamps	10.6	7.1
	Salt Rooms	7.3	3.1

CAM = complementary and alternative medicine.

^a Percentages are calculated using the column total N.

socioeconomic status, and patient demographics, including ethnicity. We also explored reasons for CAM use, potential side effects, CAM use among other family members and the amount of money spent on CAM.

2.3. Additional data collection

We collected additional information from the patients' medical records regarding markers of disease severity (such as emergency room visits, hospitalizations or oral steroids use in the past year), results of pulmonary function testing (such as forced expiratory volume and forced vital capacity), and disease characteristics (such as asthma triggers and medications). Asthma phenotype was categorized as intermittent (asthma symptoms only during an acute exacerbation) versus persistent (asthma symptoms occurring outside of a cold or acute exacerbation) [1].

2.4. Analysis

Descriptive statistics were used to identify the most commonly used types of CAM, their perceived benefits, and the amount of money spent monthly. Children were grouped into non-users of CAM, current users (used CAM within the previous 6 months), and ever users (used CAM at least once anytime in the past). Differences in baseline demographic data and markers of illness severity for non-users were compared with both current users and ever users. Severity of asthma was defined by the occurrence of acute exacerbations requiring an emergency department (ED) visit, hospitalization, or systemic corticosteroids in the past year. Categorical data were presented as percentages whereas the mean was used as the measure of central tendency for continuous data. We compared categorical data using Fisher's Exact Test and continuous

data with Wilcoxon rank sum tests. All p-values less than 0.05 were considered to be statistically significant. All statistical analysis was conducted using SAS 9.4.

We subsequently ran a series of univariable logistic regressions to identify variables that were statistically significant ($p < 0.05$ using Wald Chi-Square Test) in their association with current CAM or ever CAM use. Using a stepwise approach, we then built multivariable logistic regression models based on the statistically significant variables in the univariable analyses to determine independent predictors of current and ever CAM use. We assessed model fit using the Hosmer-Lemeshow (HL) test and C-statistic.

3. Results

One hundred and sixty one eligible families were enrolled into the study and completed questionnaires on CAM use. Eight families refused to fill out the questionnaire or left it incomplete, representing a 95% questionnaire completion rate. Of the completed questionnaires, 76.4% of children had ever used CAM in the past, with 60.9% of children using CAM within the past 6 months of questionnaire completion. Fifty nine percent of participants also reported CAM use by other family members. Only 36.7% of participants reported discussing their CAM use with the asthma clinic healthcare team, whereas 40.4% consulted another professional outside the healthcare team.

Demographic characteristics and measures of asthma severity are outlined in Table 1. Across both ever and current CAM users, we found family use, age of the child, and age of the caregiver to be significantly different between CAM users and CAM non-users. Acute asthma episodes, ED visits, and the proportion with a persistent asthma phenotype also differed between ever CAM users and CAM non-users.

Table 2 outlines the most commonly used CAM in our study population by ever use and current use. Humidifiers, air purifiers, and multivitamins were the most common forms of CAM used. Use of multiple CAM therapies was prevalent in our study population, with the mean number of CAM modalities amongst current users at 3.8 and many using 5 or more modalities. Only 5.7% of all users reported negative side effects of CAM. The average monthly cost participants reported from CAM use is illustrated in Fig. 1, which shows 24.2% of participants spent on average more than \$50 CAD per month.

Results from the univariable analyses are shown in Table 3. Family CAM use, age of child, and age of caregiver were significant unadjusted predictors of ever and current CAM use. Having an acute asthma episode in the preceding year was also identified as a significant predictor in the univariable analysis for ever CAM use. Multivariable analysis (Table 4) identified family use of CAM as the strongest independent predictor of both ever CAM use and current CAM use, followed by younger child's age. Asthma exacerbation within the preceding year was also a significant independent predictor for ever CAM use. After adjustment in the multivariate model, caregiver's age was not an independent significant predictor.

Most participants found CAM to be useful with 62%–92% of participants perceiving a benefit in alleviating breathing and/or other symptoms (Fig. 2). Mental techniques were perceived as the most helpful, followed by humidifiers, physical treatments, natural health products, and nutritional products. Participants rarely reported negative side effects of any CAM treatments.

4. Discussion

This study demonstrates that the majority of children with asthma treated in specialty clinics in Southwestern Ontario, Canada, are using CAM, with a prevalence of 76.4%. This is in keeping with recent literature in other studies of children with chronic respiratory conditions [9,11,13,21].

Aside from humidifiers and air purifiers, the most common categories of CAM used were natural health and nutritional products, and in

Table 3
Univariable associations between patient characteristic and CAM use.

Variable	'Ever' CAM Use			'Current' CAM Use ^a				
	Odds Ratio	95% CI		p-value	Odds Ratio	95% CI		p-value
		Lower	Upper			Lower	Upper	
Family Use of CAM	4.55	2.07	10.01	< 0.01 ^b	3.73	1.90	7.34	< 0.01 ^b
Income ^c	0.86	0.21	3.54	0.57	0.83	0.23	3.00	0.59
\$20-50k > \$50k	1.36	0.39	4.67	0.38	1.16	0.38	3.50	0.54
Caucasian ^d	0.96	0.38	2.46	0.94	0.74	0.32	1.71	0.48
Female sex	1.09	0.52	2.3	0.83	0.88	0.46	1.68	0.70
Acute episode^e	2.71	1.23	5.94	0.01 ^b	1.31	0.69	2.47	0.41
Use of combination therapy ^f	0.54	0.22	1.34	0.18	0.67	0.32	1.40	0.29
Intermittent asthma	1.75	0.79	3.9	0.17	1.70	0.87	3.32	0.12
Persistent asthma ^g	0.48	0.22	1.1	0.08	0.59	0.30	1.1	0.12
Higher guardian education ^h	1.63	0.69	3.87	0.26	0.95	0.43	2.12	0.90
Age of child	0.87	0.79	0.96	< 0.01 ^b	0.88	0.81	0.96	< 0.01 ^b
Age of child at diagnosis	0.92	0.83	1.02	0.11	0.97	0.88	1.06	0.47
Caregiver's year of birth	1.07	1.01	1.13	0.02 ^b	1.05	1.01	1.10	0.03 ^b
FEV1% predicted	1.01	0.99	1.03	0.51	1.00	0.98	1.02	0.85

CAM = complementary and alternative medicine.

FEV1 = forced expiratory volume in 1 s.

^a 'Current' CAM Use refers to CAM use within the past 6 months.

^b Denotes statistically significant difference at p < 0.05.

^c CAD = Canadian currency.

^d Caucasian participants were compared to non-Caucasian participants.

^e An acute episode, a marker of asthma severity, was defined as any occurrence of an asthma-related ED visit or hospitalization, or administration of oral steroids in past year.

^f Combination therapy refers to a patient reporting use of any combination inhaler therapy (Symbicort, Advair, Zenhale) or more than one controller medication (Singulair, Alvesco, Flovent, Pulmicort, QVAR).

^g Persistent asthma = asthma with symptoms occurring outside of acute exacerbations.

^h Higher level of guardian education = university or college.

Table 4
Predictors of CAM use: multivariable analysis.

Variable	'Ever' CAM Use ^a			'Current' CAM Use ^{b,c}				
	Odds Ratio	95% CI		p-value	Odds Ratio	95% CI		p-value
		Lower	Upper			Lower	Upper	
Age (years)	0.88	0.79	0.98	0.02 ^d	0.88	0.81	0.96	< 0.01 ^d
Female sex	1.22	0.52	2.84	0.64	1.09	0.53	2.21	0.82
Family use of CAM	5.44	2.34	12.67	< 0.01 ^d	3.82	1.90	7.70	< 0.01 ^d
Acute episode ^c	2.71	1.12	6.52	0.03 ^d	N/A	N/A	N/A	N/A

CAM = complementary and alternative medicine.

^a C-statistic = 0.78, HL-test p = 0.99.

^b 'Current' CAM Use refers to CAM use within the past 6 months.

^c C-statistic = 0.72, HL-test p = 0.75.

^d Denotes statistically significant difference at p < 0.05.

^e An acute episode, a marker of asthma severity, was defined as any occurrence of an asthma-related ED visit or hospitalization, or administration of oral steroids in past year.

particular, multivitamins, honey, and probiotics. Many of these CAM treatments have previously undergone efficacy studies and have not shown objective improvement in respiratory symptoms or function [26–38].

Children whose family members use CAM were significantly more likely to use CAM themselves, a finding corroborated by previous studies [8,9,14], and reflective of the culture within a given family with respect to healthcare practices. We have further identified that asthma severity as defined by having an acute episode of asthma within the preceding year was a significant independent predictor of CAM use [8,10–12,21–24]. This may be from concern about conventional medication side effects (such as steroids) or from dissatisfaction with current therapy [23,24]. We also noted that younger children were more likely to have used CAM, perhaps because asthma morbidity is highest among this age group [39], or because conventional over the counter

cough and cold preparations are not recommended for use in very young children due to a lack of safety data. We did not identify family income to be a predictor of CAM use, suggesting that families will find ways to pay for CAM even if not covered by government health insurance.

As described previously, we also noted that less than half of CAM users had discussed its use with their healthcare team [9,40,41]. This may be because the majority of practitioners do not ask about patient CAM use and do not have a standard intake form to do so, despite clear evidence of high CAM prevalence [18]. Asking families about CAM use can be a window into addressing any misconceptions about their disease state or conventional treatment.

Interestingly, 7.3% of our cohort had used salt rooms for their asthma symptoms, a rate higher than amongst the CF population in a previous study in the same practice region [9]. Some salt room

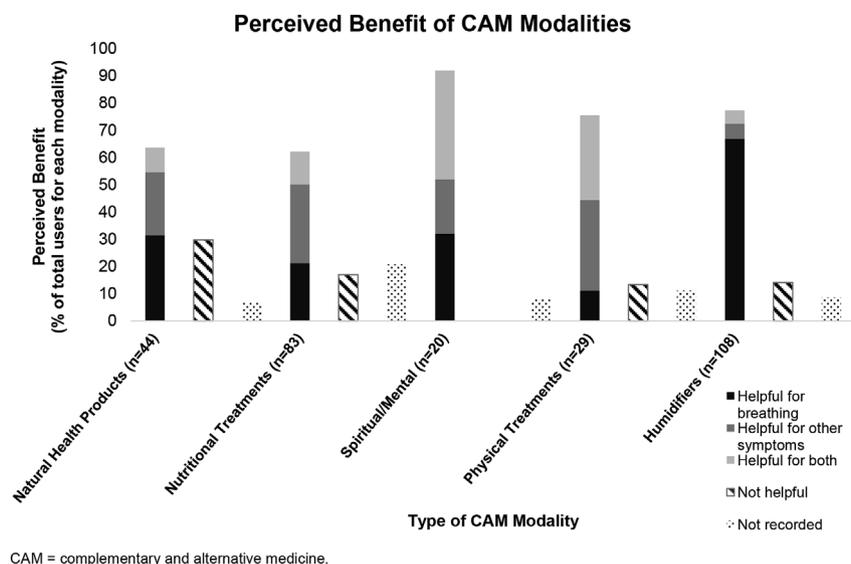


Fig. 2. Perceived benefit of CAM by modality
CAM = complementary and alternative medicine.

companies (termed ‘halotherapy’) use the evidence for nebulized hypertonic saline as a treatment for CF [42] and extrapolate this to children with asthma. In fact, a recent pilot study determined that salt rooms may have some beneficial effects in mild asthmatic children for reducing bronchial hyper-responsiveness, and improving quality of life, although treatment did not show improvement in spirometry or fractional exhaled nitric oxide as a marker of airways inflammation [43]. All patients who used halotherapy in our study found it to be beneficial. Given ongoing use of salt therapies and an increasing number of salt therapy centres across other parts of Ontario in the last 5 years, larger, randomized controlled trials of this CAM modality would be beneficial for confirming efficacy and safety in children with asthma.

While there have been some recent studies suggesting potential benefits of traditional Chinese medicine and music therapy in asthma [44,45], overall there is lack of proven efficacy for most CAM modalities. Given this, it was interesting that the majority of participants in our cohort perceived benefit in alleviating breathing and/or other symptoms from their CAM use, with very few reporting negative side effects. This suggests that CAM users will likely continue using these treatment modalities for asthma. None of the children in this present study discontinued their conventional asthma treatments, suggesting these were truly complementary modalities, in keeping with a similar study in asthmatic children which demonstrated that CAM use did not affect adherence to conventional medications [25]. In contrast, a study of inner-city children in New York attending an urban health centre, found that 44% used CAM as first treatment for asthma exacerbations [11]. Furthermore, in a recent survey of American allergists and respirologists, 81% of practitioners had patients who were using CAM over conventional therapies and 60% of practitioners had encountered adverse reactions to CAM [18]. This stresses the importance of engaging in dialogue regarding CAM use whether in the primary care or specialty care setting, to prevent adverse reactions and discontinuation of proven therapies.

By recruiting patients from specialty asthma clinics that serve the entire population in Southwestern Ontario, we captured a diversity of pediatric asthma patients thereby adding generalizability to our study results. Nonetheless, CAM use can be influenced by other factors that our study did not measure including geographical and cultural practices. Other potential limitations are that the data itself is subject to recall bias and individual biases related to reporting personal health history or information. Our questionnaire did not directly include spiritual practices and prayer, and this type of CAM use may have been

underreported compared to other studies of CAM prevalence.

5. Conclusions

Overall, our study highlights that the prevalence of CAM use in a Canadian cohort of children with asthma, and treated at specialty asthma clinics is high and associated with family CAM use, younger child age, and recent asthma exacerbation as a proxy of disease severity. When counselling patients and families about CAM, it is difficult to give information about helpfulness of CAM modalities due to a lack of efficacy studies. This study offers clinicians a reference to inform families regarding the subjectively reported helpfulness of various types of CAM modalities among a large group of children with asthma. This useful information can facilitate the dialogue between health care professionals and families interested in CAM use, and enable families to make more informed decisions.

Ethics approval

This study was approved by the research ethics board at Western University in London, Ontario, Canada.

Declarations of interest

None.

Author contributions

Conception and design of the study: Giangio, D. Radhakrishnan, A. Radhakrishnan.

Acquisition, analysis, interpretation of data: All authors.

Drafting of article: Kalaci, Giangio, Leung, D. Radhakrishnan.

Critical revision of manuscript for important intellectual content: All authors.

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Obtained funding: D. Radhakrishnan.

Study supervision: D. Radhakrishnan.

Final approval of the version to be submitted: All authors.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ctcp.2019.02.017>.

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